

CPC COOPERATIVE PATENT CLASSIFICATION

B PERFORMING OPERATIONS; TRANSPORTING (NOTES omitted)

SEPARATING; MIXING

B01 PHYSICAL OR CHEMICAL PROCESSES OR APPARATUS IN GENERAL

B01J CHEMICAL OR PHYSICAL PROCESSES, e.g. CATALYSIS OR COLLOID CHEMISTRY; THEIR RELEVANT APPARATUS

NOTES

- In this subclass, the following terms or expressions are used with the meanings indicated :
 - "solid particles" includes such particles whether catalysts, reactants or inert in solid, semi-solid or pasty state;
 - "fluidised particles" means finely divided solid particles lifted and agitated by a stream of fluid;
 - "fluidised bed-technique" means fluid-solid contacting technique in which finely divided particles are lifted and agitated by a rising stream of fluid, said stream having such a speed as to form a lower dense phase (the "bed") and an upper dilute fluidised phase of "fluidised particles";
 - "processes conducted in the presence of solid particles" does not include processes wherein the only solid particles present are formed during the reaction.
- In this subclass, tradenames that are often found in scientific and patent literature have been used in order to define precisely the scope of the groups

WARNING

The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

[B01J 37/025](#)

covered by

[B01J 37/02](#)

[B01D 15/04](#)

covered by

[B01J 39/00-B01J 49/90](#)

- | | |
|--|---|
| <p>2/00 Processes or devices for granulating materials {, e.g. fertilisers} in general; Rendering particulate materials free flowing in general, e.g. making them hydrophobic</p> | <p>2/18 . using a vibrating apparatus</p> |
| <p>2/003 . {followed by coating of the granules (to prevent the granules sticking together B01J 2/30)}</p> | <p>2/20 . by expressing the material, e.g. through sieves and fragmenting the extruded length</p> |
| <p>2/006 . {Coating of the granules without description of the process or the device by which the granules are obtained (to prevent the granules sticking together B01J 2/30)}</p> | <p>2/22 . by pressing in moulds or between rollers</p> |
| <p>2/02 . by dividing the liquid material into drops, e.g. by spraying, and solidifying the drops</p> | <p>2/24 . Obtaining flakes by scraping a solid layer from a surface</p> |
| <p>2/04 . . in a gaseous medium { (if combined with suspending the material in a gas, e.g. fluidised beds B01J 2/16) }</p> | <p>2/26 . on endless conveyor belts</p> |
| <p>2/06 . . in a liquid medium</p> | <p>2/28 . using special binding agents</p> |
| <p>2/08 . . . Gelation of a colloidal solution</p> | <p>2/30 . using agents to prevent the granules sticking together; Rendering particulate materials free flowing in general, e.g. making them hydrophobic</p> |
| <p>2/10 . in stationary drums or troughs, provided with kneading or mixing appliances</p> | <p>3/00 Processes of utilising sub-atmospheric or super-atmospheric pressure to effect chemical or physical change of matter; Apparatus therefor (pressure vessels for containing or storing compressed, liquefied or solidified gases F17C)</p> |
| <p>2/12 . in rotating drums</p> | <p>3/002 . {Component parts of these vessels not mentioned in B01J 3/004, B01J 3/006, B01J 3/02 - B01J 3/08; Measures taken in conjunction with the process to be carried out, e.g. safety measures}</p> |
| <p>2/14 . in rotating dishes or pans</p> | <p>3/004 . {Sight-glasses therefor (see also G02B)}</p> |
| <p>2/16 . by suspending the powder material in a gas, e.g. in fluidised beds or as a falling curtain</p> | <p>3/006 . {Processes utilising sub-atmospheric pressure; Apparatus therefor}</p> |
| <p><u>NOTE</u></p> <p>For classification in B01J 2/16, the fact that during the process the material is suspended in a gas prevails over the aggregation state of the material at the moment of its suspension in the gas</p> | <p>3/008 . {Processes carried out under supercritical conditions}</p> |
| | <p>3/02 . Feed or outlet devices therefor</p> |
| | <p>3/03 . Pressure vessels, or vacuum vessels, having closure members or seals specially adapted therefor</p> |
| | <p>3/04 . Pressure vessels, e.g. autoclaves</p> |
| | <p>3/042 . . {in the form of a tube}</p> |

- 3/044 . . {in the form of a loop}
- 3/046 . . {Pressure-balanced vessels}
- 3/048 . . {Multiwall, strip or filament wound vessels (for pressurised gas vessels [F17C 1/06](#); for making them [B29](#))}
- 3/06 . Processes using ultra-high pressure, e.g. for the formation of diamonds; Apparatus therefor, e.g. moulds or dies ([B01J 3/04](#) takes precedence)
- 3/062 . . {characterised by the composition of the materials to be processed}
- 3/065 . . {Presses for the formation of diamonds or boronitrides}
- 3/067 . . . {Presses using a plurality of pressing members working in different directions}
- 3/08 . . Application of shock waves for chemical reactions or for modifying the crystal structure of substances
- 4/00 Feed {or outlet} devices; Feed or outlet control devices** (feed or outlet devices for pressure vessels [B01J 3/02](#) ; feeding of particles into and evacuation of particles out of the reactor [B01J 8/0015](#))
- 4/001 . {Feed or outlet devices as such, e.g. feeding tubes}
- 4/002 . . {Nozzle-type elements (nozzle-type reactors [B01J 19/26](#))}
- 4/004 . . {Sparger-type elements}
- 4/005 . . {provided with baffles}
- 4/007 . . {provided with moving parts}
- 4/008 . {Feed or outlet control devices}
- 4/02 . for feeding measured {, i.e. prescribed} quantities of reagents
- 4/04 . using osmotic pressure {using membranes, porous plates}
- 6/00 {Heat treatments such as} Calcining; Fusing {Pyrolysis (furnaces [F27D](#))}**
- 6/001 . {Calcining}
- 6/002 . . {using rotating drums}
- 6/004 . . {using hot gas streams in which the material is moved}
- 6/005 . {Fusing}
- 6/007 . . {in crucibles}
- 6/008 . {Pyrolysis reactions (of hydrocarbons [C10G 9/00](#))}
- 7/00 Apparatus for generating gases** (production of inert gas mixtures [B01J 19/14](#); for generating specific gases, see the relevant subclasses, e.g. [C01B](#), [C10J](#) ; in "air bags" on vehicles [B60R 21/26](#); for starter gas [F02C 7/26](#); blasting cartridges for producing gas under pressure [F42B 3/04](#))
- 7/02 . by wet methods
- 8/00 Chemical or physical processes in general, conducted in the presence of fluids and solid particles; Apparatus for such processes**
- 8/0005 . {Catalytic processes under superatmospheric pressure (non-catalytic processes [B01J 3/00](#))}
- 8/001 . {Controlling catalytic processes ([B01J 8/1809](#) takes precedence)}
- 8/0015 . {Feeding of the particles in the reactor; Evacuation of the particles out of the reactor}
- 8/002 . . {with a moving instrument}
- 8/0025 . . {by an ascending fluid}
- 8/003 . . {in a downward flow}
- 8/0035 . . {Periodical feeding or evacuation}
- 8/004 . . {by means of a nozzle}
- 8/0045 . . {by means of a rotary device in the flow channel}
- 8/005 . {Separating solid material from the gas/liquid stream (separation processes *per se* [B01D](#))}
- 8/0055 . . {using cyclones}
- 8/006 . . {by filtration}
- 8/0065 . . {by impingement against stationary members}
- 8/007 . . {by sedimentation}
- 8/0075 . . {by electrostatic precipitation}
- 8/008 . {Details of the reactor or of the particulate material; Processes to increase or to retard the rate of reaction ([B01J 8/0285](#), [B01J 8/067](#), [B01J 8/087](#), [B01J 8/1836](#) take precedence)}
- 8/0085 . . {promoting uninterrupted fluid flow, e.g. by filtering out particles in front of the catalyst layer}
- 8/009 . . {Membranes, e.g. feeding or removing reactants or products to or from the catalyst bed through a membrane}
- 8/0095 . {in which two different types of particles react with each other}
- 8/02 . with stationary particles, e.g. in fixed beds
- 8/0207 . . {the fluid flow within the bed being predominantly horizontal}
- 8/0214 . . . {in a cylindrical annular shaped bed}
- 8/0221 . . . {in a cylindrical shaped bed ([B01J 8/0214](#) takes precedence)}
- 8/0228 . . . {in a conically shaped bed}
- 8/0235 . . . {in a spiral shaped bed}
- 8/0242 . . {the fluid flow within the bed being predominantly vertical}
- 8/025 . . . {in a cylindrical shaped bed}
- 8/0257 . . . {in a cylindrical annular shaped bed}
- 8/0264 . . . {in a conically shaped bed}
- 8/0271 . . . {in a spiral shaped bed}
- 8/0278 . . {Feeding reactive fluids (for solid material [B01J 8/0015](#))}
- 8/0285 . . {Heating or cooling the reactor (for tubular reactors in furnaces [B01J 8/062](#))}
- 8/0292 . . {with stationary packing material in the bed, e.g. bricks, wire rings, baffles}
- 8/04 . . the fluid passing successively through two or more beds
- 8/0403 . . . {the fluid flow within the beds being predominantly horizontal}
- 8/0407 {through two or more cylindrical annular shaped beds}
- 8/0411 {the beds being concentric}
- 8/0415 {the beds being superimposed one above the other ([B01J 8/0434](#) takes precedence)}
- 8/0419 {the beds being placed in separate reactors}
- 8/0423 {through two or more otherwise shaped beds}
- 8/0426 {the beds being superimposed one above the other}
- 8/043 {in combination with one cylindrical annular shaped bed}
- 8/0434 {in combination with two or more cylindrical annular shaped beds}
- 8/0438 {the beds being placed next to each other}
- 8/0442 {the beds being placed in separate reactors}

- 8/0446 . . . {the flow within the beds being predominantly vertical}
- 8/0449 {in two or more cylindrical beds}
- 8/0453 {the beds being superimposed one above the other}
- 8/0457 {the beds being placed in separate reactors}
- 8/0461 {in two or more cylindrical annular shaped beds}
- 8/0465 {the beds being concentric}
- 8/0469 {the beds being superimposed one above the other}
- 8/0473 {the beds being placed in separate reactors}
- 8/0476 {in two or more otherwise shaped beds}
- 8/048 {the beds being superimposed one above the other}
- 8/0484 {the beds being placed next to each other}
- 8/0488 {the beds being placed in separate reactors}
- 8/0492 . . . {Feeding reactive fluids (for solid material, see [B01J 8/0015](#))}
- 8/0496 . . . {Heating or cooling the reactor}
- 8/06 . . in tube reactors; the solid particles being arranged in tubes
- 8/062 . . . {being installed in a furnace}
- 8/065 . . . {Feeding reactive fluids}
- 8/067 . . . {Heating or cooling the reactor ([B01J 8/062 takes precedence](#))}
- 8/08 . . with moving particles ([with fluidised particles B01J 8/18](#))
- 8/082 . . {Controlling processes}
- 8/085 . . {Feeding reactive fluids (for solid material, see [B01J 8/0015](#))}
- 8/087 . . {Heating or cooling the reactor}
- 8/10 . . moved by stirrers or by rotary drums or rotary receptacles {or endless belts}
- 8/12 . . moved by gravity in a downward flow
- 8/125 . . . {with multiple sections one above the other separated by distribution aids, e.g. reaction and regeneration sections}
- 8/14 . . moving in free vortex flow apparatus
- 8/16 . . with particles being subjected to vibrations or pulsations ([B01J 8/40 takes precedence](#))
- 8/18 . . with fluidised particles {(combustion apparatus with fluidised bed in general [F23C 10/00](#); furnaces with fluidised bed [F27B 15/00](#))}
- 8/1809 . . {Controlling processes}
- 8/1818 . . {Feeding of the fluidising gas ([B01J 8/44 takes precedence](#))}
- 8/1827 . . . {the fluidising gas being a reactant}
- 8/1836 . . {Heating and cooling the reactor ([B01J 8/42 takes precedence](#))}
- 8/1845 . . {with particles moving upwards while fluidised}
- 8/1854 . . . {followed by a downward movement inside the reactor to form a loop}
- 8/1863 . . . {followed by a downward movement outside the reactor and subsequently re-entering it}
- 8/1872 . . {Details of the fluidised bed reactor ([B01J 8/1836 takes precedence](#))}
- 8/1881 . . {with particles moving downwards while fluidised}
- 8/189 . . . {moving downwards in a zig-zag manner}
- 8/20 . . with liquid as a fluidising medium
- 8/22 . . . gas being introduced into the liquid
- 8/222 {in the presence of a rotating device only}
- 8/224 {the particles being subject to a circulatory movement ([B01J 8/222 takes precedence](#))}
- 8/226 {internally, i.e. the particles rotate within the vessel}
- 8/228 {externally, i.e. the particles leaving the vessel and subsequently re-entering it}
- 8/24 . . according to "fluidised-bed" technique ([B01J 8/20 takes precedence](#))
- 8/245 . . . {Spouted-bed technique}
- 8/26 . . . with two or more fluidised beds, e.g. reactor and regeneration installations
- 8/28 the one above the other
- 8/30 the edge of a lower bed projecting beyond the edge of the superjacent bed
- 8/32 . . . with introduction into the fluidised bed of more than one kind of moving particles
- 8/34 . . . with stationary packing material in the fluidised bed, e.g. bricks, wire rings, baffles
- 8/36 . . . with fluidised bed through which there is an essentially horizontal flow of particles
- 8/38 . . . with fluidised bed containing a rotatable device or being subject to rotation {or to a circulatory movement, i.e. leaving a vessel and subsequently re-entering it}
- 8/382 {with a rotatable device only}
- 8/384 {being subject to a circulatory movement only ([B01J 8/382 takes precedence](#))}
- 8/386 {internally, i.e. the particles rotate within the vessel}
- 8/388 {externally, i.e. the particles leaving the vessel and subsequently re-entering it}
- 8/40 . . . with fluidised bed subjected to vibrations or pulsations
- 8/42 . . . with fluidised bed subjected to electric current or to radiations {this sub-group includes the fluidised bed subjected to electric or magnetic fields}
- 8/44 . . . Fluidisation grids
- 8/46 . . . for treatment of endless filamentary, band or sheet material
- 10/00 Chemical processes in general for reacting liquid with gaseous media other than in the presence of solid particles, or apparatus specially adapted therefor ([B01J 19/08 takes precedence](#); separation, e.g. distillation, also combined with chemical reactions [B01D](#), {e.g. [B01D 3/009](#)})**
 - 10/002 . {carried out in foam, aerosol or bubbles}
 - 10/005 . {carried out at high temperatures in the presence of a molten material}
 - 10/007 . {in the presence of catalytically active bodies, e.g. porous plates}
 - 10/02 . of the thin-film type
- 12/00 Chemical processes in general for reacting gaseous media with gaseous media; Apparatus specially adapted therefor ([B01J 3/08](#), [B01J 8/00](#), [B01J 19/08 take precedence](#))**
 - 12/002 . {carried out in the plasma state ([generating or handling plasma H05H 1/00](#))}
 - 12/005 . {carried out at high temperatures, e.g. by pyrolysis}

- 12/007 . {in the presence of catalytically active bodies, e.g. porous plates}
- 12/02 . for obtaining at least one reaction product which, at normal temperature, is in the solid state
- 13/00 Colloid chemistry, e.g. the production of colloidal materials or their solutions, not otherwise provided for; Making microcapsules or microballoons**
- 13/0004 . {Preparation of sols (by physical processes [B01J 13/0086](#), aerosols [B01J 13/0095](#))}
- 13/0008 . . {Sols of inorganic materials in water}
- 13/0013 . . . {from a precipitate}
- 13/0017 . . . {by extraction of ions from aqueous solutions}
- 13/0021 . . {containing a solid organic phase}
- 13/0026 . . {containing a liquid organic phase}
- 13/003 . . . {Preparation from aqueous sols}
- 13/0034 . . {Additives, e.g. in view of promoting stabilisation or peptisation}
- 13/0039 . . {Post treatment}
- 13/0043 . . {containing elemental metal (for medical or diagnostical purposes [A61K](#), [G01N](#))}
- 13/0047 . . {containing a metal oxide}
- 13/0052 . {Preparation of gels}
- 13/0056 . . {containing inorganic material and water}
- 13/006 . . . {by precipitation, coagulation, hydrolyse coacervation}
- 13/0065 . . {containing an organic phase}
- 13/0069 . . {Post treatment}
- 13/0073 . {Preparation of non-Newtonian sols, e.g. thixotropic solutions}
- 13/0078 . . {containing inorganic material and water}
- 13/0082 . . {containing an organic phase}
- 13/0086 . {Preparation of sols by physical processes (colloid mills [B02C](#))}
- 13/0091 . {Preparation of aerogels, e.g. xerogels}
- 13/0095 . {Preparation of aerosols}
- 13/02 . Making microcapsules or microballoons {(for medical preparations [A61K 9/50](#))}
- 13/025 . . {Applications of microcapsules not provided for in other subclasses}
- 13/04 . . by physical processes, e.g. drying, spraying
- 13/043 . . . {Drying and spraying}
- 13/046 . . . {combined with gelification or coagulation}
- 13/06 . . by phase separation
- 13/08 . . . Simple coacervation, i.e. addition of highly hydrophilic material {(combined with spraying [B01J 13/043](#); combined with mechanical division [B01J 13/04](#))}
- 13/10 . . . Complex coacervation, i.e. interaction of oppositely charged particles
- 13/12 . . . removing solvent from the wall-forming material solution
- 13/125 {by evaporation of the solvent (apparatus therefor [B01J 13/043](#))}
- 13/14 . . . Polymerisation; cross-linking
- 13/16 Interfacial polymerisation
- 13/18 *In situ* polymerisation with all reactants being present in the same phase
- 13/185 {in an organic phase}
- 13/20 . . After-treatment of capsule walls, e.g. hardening
- 13/203 . . . {Exchange of core-forming material by diffusion through the capsule wall}
- 13/206 . . . {Hardening; drying}
- 13/22 . . . Coating
- 14/00 Chemical processes in general for reacting liquids with liquids; Apparatus specially adapted therefor ([B01J 8/00](#), [B01J 19/08](#) take precedence)**
- 14/005 . {in the presence of catalytically active bodies, e.g. porous plates}
- 15/00 Chemical processes in general for reacting gaseous media with non-particulate solids, e.g. sheet material; Apparatus specially adapted therefor ([B01J 19/08](#) takes precedence)**
- 15/005 . {in the presence of catalytically active bodies, e.g. porous plates}
- 16/00 Chemical processes in general for reacting liquids with non-particulate solids, e.g. sheet material; Apparatus specially adapted therefor ([B01J 19/08](#) takes precedence)**
- 16/005 . {in the presence of catalytically active bodies, e.g. porous plates}
- 19/00 Chemical, physical or physico-chemical processes in general; Their relevant apparatus**
- 19/0006 . {Controlling or regulating processes (controlling or regulating in general [G05](#))}
- 19/0013 . . {Controlling the temperature of the process}
- 19/002 . . {Avoiding undesirable reactions or side-effects, e.g. avoiding explosions, or improving the yield by suppressing side-reactions}
- 19/0026 . . . {Avoiding carbon deposits (inhibiting incrustation in general, [C23F 14/00](#), [C23F 15/00](#))}
- 19/0033 . . {Optimisation processes, i.e. processes with adaptive control systems (adaptive control systems per se [G05B 13/00](#))}
- 19/004 . . {Multifunctional apparatus for automatic manufacturing of various chemical products (sequential reactions [B01J 19/0046](#))}
- 19/0046 . {Sequential or parallel reactions, e.g. for the synthesis of polypeptides or polynucleotides; Apparatus and devices for combinatorial chemistry or for making molecular arrays (synthesis methods per se [C40B 50/00](#))}
- 19/0053 . {Details of the reactor}
- 19/006 . . {Baffles}
- 19/0066 . . {Stirrers (mixing per se [B01F](#))}
- 19/0073 . . {Sealings (sealings for pressure vessels per se [F16J 15/00](#))}
- 19/008 . {Processes for carrying out reactions under cavitation conditions}
- 19/0086 . {Processes carried out with a view to control or to change the pH-value; Applications of buffer salts; Neutralisation reactions}
- 19/0093 . {Microreactors, e.g. miniaturised or microfabricated reactors (laboratory containers with capillary fluid transport in microfabricated channels or chambers [B01L 3/5027](#))}
- 19/02 . Apparatus characterised by being constructed of material selected for its chemically-resistant properties
- 19/06 . Solidifying liquids (making microcapsules [B01J 13/02](#))

- 19/08 . . Processes employing the direct application of electric or wave energy, or particle radiation; Apparatus therefor ([application of shock waves B01J 3/08](#))
- 19/081 . . {employing particle radiation or gamma-radiation}
- 19/082 . . . {Gamma-radiation only}
- 19/084 . . . {Neutron beams only}
- 19/085 . . . {Electron beams only}
- 19/087 . . {employing electric or magnetic energy}
- 19/088 . . . {giving rise to electric discharges (for heating purposes [H05B 7/00](#); for the production of ozone [C01B 13/11](#), [H01T 19/00](#))}
- 19/10 . . employing sonic or ultrasonic vibrations
- 19/12 . . employing electromagnetic waves
- 19/121 . . . {Coherent waves, e.g. laser beams ([lasers per se H01S 3/00](#))}
- 19/122 . . . {Incoherent waves ([gamma-radiation B01J 19/082](#))}
- 19/123 {Ultra-violet light}
- 19/124 {generated by microwave irradiation}
- 19/125 {X-rays}
- 19/126 {Microwaves}
- 19/127 {Sunlight; Visible light}
- 19/128 {Infra-red light}
- 19/129 {Radiofrequency}
- 19/14 . . Production of inert gas mixtures; Use of inert gases in general
- 19/16 . . Preventing evaporation or oxidation of non-metallic liquids by applying a floating layer, e.g. of microballoons ([in storage tanks B65D 90/42](#))}
- 19/18 . . Stationary reactors having moving elements inside ([B01J 19/08](#), [B01J 19/26 take precedence](#))
- 19/1806 . . {resulting in a turbulent flow of the reactants, such as in centrifugal-type reactors, or having a high Reynolds-number}
- 19/1812 . . {Tubular reactors}
- 19/1818 . . . {in series}
- 19/1825 . . . {in parallel}
- 19/1831 . . . {spirally, concentrically or zigzag wound}
- 19/1837 . . . {Loop-type reactors}
- 19/1843 . . . {Concentric tube}
- 19/185 . . {of the pulsating type}
- 19/1856 . . {placed in parallel}
- 19/1862 . . {placed in series}
- 19/1868 . . {resulting in a loop-type movement}
- 19/1875 . . . {internally, i.e. the mixture circulating inside the vessel such that the upwards stream is separated physically from the downwards stream(s)}
- 19/1881 . . . {externally, i.e. the mixture leaving the vessel and subsequently re-entering it}
- 19/1887 . . {forming a thin film}
- 19/1893 . . {Membrane reactors ([membranes B01D 71/00](#); [catalytic membranes B01J 35/065](#))}
- 19/20 . . in the form of helices, e.g. screw reactors
- 19/22 . . in the form of endless belts
- 19/24 . . Stationary reactors without moving elements inside ([B01J 19/08](#), [B01J 19/26 take precedence](#); with stationary particles [B01J 8/02](#))
- 19/2405 . . {provoking a turbulent flow of the reactants, such as in cyclones, or having a high Reynolds-number}
- 19/241 . . . {of the pulsating type}
- 19/2415 . . . {Tubular reactors}
- 19/242 {in series}
- 19/2425 {in parallel}
- 19/243 {spirally, concentrically or zigzag wound}
- 19/2435 {Loop-type reactors}
- 19/244 {Concentric tubes}
- 19/2445 . . . {placed in parallel}
- 19/245 . . . {placed in series}
- 19/2455 . . . {provoking a loop type movement of the reactants ([tubular loop-type reactors B01J 19/2435](#); [loop reactors having moving elements inside B01J 19/1868](#))}
- 19/246 {internally, i.e. the mixture circulating inside the vessel such that the upward stream is separated physically from the downward stream(s)}
- 19/2465 {externally, i.e. the mixture leaving the vessel and subsequently re-entering it}
- 19/247 . . . {Suited for forming thin films}
- 19/2475 . . . {Membrane reactors}
- 19/248 . . . {Reactors comprising multiple separated flow channels}
- 19/2485 {Monolithic reactors}
- 19/249 {Plate-type reactors}
- 19/2495 {Net-type reactors}
- 19/26 . . Nozzle-type reactors, i.e. the distribution of the initial reactants within the reactor is effected by their introduction or injection through nozzles
- 19/28 . . Moving reactors, e.g. rotary drums ([B01J 19/08 takes precedence](#))
- 19/285 . . . {Shaking or vibrating reactors; reactions under the influence of low-frequency vibrations or pulsations ([for sonic and ultrasonic vibrations B01J 19/10](#))}
- 19/30 . . Loose or shaped packing elements, e.g. Raschig rings or Berl saddles, for pouring into the apparatus for mass or heat transfer
- 19/305 . . . {Supporting elements therefor, e.g. grids, perforated plates}
- 19/32 . . Packing elements in the form of grids or built-up elements for forming a unit or module inside the apparatus for mass or heat transfer
- 19/325 . . . {Attachment devices therefor, e.g. hooks, consoles, brackets}

Solid sorbent compositions or filter aid compositions; Sorbents for chromatography; Catalysts

NOTES

1. In groups [B01J 20/00](#) - [B01J 31/00](#), metal salts having an anion composed of metal and oxygen only, e.g. molybdates, are considered as chemically bound mixtures of the component metal oxides.
2. Attention is drawn to the definitions of groups of chemical elements following the title of section [C](#).
3. In group [B01J 20/00](#) and in each set of groups [B01J 21/00](#) - [B01J 31/00](#) and [B01J 32/00](#) - [B01J 38/00](#), the last place priority rule is applied, i.e. at each hierarchical level, in the absence of an indication to the contrary, classification is made in the last appropriate place.
4. Pure compounds or elements, or their recovery from solid sorbent compositions, filter aid compositions, or catalysts, are classified in the appropriate subclass for chemical compounds or elements. However, when it is explicitly stated that the pure compound

- or element, in a particular form, is especially useful as a solid sorbent, filter aid, or catalyst, it is further classified in group [B01J 20/00](#) or [B01J 35/00](#).
5. {In groups [B01J 21/00](#) - [B01J 38/00](#), the following term is used with the meaning indicated:
- "catalyst" covers also a carrier forming part of the catalyst.}
6. {Classification of the:
- carriers;
 - forms or physical properties;
 - preparation or activation;
 - regeneration or reactivation of catalysts according to more than one of main groups [B01J 21/00](#) - [B01J 31/00](#) is made in the following general groups:
 - [B01J 32/00](#) for such carriers;
 - [B01J 35/00](#) for such forms or physical properties;
 - [B01J 37/00](#) for such preparation or activation;
 - [B01J 38/00](#) for such regeneration or reactivation.}
- 20/00 Solid sorbent compositions or filter aid compositions; Sorbents for chromatography; Processes for preparing, regenerating or reactivating thereof**
- 20/02 . . comprising inorganic material
- 20/0203 . . {comprising compounds of metals not provided for in [B01J 20/04](#) (oxides or hydroxides thereof [B01J 20/06](#))}
- NOTE**
- Compounds classified in group [B01J 20/0203](#) and subgroups are also classified in [B01J 20/0274](#) according to the type of anion
- 20/0207 . . . {Compounds of Sc, Y or Lanthanides}
- 20/0211 . . . {Compounds of Ti, Zr, Hf}
- 20/0214 . . . {Compounds of V, Nb, Ta}
- 20/0218 . . . {Compounds of Cr, Mo, W}
- 20/0222 . . . {Compounds of Mn, Re}
- 20/0225 . . . {Compounds of Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt}
- 20/0229 {Compounds of Fe}
- 20/0233 . . . {Compounds of Cu, Ag, Au}
- 20/0237 {Compounds of Cu}
- 20/024 . . . {Compounds of Zn, Cd, Hg}
- 20/0244 {Compounds of Zn}
- 20/0248 . . . {Compounds of B, Al, Ga, In, Tl ([B01J 20/08](#) takes precedence)}
- 20/0251 . . . {Compounds of Si, Ge, Sn, Pb ([B01J 20/10](#) takes precedence)}
- 20/0255 {Compounds of Pb}
- 20/0259 . . . {Compounds of N, P, As, Sb, Bi}
- 20/0262 . . . {Compounds of O, S, Se, Te}
- 20/0266 {Compounds of S}
- 20/027 . . . {Compounds of F, Cl, Br, I}
- 20/0274 . . . {characterised by the type of anion}
- 20/0277 {Carbonates of compounds other than those provided for in [B01J 20/043](#)}
- 20/0281 {Sulfates of compounds other than those provided for in [B01J 20/045](#)}
- 20/0285 {Sulfides of compounds other than those provided for in [B01J 20/045](#)}
- 20/0288 {Halides of compounds other than those provided for in [B01J 20/046](#)}
- 20/0292 {Phosphates of compounds other than those provided for in [B01J 20/048](#)}
- 20/0296 {Nitrates of compounds other than those provided for in [B01J 20/04](#)}
- 20/04 . . comprising compounds of alkali metals, alkaline earth metals or magnesium
- 20/041 . . . {Oxides or hydroxides}
- 20/043 . . . {Carbonates or bicarbonates, e.g. limestone, dolomite, aragonite}
- 20/045 . . . {containing sulfur, e.g. sulfates, thiosulfates, gypsum}
- 20/046 . . . {containing halogens, e.g. halides}
- 20/048 . . . {containing phosphorus, e.g. phosphates, apatites, hydroxyapatites}
- 20/06 . . comprising oxides or hydroxides of metals not provided for in group [B01J 20/04](#)
- 20/08 . . . comprising aluminium oxide or hydroxide; comprising bauxite
- 20/10 . . comprising silica or silicate
- 20/103 . . . {comprising silica}
- 20/106 {Perlite}
- 20/12 . . . Naturally occurring clays or bleaching earth
- 20/14 . . . Diatomaceous earth
- 20/16 . . . Alumino-silicates ([B01J 20/12](#) takes precedence)
- 20/165 {Natural alumino-silicates, e.g. zeolites}
- 20/18 Synthetic zeolitic molecular sieves
- 20/183 {Physical conditioning without chemical treatment, e.g. drying, granulating, coating, irradiation}
- 20/186 {Chemical treatments in view of modifying the properties of the sieve, e.g. increasing the stability or the activity, also decreasing the activity}
- 20/20 . . comprising free carbon; comprising carbon obtained by carbonising processes
- 20/205 . . . {Carbon nanostructures, e.g. nanotubes, nanohorns, nanocones, nanoballs ([carbon nanotubes per se C01B 32/15](#))}
- 20/22 . . comprising organic material
- 20/223 . . {containing metals, e.g. organo-metallic compounds, coordination complexes}
- 20/226 . . . {Coordination polymers, e.g. metal-organic frameworks [MOF], zeolitic imidazolate frameworks [ZIF] ([preparation of metal complexes containing carboxylic acid moieties C07C 51/418](#); [MOF's per se C07F](#))}
- 20/24 . . Naturally occurring macromolecular compounds, e.g. humic acids or their derivatives
- 20/26 . . Synthetic macromolecular compounds
- 20/261 . . . {obtained by reactions only involving carbon to carbon unsaturated bonds ([macromolecular compounds obtained by reactions only involving carbon-to-carbon unsaturated bonds per se C08F](#))}
- 20/262 . . . {obtained otherwise than by reactions only involving carbon to carbon unsaturated bonds, e.g. obtained by polycondensation ([macromolecular compounds obtained otherwise than by reactions only involving unsaturated carbon-to-carbon bonds per se C08G](#))}
- 20/264 . . . {derived from different types of monomers, e.g. linear or branched copolymers, block copolymers, graft copolymers}

- 20/265 . . . {modified or post-treated polymers ([polymer carriers or substrates subjected to further impregnating or coating B01J 20/3208](#))}
 - 20/267 {Cross-linked polymers}
 - 20/268 . . . {Polymers created by use of a template, e.g. molecularly imprinted polymers}
 - 20/28 . characterised by their form or physical properties
 - 20/28002 . . {characterised by their physical properties}
 - 20/28004 . . . {Sorbent size or size distribution, e.g. particle size}
 - 20/28007 {with size in the range 1-100 nanometers, e.g. nanosized particles, nanofibers, nanotubes, nanowires or the like ([carbon nanostructures B01J 20/205](#))}
 - 20/28009 . . . {Magnetic properties}
 - 20/28011 . . . {Other properties, e.g. density, crush strength}
 - 20/28014 . . {characterised by their form}
 - 20/28016 . . . {Particle form}
 - 20/28019 {Spherical, ellipsoidal or cylindrical}
 - 20/28021 {Hollow particles, e.g. hollow spheres, microspheres or cenospheres}
 - 20/28023 . . . {Fibres or filaments ([fibres or filaments in the form of membranes B01J 20/28038](#); [B01J 20/28007 takes precedence](#))}
 - 20/28026 . . . {Particles within, immobilised, dispersed, entrapped in or on a matrix, e.g. a resin}
 - 20/28028 . . . {Particles immobilised within fibres or filaments}
 - 20/2803 . . . {Sorbents comprising a binder, e.g. for forming aggregated, agglomerated or granulated products}
 - 20/28033 . . . {Membrane, sheet, cloth, pad, lamellar or mat}
 - 20/28035 {with more than one layer, e.g. laminates, separated sheets}
 - 20/28038 {Membranes or mats made from fibers or filaments}
 - 20/2804 {Sheets with a specific shape, e.g. corrugated, folded, pleated, helical}
 - 20/28042 . . . {Shaped bodies; Monolithic structures}
 - 20/28045 {Honeycomb or cellular structures; Solid foams or sponges}
 - 20/28047 . . . {Gels}
 - 20/2805 . . . {Sorbents inside a permeable or porous casing, e.g. inside a container, bag or membrane}
 - 20/28052 . . . {Several layers of identical or different sorbents stacked in a housing, e.g. in a column}
 - 20/28054 . . {characterised by their surface properties or porosity}
 - 20/28057 . . . {Surface area, e.g. B.E.T specific surface area}
 - 20/28059 {being less than 100 m²/g}
 - 20/28061 {being in the range 100-500 m²/g}
 - 20/28064 {being in the range 500-1000 m²/g}
 - 20/28066 {being more than 1000 m²/g}
 - 20/28069 . . . {Pore volume, e.g. total pore volume, mesopore volume, micropore volume}
 - 20/28071 {being less than 0.5 ml/g}
 - 20/28073 {being in the range 0.5-1.0 ml/g}
 - 20/28076 {being more than 1.0 ml/g}
 - 20/28078 . . . {Pore diameter}
 - 20/2808 {being less than 2 nm, i.e. micropores or nanopores}
 - 20/28083 {being in the range 2-50 nm, i.e. mesopores}
 - 20/28085 {being more than 50 nm, i.e. macropores}
 - 20/28088 {Pore-size distribution}
 - 20/2809 {Monomodal or narrow distribution, uniform pores}
 - 20/28092 {Bimodal, polymodal, different types of pores or different pore size distributions in different parts of the sorbent}
 - 20/28095 {Shape or type of pores, voids, channels, ducts}
 - 20/28097 {being coated, filled or plugged with specific compounds}
 - 20/281 . Sorbents specially adapted for preparative, analytical or investigative chromatography
- NOTE**
- In groups [B01J 20/281](#) - [B01J 20/292](#) it is desirable to add indexing codes for aspects relating to sorbents specially adapted for preparative, analytical or investigative chromatography. The indexing codes are chosen from groups [B01J 2220/80](#) - [B01J 2220/86](#)
- 20/282 . . Porous sorbents ([ion exchange B01J 39/00](#) - [B01J 41/00](#))
 - 20/283 . . . based on silica
 - 20/284 . . . based on alumina
 - 20/285 . . . based on polymers
 - 20/286 . . Phases chemically bonded to a substrate, e.g. to silica or to polymers
 - 20/287 . . . Non-polar phases; Reversed phases
 - 20/288 . . . Polar phases
 - 20/289 . . . bonded via a spacer
 - 20/29 . . Chiral phases
 - 20/291 . . Gel sorbents
 - 20/292 . . Liquid sorbents
 - 20/30 . Processes for preparing, regenerating, or reactivating
 - 20/3007 . . {Moulding, shaping or extruding}
 - 20/3014 . . {Kneading}
 - 20/3021 . . {Milling, crushing or grinding}
 - 20/3028 . . {Granulating, agglomerating or aggregating}
 - 20/3035 . . {Compressing}
 - 20/3042 . . {Use of binding agents; addition of materials ameliorating the mechanical properties of the produced sorbent}
 - 20/305 . . {Addition of material, later completely removed, e.g. as result of heat treatment, leaching or washing, e.g. for forming pores}
 - 20/3057 . . . {Use of a templating or imprinting material ([molecularly imprinted polymers B01J 20/268](#)); filling pores of a substrate or matrix followed by the removal of the substrate or matrix}
 - 20/3064 . . . {Addition of pore forming agents, e.g. pore inducing or porogenic agents}
 - 20/3071 . . {Washing or leaching}
 - 20/3078 . . {Thermal treatment, e.g. calcining or pyrolyzing}
 - 20/3085 . . {Chemical treatments not covered by groups [B01J 20/3007](#) - [B01J 20/3078](#)}
 - 20/3092 . . {Packing of a container, e.g. packing a cartridge or column ([of chromatography columns B01D 15/206](#))}
 - 20/32 . . Impregnating or coating {; Solid sorbent compositions obtained from processes involving impregnating or coating}

20/3202	. . . {characterised by the carrier, support or substrate used for impregnation or coating}	20/3257	. . . . . {the functional group or the linking, spacer or anchoring group as a whole comprising at least one of the heteroatoms nitrogen, oxygen or sulfur together with at least one silicon atom, these atoms not being part of the carrier as such}
20/3204	. . . . {Inorganic carriers, supports or substrates}		
20/3206	. . . . {Organic carriers, supports or substrates}		
20/3208	. . . . . {Polymeric carriers, supports or substrates}		
20/321	. . . . . {consisting of a polymer obtained by reactions involving only carbon to carbon unsaturated bonds}	20/3259	. . . . . {comprising at least two different types of heteroatoms selected from nitrogen, oxygen or sulfur with at least one silicon atom}
20/3212	. . . . . {consisting of a polymer obtained by reactions otherwise than involving only carbon to carbon unsaturated bonds}	20/3261	. . . . . {comprising a cyclic structure not containing any of the heteroatoms nitrogen, oxygen or sulfur, e.g. aromatic structures}
20/3214	. . . {characterised by the method for obtaining this coating or impregnating}	20/3263	. . . . . {comprising a cyclic structure containing at least one of the heteroatoms nitrogen, oxygen or sulfur, e.g. an heterocyclic or heteroaromatic structure}
20/3217	. . . . {Resulting in a chemical bond between the coating or impregnating layer and the carrier, support or substrate, e.g. a covalent bond}	20/3265	. . . . . {with an organic functional group containing a metal, e.g. a metal affinity ligand}
20/3219	. . . . . {involving a particular spacer or linking group, e.g. for attaching an active group}	20/3268	. . . . . {Macromolecular compounds}
20/3221	. . . . . {the chemical bond being an ionic interaction}	20/327	. . . . . {Polymers obtained by reactions involving only carbon to carbon unsaturated bonds}
20/3223	. . . . {by means of an adhesive agent}	20/3272	. . . . . {Polymers obtained by reactions otherwise than involving only carbon to carbon unsaturated bonds}
20/3225	. . . . {involving a post-treatment of the coated or impregnated product}	20/3274	. . . . . {Proteins, nucleic acids, polysaccharides, antibodies or antigens}
20/3227	. . . . . {by end-capping, i.e. with or after the introduction of functional or ligand groups}	20/3276	. . . . . {Copolymers}
20/3229	. . . . . {for preventing leaching, leaking of attached functional or ligand groups}	20/3278	. . . . . {Polymers being grafted on the carrier}
20/3231	. . . {characterised by the coating or impregnating layer}	20/328	. . . . . {Polymers on the carrier being further modified}
20/3234	. . . . {Inorganic material layers}	20/3282	. . . . . {Crosslinked polymers}
20/3236	. . . . . {containing metal, other than zeolites, e.g. oxides, hydroxides, sulphides or salts}	20/3285	. . . . . {Coating or impregnation layers comprising different type of functional groups or interactions, e.g. different ligands in various parts of the sorbent, mixed mode, dual zone, bimodal, multimodal, ionic or hydrophobic, cationic or anionic, hydrophilic or hydrophobic}
20/3238	. . . . . {containing any type of zeolite}		
20/324	. . . . . {containing free carbon, e.g. activated carbon}	20/3287	. . . . {Layers in the form of a liquid}
20/3242	. . . . {Layers with a functional group, e.g. an affinity material, a ligand, a reactant or a complexing group}	20/3289	. . . . {Coatings involving more than one layer of same or different nature}
20/3244	. . . . . {Non-macromolecular compounds}	20/3291	. . . {Characterised by the shape of the carrier, the coating or the obtained coated product}
20/3246	. . . . . {having a well defined chemical structure}	20/3293	. . . . {Coatings on a core, the core being particle or fiber shaped, e.g. encapsulated particles, coated fibers}
20/3248	. . . . . {the functional group or the linking, spacer or anchoring group as a whole comprising at least one type of heteroatom selected from a nitrogen, oxygen or sulfur, these atoms not being part of the carrier as such}	20/3295	. . . . {Coatings made of particles, nanoparticles, fibers, nanofibers}
20/3251	. . . . . {comprising at least two different types of heteroatoms selected from nitrogen, oxygen or sulphur}	20/3297	. . . . {Coatings in the shape of a sheet}
20/3253	. . . . . {comprising a cyclic structure not containing any of the heteroatoms nitrogen, oxygen or sulfur, e.g. aromatic structures}	20/34	. . Regenerating or reactivating
20/3255	. . . . . {comprising a cyclic structure containing at least one of the heteroatoms nitrogen, oxygen or sulfur, e.g. heterocyclic or heteroaromatic structures}	20/3408	. . . {of aluminosilicate molecular sieves}
		20/3416	. . . {of sorbents or filter aids comprising free carbon, e.g. activated carbon}
		20/3425	. . . {of sorbents or filter aids comprising organic materials}
		20/3433	. . . {of sorbents or filter aids other than those covered by B01J 20/3408 - B01J 20/3425 }

- 20/3441 . . . {Regeneration or reactivation by electric current, ultrasound or irradiation, e.g. electromagnetic radiation such as X-rays, UV, light, microwaves}
- 20/345 . . . {using a particular desorbing compound or mixture (elution or regeneration of stationary phases in liquid chromatography [B01D 15/08](#))}
- 20/3458 {in the gas phase}
- 20/3466 {with steam}
- 20/3475 {in the liquid phase}
- 20/3483 . . . {by thermal treatment not covered by groups [B01J 20/3441](#) - [B01J 20/3475](#), e.g. by heating or cooling}
- 20/3491 . . . {by pressure treatment}
- 21/00 Catalysts comprising the elements, oxides, or hydroxides of magnesium, boron, aluminium, carbon, silicon, titanium, zirconium, or hafnium**
- 21/005 . {Spinels}
- 21/02 . Boron or aluminium; Oxides or hydroxides thereof
- 21/04 . . Alumina
- 21/06 . Silicon, titanium, zirconium or hafnium; Oxides or hydroxides thereof
- 21/063 . . {Titanium; Oxides or hydroxides thereof}
- 21/066 . . {Zirconium or hafnium; Oxides or hydroxides thereof}
- 21/08 . . Silica
- 21/10 . Magnesium; Oxides or hydroxides thereof
- 21/12 . Silica and alumina
- 21/14 . Silica and magnesia
- 21/16 . Clays or other mineral silicates
- 21/18 . Carbon
- 21/185 . . {Carbon nanotubes (carbon nanotubes [per se](#) [C01B 32/15](#))}
- 21/20 . Regeneration or reactivation
- 23/00 Catalysts comprising metals or metal oxides or hydroxides, not provided for in group [B01J 21/00](#) ([B01J 21/16](#) takes precedence)**
- 23/002 . {Mixed oxides other than spinels, e.g. perovskite}
- NOTE**
- In group [B01J 23/002](#), elements constituting the exemplified mixed oxide are further indexed under the form of a C-set with [B01J 2523/00](#) as base symbol using the relevant classification symbols of [B01J 2523/10](#) - [B01J 2523/847](#), in numerical order, as further symbols and separated by ",", e.g. the mixed oxide $\text{Mo}_a\text{V}_b\text{Te}_c\text{O}_x$ is classified as ([B01J 2523/00](#), [B01J 2523/55](#), [B01J 2523/64](#), [B01J 2523/68](#)).
- 23/005 . {Spinels}
- 23/007 . {Mixed salts}
- 23/02 . of the alkali- or alkaline earth metals or beryllium
- 23/04 . . Alkali metals
- 23/06 . of zinc, cadmium or mercury
- 23/08 . of gallium, indium or thallium
- 23/10 . of rare earths
- 23/12 . of actinides
- 23/14 . of germanium, tin or lead
- 23/16 . of arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
- 23/18 . . Arsenic, antimony or bismuth
- 23/20 . . Vanadium, niobium or tantalum
- 23/22 . . . Vanadium
- 23/24 . . Chromium, molybdenum or tungsten
- 23/26 . . . Chromium
- 23/28 . . . Molybdenum
- 23/30 . . . Tungsten
- 23/31 . . . combined with bismuth
- 23/32 . . Manganese, technetium or rhenium
- 23/34 . . . Manganese
- 23/36 . . . Rhenium
- 23/38 . of noble metals
- 23/40 . . of the platinum group metals
- 23/42 . . . Platinum
- 23/44 . . . Palladium
- 23/46 . . . Ruthenium, rhodium, osmium or iridium
- 23/462 {Ruthenium}
- 23/464 {Rhodium}
- 23/466 {Osmium}
- 23/468 {Iridium}
- 23/48 . . Silver or gold
- 23/50 . . . Silver
- 23/52 . . . Gold
- 23/54 . . combined with metals, oxides or hydroxides provided for in groups [B01J 23/02](#) - [B01J 23/36](#)
- 23/56 . . . Platinum group metals
- 23/58 with alkali- or alkaline earth metals
- 23/60 with zinc, cadmium or mercury
- 23/62 with gallium, indium, thallium, germanium, tin or lead
- 23/622 {with germanium, tin or lead}
- 23/624 {with germanium}
- 23/626 {with tin}
- 23/628 {with lead}
- 23/63 with rare earths or actinides
- 23/64 with arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
- 23/644 Arsenic, antimony or bismuth
- 23/6442 {Arsenic}
- 23/6445 {Antimony}
- 23/6447 {Bismuth}
- 23/648 Vanadium, niobium or tantalum {or polonium}
- 23/6482 {Vanadium}
- 23/6484 {Niobium}
- 23/6486 {Tantalum}
- 23/6488 {Polonium}
- 23/652 Chromium, molybdenum or tungsten
- 23/6522 {Chromium}
- 23/6525 {Molybdenum}
- 23/6527 {Tungsten}
- 23/656 Manganese, technetium or rhenium
- 23/6562 {Manganese}
- 23/6565 {Technetium}
- 23/6567 {Rhenium}
- 23/66 . . . Silver or gold
- 23/68 with arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
- 23/681 {with arsenic, antimony or bismuth}

23/682	. . . . . {with vanadium, niobium, tantalum or polonium}	23/8894	. . . . . {Technetium}
23/683	. . . . . {with chromium, molybdenum or tungsten}	23/8896	. . . . . {Rhenium}
23/685	. . . . . {with chromium}	23/8898	. . . . . {containing also molybdenum}
23/686	. . . . . {with molybdenum}	23/89	. . combined with noble metals
23/687	. . . . . {with tungsten}	23/8906	. . . {Iron and noble metals}
23/688	. . . . . {with manganese, technetium or rhenium}	23/8913	. . . {Cobalt and noble metals}
23/70	. of the iron group metals or copper	23/892	. . . {Nickel and noble metals}
23/72	. . Copper	23/8926	. . . {Copper and noble metals}
23/74	. . Iron group metals	23/8933	. . . {also combined with metals, or metal oxides or hydroxides provided for in groups B01J 23/02 - B01J 23/36 }
23/745	. . . Iron	23/894	. . . . . {with rare earths or actinides}
23/75	. . . Cobalt	23/8946	. . . . . {with alkali or alkaline earth metals}
23/755	. . . Nickel	23/8953	. . . . . {with zinc, cadmium or mercury}
23/76	. . combined with metals, oxides or hydroxides provided for in groups B01J 23/02 - B01J 23/36	23/896	. . . . . {with gallium, indium or thallium}
23/78	. . . with alkali- or alkaline earth metals	23/8966	. . . . . {with germanium, tin or lead}
23/80	. . . with zinc, cadmium or mercury	23/8973	. . . . . {with arsenic, antimony or bismuth}
23/825	. . . with gallium, indium or thallium	23/898	. . . . . {with vanadium, tantalum, niobium or polonium}
23/83	. . . with rare earths or actinides	23/8986	. . . . . {with manganese, technetium or rhenium}
23/835	. . . with germanium, tin or lead	23/8993	. . . . . {with chromium, molybdenum or tungsten}
23/84	. . . with arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium	23/90	. Regeneration or reactivation
23/843	. . . . Arsenic, antimony or bismuth	23/92	. . of catalysts comprising metals, oxides or hydroxides provided for in groups B01J 23/02 - B01J 23/36
23/8432	. . . . . {Arsenic}	23/94	. . of catalysts comprising metals, oxides or hydroxides of the iron group metals or copper
23/8435	. . . . . {Antimony}	23/96	. . of catalysts comprising metals, oxides or hydroxides of the noble metals
23/8437	. . . . . {Bismuth}		
23/847	. . . . Vanadium, niobium or tantalum {or polonium}	25/00	Catalysts of the Raney type
23/8472	. . . . . {Vanadium}	25/02	. Raney nickel
23/8474	. . . . . {Niobium}	25/04	. Regeneration or reactivation
23/8476	. . . . . {Tantalum}		
23/8478	. . . . . {Polonium}	27/00	Catalysts comprising the elements or compounds of halogens, sulfur, selenium, tellurium, phosphorus or nitrogen; Catalysts comprising carbon compounds
23/85	. . . . Chromium, molybdenum or tungsten		
23/86	. . . . . Chromium		
23/862	. . . . . {Iron and chromium}		
23/864	. . . . . {Cobalt and chromium}		
23/866	. . . . . {Nickel and chromium}		
23/868	. . . . . {copper and chromium}		
23/88	. . . . . Molybdenum		
23/881	. . . . . and iron		
23/882	. . . . . and cobalt		
23/883	. . . . . and nickel	27/02	. Sulfur, selenium or tellurium; Compounds thereof
23/885	. . . . . and copper	27/04	. . Sulfides
23/887	. . . . . containing in addition other metals, oxides or hydroxides provided for in groups B01J 23/02 - B01J 23/36	27/043	. . . with iron group metals or platinum group metals
23/8871	. . . . . {Rare earth metals or actinides}	27/045	. . . . Platinum group metals
23/8872	. . . . . {Alkali or alkaline earth metals}	27/047	. . . with chromium, molybdenum, tungsten or polonium
23/8873	. . . . . {Zinc, cadmium or mercury}	27/049	. . . . with iron group metals or platinum group metals
23/8874	. . . . . {Gallium, indium or thallium}	27/051	. . . . Molybdenum
23/8875	. . . . . {Germanium, tin or lead}	27/0515	. . . . . {with iron group metals or platinum group metals}
23/8876	. . . . . {Arsenic, antimony or bismuth}		
23/8877	. . . . . {Vanadium, tantalum, niobium or polonium}	27/053	. . Sulfates
23/8878	. . . . . {Chromium}	27/055	. . . with alkali metals, copper, gold or silver
23/888	. . . . . Tungsten	27/057	. . Selenium or tellurium; Compounds thereof
23/8885	. . . . . {containing also molybdenum}	27/0573	. . . {Selenium; Compounds thereof}
23/889	. . . . Manganese, technetium or rhenium	27/0576	. . . {Tellurium; Compounds thereof}
23/8892	. . . . . {Manganese}	27/06	. Halogens; Compounds thereof

NOTE

Metal catalysts or metal oxide catalysts activated or conditioned by halogens, sulfur or phosphorus, or compounds thereof are classified in the appropriate groups for metal or metal oxide catalysts

27/08	. . Halides	27/32	. . of catalysts comprising compounds of halogens
27/10	. . . Chlorides	29/00	Catalysts comprising molecular sieves {(molecular sieves per se C01B)}
27/12	. . . Fluorides		NOTES
27/122	. . . of copper		1. In this group, the following term is used with the meaning indicated:
27/125	. . with scandium, yttrium, aluminium, gallium, indium or thallium		• "zeolites" means:
27/128	. . with iron group metals or platinum group metals		i. crystalline aluminosilicates with base-exchange and molecular sieve properties, having three dimensional, microporous lattice framework structure of tetrahedral oxide units;
27/13	. . . Platinum group metals		ii. compounds isomorphous to those of the former category, wherein the aluminium or silicon atoms in the framework are partly or wholly replaced by atoms of other elements, e.g. by gallium, germanium, phosphorus or boron.
27/132	. . with chromium, molybdenum, tungsten or polonium		2. If metals are introduced into the framework of the molecular sieve already in the synthesis stage, B01J 29/86 - B01J 29/89 take precedence.
27/135	. . with titanium, zirconium, hafnium, germanium, tin or lead		3. Mixtures of molecular sieves are classified in B01J 29/005 or B01J 29/80 and receive indexing codes chosen from groups B01J 29/03 - B01J 29/89 to identify the individual constituents of these mixtures
27/138	. . with alkaline earth metals, magnesium, beryllium, zinc, cadmium or mercury	29/005	. {Mixtures of molecular sieves comprising at least one molecular sieve which is not an aluminosilicate zeolite, e.g. from groups B01J 29/03 - B01J 29/049 or B01J 29/82 - B01J 29/89 }
27/14	. Phosphorus; Compounds thereof	29/03	. not having base-exchange properties {(B01J 29/005 takes precedence)}
27/16	. . containing oxygen {, i.e. acids, anhydrides and their derivatives with N, S, B or halogens without carriers or on carriers based on C, Si, Al or Zr; also salts of Si, Al and Zr}	29/0308	. . {Mesoporous materials not having base exchange properties, e.g. Si-MCM-41}
27/18	. . . with metals {other than Al or Zr}	29/0316	. . . {containing iron group metals, noble metals or copper}
27/1802	. . . . {Salts or mixtures of anhydrides with compounds of other metals than V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, e.g. phosphates, thiophosphates}	29/0325	. . . . {Noble metals}
27/1804	. . . . . {with rare earths or actinides}	29/0333	. . . . {Iron group metals or copper}
27/1806	. . . . . {with alkaline or alkaline earth metals}	29/0341	. . . {containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium}
27/1808	. . . . . {with zinc, cadmium or mercury}	29/035	. . {Microporous crystalline materials not having base exchange properties, such as} silica polymorphs, e.g. silicalites
27/1811	. . . . . {with gallium, indium or thallium}	29/0352	. . . {containing iron group metals, noble metals or copper}
27/1813	. . . . . {with germanium, tin or lead}	29/0354	. . . . {Noble metals}
27/1815	. . . . . {with arsenic, antimony or bismuth}	29/0356	. . . . {Iron group metals or copper}
27/1817	. . . . . {with copper, silver or gold}	29/0358	. . . {containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium}
27/182	. . with silicon	29/04	. having base-exchange properties, e.g. crystalline zeolites {(B01J 29/005 takes precedence)}
27/185	. . with iron group metals or platinum group metals	29/041	. . {Mesoporous materials having base exchange properties, e.g. Si/Al-MCM-41}
27/1853	. . . {with iron, cobalt or nickel}	29/042	. . . {containing iron group metals, noble metals or copper}
27/1856	. . . {with platinum group metals}	29/043	. . . . {Noble metals}
27/186	. . with arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium	29/044	. . . . {Iron group metals or copper}
27/187	. . . with manganese, technetium or rhenium		
27/188	. . . with chromium, molybdenum, tungsten or polonium		
27/19	. . . . Molybdenum		
27/192	. . . . . with bismuth		
27/195	. . . with vanadium, niobium or tantalum		
27/198	. . . . Vanadium		
27/199	. . . . . with chromium, molybdenum, tungsten or polonium		
27/20	. Carbon compounds		
27/22	. . Carbides		
27/224	. . . Silicon carbide		
27/228	. . . . with phosphorus, arsenic, antimony or bismuth		
27/232	. . Carbonates		
27/236	. . . Hydroxy carbonates		
27/24	. Nitrogen compounds		
27/25	. . Nitrates		
27/26	. . Cyanides		
27/28	. Regeneration or reactivation		
27/285	. . {of catalysts comprising compounds of phosphorus}		
27/30	. . of catalysts comprising compounds of sulfur, selenium or tellurium		

29/045	. . . {containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium}	29/40	. . . of the pentasil type, e.g. types ZSM-5, ZSM-8 or ZSM-11, as exemplified by patent documents US3702886, GB1334243 and US3709979, respectively
29/046	. . {Chromiasilicates; Aluminochromosilicates (B01J 29/005 takes precedence)}	29/405	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}
29/047	. . {Germanosilicates; Aluminogermanosilicates (B01J 29/005 takes precedence)}	29/42	. . . . containing iron group metals, noble metals or copper
29/048	. . {Zincosilicates, Aluminozincosilicates (B01J 29/005 takes precedence)}	29/44	. . . . . Noble metals
29/049	. . {Pillared clays}	29/46	. . . . . Iron group metals or copper
29/06	. . Crystalline aluminosilicate zeolites; Isomorphous compounds thereof	29/48	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/061	. . . {containing metallic elements added to the zeolite}	29/50	. . . of the erionite or offretite type, e.g. zeolite T, as exemplified by patent document US2950952
2029/062	. . . {Mixtures of different aluminosilicates}	29/505	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}
29/064	. . . containing iron group metals, noble metals or copper	29/52	. . . . containing iron group metals, noble metals or copper
29/068	. . . . Noble metals	29/54	. . . . . Noble metals
29/072	. . . . Iron group metals or copper	29/56	. . . . . Iron group metals or copper
29/076	. . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium	29/58	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/08	. . . of the faujasite type, e.g. type X or Y	29/60	. . . of the type L, as exemplified by patent document US3216789
2029/081	. . . . {Increasing the silica/alumina ratio; Desalumination}	29/605	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}
29/082	. . . . {X-type faujasite}	29/61	. . . . containing iron group metals, noble metals or copper
29/084	. . . . {Y-type faujasite}	29/62	. . . . . Noble metals
29/085	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}	29/63	. . . . . Iron group metals or copper
29/087	. . . . . {X-type faujasite}	29/64	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/088	. . . . . {Y-type faujasite}	29/65	. . . of the ferrierite type, e.g. types ZSM-21, ZSM-35 or ZSM-38, as exemplified by patent documents US4046859, US4016245 and US4046859, respectively
29/10	. . . . containing iron group metals, noble metals or copper	29/655	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}
29/103	. . . . . {X-type faujasite}	29/66	. . . . containing iron group metals, noble metals or copper
29/106	. . . . . {Y-type faujasite}	29/67	. . . . . Noble metals
29/12	. . . . . Noble metals	29/68	. . . . . Iron group metals or copper
29/123	. . . . . {X-type faujasite}	29/69	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/126	. . . . . {Y-type faujasite}	29/70	. . . of types characterised by their specific structure not provided for in groups B01J 29/08 - B01J 29/65
29/14	. . . . . Iron group metals or copper	29/7003	. . . . {A-type}
29/143	. . . . . {X-type faujasite}		
29/146	. . . . . {Y-type faujasite}		
29/16	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium		
29/163	. . . . . {X-type faujasite}		
29/166	. . . . . {Y-type faujasite}		
29/18	. . . of the mordenite type		
29/185	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}		
29/20	. . . . containing iron group metals, noble metals or copper		
29/22	. . . . . Noble metals		
29/24	. . . . . Iron group metals or copper		
29/26	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium		

29/7007	. . . . {Zeolite Beta}	29/7423	. . . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}
29/7011	. . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}	29/743	. . . . . {CHA-type, e.g. Chabazite, LZ-218}
29/7015	. . . . {CHA-type, e.g. Chabazite, LZ-218}	29/7438	. . . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}
29/7019	. . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}	29/7446	. . . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}
29/7023	. . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}	29/7453	. . . . . {MFS-type, e.g. ZSM-57}
29/7026	. . . . {MFS-type, e.g. ZSM-57}	29/7461	. . . . . {MRE-type, e.g. ZSM-48}
29/703	. . . . {MRE-type, e.g. ZSM-48}	29/7469	. . . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}
29/7034	. . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}	29/7476	. . . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}
29/7038	. . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}	29/7484	. . . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}
29/7042	. . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}	29/7492	. . . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}
29/7046	. . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}	29/76	. . . . . Iron group metals or copper
29/7049	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}	29/7607	. . . . . {A-type}
29/7053	. . . . . {A-type}	29/7615	. . . . . {Zeolite Beta}
29/7057	. . . . . {Zeolite Beta}	29/7623	. . . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}
29/7061	. . . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}	29/763	. . . . . {CHA-type, e.g. Chabazite, LZ-218}
29/7065	. . . . . {CHA-type, e.g. Chabazite, LZ-218}	29/7638	. . . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}
29/7069	. . . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}	29/7646	. . . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}
29/7073	. . . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}	29/7653	. . . . . {MFS-type, e.g. ZSM-57}
29/7076	. . . . . {MFS-type, e.g. ZSM-57}	29/7661	. . . . . {MRE-type, e.g. ZSM-48}
29/708	. . . . . {MRE-type, e.g. ZSM-48}	29/7669	. . . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}
29/7084	. . . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}	29/7676	. . . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}
29/7088	. . . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}	29/7684	. . . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}
29/7092	. . . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}	29/7692	. . . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}
29/7096	. . . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}	29/78	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/72	. . . . containing iron group metals, noble metals or copper	29/7807	. . . . . {A-type}
29/7207	. . . . . {A-type}	29/7815	. . . . . {Zeolite Beta}
29/7215	. . . . . {Zeolite Beta}	29/7823	. . . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}
29/7223	. . . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}	29/783	. . . . . {CHA-type, e.g. Chabazite, LZ-218}
29/723	. . . . . {CHA-type, e.g. Chabazite, LZ-218}	29/7838	. . . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}
29/7238	. . . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}	29/7846	. . . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}
29/7246	. . . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}	29/7853	. . . . . {MFS-type, e.g. ZSM-57}
29/7253	. . . . . {MFS-type, e.g. ZSM-57}	29/7861	. . . . . {MRE-type, e.g. ZSM-48}
29/7261	. . . . . {MRE-type, e.g. ZSM-48}	29/7869	. . . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}
29/7269	. . . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}	29/7876	. . . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}
29/7276	. . . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}	29/7884	. . . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}
29/7284	. . . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}	29/7892	. . . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}
29/7292	. . . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}	29/80	. . . Mixtures of different zeolites
29/74	. . . . . Noble metals	29/82	. Phosphates { B01J 29/005 takes precedence}
29/7407	. . . . . {A-type}	29/83	. . Aluminophosphates (APO compounds)
29/7415	. . . . . {Zeolite Beta}		

- 29/84 . . Aluminophosphates containing other elements, e.g. metals, boron
- 29/85 . . . Silicoaluminophosphates (SAPO compounds)
- 29/86 . Borosilicates; Aluminoborosilicates { ([B01J 29/005](#) takes precedence) }
- 29/87 . Gallosilicates; Aluminogallosilicates; Galloborosilicates { ([B01J 29/005](#) takes precedence) }
- 29/88 . Ferrosilicates; Ferroaluminosilicates { ([B01J 29/005](#) takes precedence) }
- 29/89 . Silicates, aluminosilicates or borosilicates of titanium, zirconium or hafnium { ([B01J 29/005](#) takes precedence) }
- 29/90 . Regeneration or reactivation

31/00 Catalysts comprising hydrides, coordination complexes or organic compounds (catalyst compositions used only in polymerisation reactions C08 {; catalytic antibodies C12N 9/0002})

NOTES

1. Group [B01J 31/003](#) takes precedence over groups [B01J 31/02](#) - [B01J 31/24](#) (catalytic antibodies [C12N 9/0002](#))
2. In this group, the following terms or expressions are used with the meanings indicated:
 - "Organic compound" a compound in which carbon is bonded to
 - (1) a second carbon;
 - (2) at least one atom of hydrogen or halogen; or
 - (3) nitrogen by a single or double bond; except cyanic acid (HOCN), cyanogen (NCCN), cyanamide (H₂NCN), cyanogen halide (HalCN), hydrocyanic acid (HCN) isocyanic acid (HNCO) fulminic acid (HCNO) and metal carbides (MCCM) (catalysts comprising any of these exceptions or their salts [B01J 27/20](#) - [B01J 27/26](#)).
 - "Organometallic compounds" includes all organic compounds wherein a metal or metalloid atom is bonded directly to a carbon fragment, the latter being formally anionic, no further neutral ligands being coordinated to the metal and the compound requiring no further cations for charge balance; e.g. M(1-CR₃)_n with M= main group metal, n= valency of metal and R= H or hydrocarbyl. (Compounds comprising anionic organonitrogen, organooxygen and organosulfur fragments, excluding carboxylates, with a metal bonded to these heteroatoms [B01J 31/02](#) - [B01J 31/0254](#); unsaturated carbon fragments in combination with transition metals [B01J 31/2282](#)).
 - "Coordination complexes" includes any donor-acceptor compounds or complex ions comprising organic or inorganic, anionic or neutral Lewis basic ligands, attached to a Lewis acid central metal or metal ion through one or several complexing donor atoms with at least one lone-pair of electrons, e.g. N, O, S, P, to provide at least a Sigma-bond. Typically the maximum number of same or different ligands according to the coordination number, spatial requirements of the ligand and electronic configuration of the metal is bound in

a predictable geometry. Complexes of neutral, cationic or anionic hydrocarbon ligands with delocalised charge and/or bonding site, e.g. Pd-olefin complexes or metallocenes, are also included (the following groups take precedence: simple hydrocarbyl metal compounds, e.g. of main group metal(oids) [B01J 31/12](#); oxoacid salts [B01J 31/04](#) - [B01J 31/10](#); other compounds comprising anionic organonitrogen, organooxygen and organosulfur fragments with a metal bonded to these heteroatoms [B01J 31/02](#) - [B01J 31/0254](#)).

- "Organometallic complexes" includes all coordination complexes comprising a M-C bond, e.g. metal carbonyls (complex cyanides such as M₄[Fe(CN)₆] [B01J 27/26](#)). Included are furthermore complexes which are not strictly organometallic per se, e.g. comprising only N, O, S and/or P coordinated ligands, but are described as involving, or known to involve, organometallic intermediates and/or transition states during use, e.g. Group 8-10 metal complexes for a variety of catalytic reactions or steps thereof, such as oxidative addition, e.g. of ArX, hydrogenation, carbonylation, epoxidation, etc.
 - "Organic complexes" includes all coordination complexes comprising organic ligands (groups [B01J 31/1608](#) - [B01J 31/1895](#) take precedence).
 - "Polymer" includes any macromolecular substance (typically M>10000 g/mol), which comprises repeating units made up of one or several kinds of atoms or groups of atoms, which are identically connected to one another. Oligomers, i.e. more than two identical repeating units connected to one another and typically 500<M<10000 g/mol, are grouped with the respective polymers (polymers per se [C08](#)).
3. In this group, if two or more aspects are of equal importance, these are each classified, e.g. two components in a catalyst system such as:
 - support and pendant or otherwise immobilised coordination complex; or
 - coordination complex and essential additive.
 However, if two components, even if separately added, are described as forming, or known to form, a coordination complex, only the latter is classified, e.g. phosphine and Group 8-10 metal such as rhodium. The groups [B01J 31/26](#) - [B01J 31/38](#) are not to be used for the central metals in coordination complexes but rather for separately added further inorganic ingredients. Each specifically disclosed alternative is separately classified, i.e. specifically disclosed by ways of worked examples, specific claims and/or explicit alternatives therein.
 4. { When classifying in [B01J 31/00](#), additional information for the catalysts is provided as follows:
 - (4-1) the specifically disclosed intended uses are indexed in [B01J 2231/00](#);
 - (4-2) general aspects of the complexes of group [B01J 31/16](#) and the specifically disclosed central metal(s) therein, as well as additional information regarding any special solvents

B01J 31/00

(continued)

- used for any catalyst system of this group are indexed in [B01J 2531/00](#).
(4-3) conceptual articles, e.g. reviews, are separately indexed in [B01J 2231/005](#) and [B01J 2531/001](#);
(4-4) additional information regarding the complexes or ligands classified in [B01J 31/16](#) - [B01J 31/24](#) and indexed in [B01J 2531/00](#) is indexed in [B01J 2540/00](#), e.g. non-coordinating substituents on the ligand periphery}
- 31/003 . {containing enzymes}
NOTE
In this group, the presence of water is disregarded for classification purposes
- 31/006 . {comprising organic radicals, e.g. TEMPO}
31/02 . containing organic compounds or metal hydrides
31/0201 . . {Oxygen-containing compounds}
31/0202 . . . {Alcohols or phenols}
31/0204 . . . {Ethers}
31/0205 . . . {comprising carbonyl groups or oxygen-containing derivatives, e.g. acetals, ketals, cyclic peroxides}
31/0207 {Aldehydes or acetals}
31/0208 {Ketones or ketals}
31/0209 . . . {Esters of carboxylic or carbonic acids}
31/0211 . . . {with a metal-oxygen link}
31/0212 {Alkoxylates}
31/0214 {Aryloxylates, e.g. phenolates}
31/0215 . . {Sulfur-containing compounds}
31/0217 . . . {Mercaptans or thiols}
31/0218 . . . {Sulfides}
31/022 {Disulfides}
31/0221 {Polysulfides}
31/0222 . . . {comprising sulfonyl groups}
31/0224 {being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional compounds}
31/0225 . . . {comprising sulfonic acid groups or the corresponding salts}
31/0227 {being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional compounds}
31/0228 . . . {with a metal-sulfur link, e.g. mercaptides}
31/0229 . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0214](#)}
31/0231 . . {Halogen-containing compounds}
31/0232 . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0228](#) (perfluorinated sulfonyl compounds or moieties [B01J 31/0224](#); perfluorosulfonic acids [B01J 31/0227](#))}
31/0234 . . {Nitrogen-, phosphorus-, arsenic- or antimony-containing compounds}
31/0235 . . . {Nitrogen containing compounds}
31/0237 {Amines}
31/0238 {with a primary amino group}
31/0239 {Quaternary ammonium compounds}
31/0241 {Imines or enamines}
31/0242 {Enamines}
- 31/0244 {with nitrogen contained as ring member in aromatic compounds or moieties, e.g. pyridine}
31/0245 {being derivatives of carboxylic or carbonic acids}
31/0247 {Imides, amides or imidates ($R-C=NR(OR)$)}
31/0248 {Nitriles}
31/0249 {Ureas ($R_2N-C(=O)-NR_2$)}
31/0251 {Guanidides ($R_2N-C(=NR)-NR_2$)}
31/0252 {with a metal-nitrogen link, e.g. metal amides, metal guanidides}
31/0254 {on mineral substrates}
31/0255 . . . {Phosphorus containing compounds}
31/0257 {Phosphorus acids or phosphorus acid esters}
31/0258 {Phosphoric acid mono-, di- or triesters ($(RO)(R'O)2P=O$), i.e. $R= C$, $R'= C$, H }
31/0259 {comprising phosphorous acid (-ester) groups ($(RO)P(OR')2$) or the isomeric phosphonic acid (-ester) groups ($R(R'O)2P=O$), i.e. $R= C$, $R'= C$, H }
31/0261 {comprising phosphonous acid (-ester) groups ($RP(OR')2$) or the isomeric phosphinic acid (-ester) groups ($R2(R'O)P=O$), i.e. $R= C$, $R'= C$, H }
31/0262 {comprising phosphinous acid (-ester) groups ($R2P(OR')$) or the isomeric phosphine oxide groups ($R3P=O$), i.e. $R= C$, $R'= C$, H }
31/0264 {Phosphorus acid amides}
31/0265 {Phosphazenes, oligomers thereof or the corresponding phosphazanium salts ([polyphosphazenes per se C07F 9/067](#))}
31/0267 {Phosphines or phosphonium compounds, i.e. phosphorus bonded to at least one carbon atom, including e.g. sp²-hybridised phosphorus compounds such as phosphabenzene, the other atoms bonded to phosphorus being either carbon or hydrogen}
31/0268 {Phosphonium compounds, i.e. phosphine with an additional hydrogen or carbon atom bonded to phosphorous so as to result in a formal positive charge on phosphorous}
31/0269 {on mineral substrates}
31/0271 . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0231](#)}
31/0272 . . {containing elements other than those covered by [B01J 31/0201](#) - [B01J 31/0255](#)}
31/0274 . . . {containing silicon (ligands in coordination complexes [B01J 31/1608](#))}
31/0275 . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0269](#)}
31/0277 . . {comprising ionic liquids, as components in catalyst systems or catalysts *per se*, the ionic liquid compounds being used in the molten state at the respective reaction temperature}
31/0278 . . . {containing nitrogen as cationic centre}
31/0279 {the cationic portion being acyclic or nitrogen being a substituent on a ring}
31/0281 {the nitrogen being a ring member}
31/0282 {of an aliphatic ring, e.g. morpholinium}
31/0284 {of an aromatic ring, e.g. pyridinium}

- 31/0285 {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0274](#)}
- 31/0287 . . . {containing atoms other than nitrogen as cationic centre}
- 31/0288 {Phosphorus}
- 31/0289 {Sulfur}
- 31/0291 {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0274](#)}
- 31/0292 . . . {immobilised on a substrate}
- 31/0294 {by polar or ionic interaction with the substrate, e.g. glass}
- 31/0295 {by covalent attachment to the substrate, e.g. silica}
- 31/0297 {the substrate being a soluble polymer, dendrimer or oligomer of characteristic microstructure of groups [B01J 31/061](#) - [B01J 31/068](#)}
- 31/0298 . . . {the ionic liquids being characterised by the counter-anions}
- 31/04 . . containing carboxylic acids or their salts {([B01J 31/0277](#) - [B01J 31/0298](#) take precedence; multi-metal carboxylate complexes like Pd (II) acetate, i.e. Pd3 (OAc) 6 or Cr(II)acetate, i.e. Cr₂(OAc)₄ [B01J 31/2226](#))}
- 31/06 . . containing polymers {(organometallic polymers [B01J 31/123](#); polymer-bound organometallic complexes [B01J 31/165](#); coordination polymers [B01J 31/1691](#))}
- 31/061 . . . {Chiral polymers}
- 31/062 {Polymeric amino acids}
- 31/063 . . . {Polymers comprising a characteristic microstructure}
- 31/064 {Dendrimers}
- 31/065 {Cyclodextrins}
- 31/066 {Calixarenes and hetero-analogues, e.g. thiacalixarenes}
- 31/067 {Molecularly imprinted polymers (catalytic antibodies [C12N 9/0002](#))}
- 31/068 . . . {Polyalkylene glycols}
- 31/069 . . . {Hybrid organic-inorganic polymers, e.g. silica derivatized with organic groups (nitrogen containing groups on mineral substrates [B01J 31/0254](#); organometallic polymers [B01J 31/123](#); coordination complexes immobilised on an inorganic support [B01J 31/1616](#); coordination polymers, e.g. metal-organic frameworks [B01J 31/1691](#))}
- 31/08 . . . Ion-exchange resins
- 31/10 sulfonated
- 31/12 . . containing organo-metallic compounds or metal hydrides
- 31/121 . . . {Metal hydrides}
- 31/122 . . . {Metal aryl or alkyl compounds}
- 31/123 . . . {Organometallic polymers, e.g. comprising C-Si bonds in the main chain or in subunits grafted to the main chain ([B01J 31/064](#), [B01J 31/066](#), [B01J 31/067](#), [B01J 31/08](#) and [B01J 31/10](#) take precedence; polymer-bound organometallic complexes [B01J 31/165](#); coordination polymers [B01J 31/1691](#); catalysts for the preparation of polysiloxanes, e.g. Karstedt catalysts [C08G 77/08](#))}
- 31/124 {Silicones or siloxanes or comprising such units}
- 31/125 {Cyclic siloxanes}
- 31/126 {the siloxanes or siloxane units, cyclic or not, comprising an additional Si-H bond, e.g. polyhydromethylsiloxane [PHMS]}
- 31/127 {the siloxane units, e.g. silsesquioxane units, being grafted onto other polymers or inorganic supports, e.g. via an organic linker}
- 31/128 . . . {Mixtures of organometallic compounds}
- 31/14 . . . of aluminium or boron
- 31/143 {of aluminium}
- 31/146 {of boron}
- 31/16 . . containing coordination complexes
- 31/1608 . . {the ligands containing silicon}
- 31/1616 . . {Coordination complexes, e.g. organometallic complexes, immobilised on an inorganic support, e.g. ship-in-a-bottle type catalysts (catalysts comprising molecular sieves [B01J 29/00](#))}
- 31/1625 . . . {immobilised by covalent linkages, i.e. pendant complexes with optional linking groups}
- 31/1633 {covalent linkages via silicon containing groups}
- 31/1641 {established via a metathesis reaction using a silicon-containing olefin}
- 31/165 . . {Polymer immobilised coordination complexes, e.g. organometallic complexes}
- 31/1658 . . . {immobilised by covalent linkages, i.e. pendant complexes with optional linking groups, e.g. on Wang or Merrifield resins}
- 31/1666 {the linkage established via an olefin metathesis reaction}
- 31/1675 {the linkage being to an organometallic polymer covered by groups [B01J 31/123](#) - [B01J 31/127](#), e.g. polyhydrosiloxanes}
- 31/1683 {the linkage being to a soluble polymer, e.g. PEG or dendrimer, i.e. molecular weight enlarged complexes}
- 31/1691 . . {Coordination polymers, e.g. metal-organic frameworks [MOF] (preparation of metal complexes containing carboxylic acid moieties [C07C 51/418](#); MOF's per se [C07F](#))}
- 31/18 . . containing nitrogen, phosphorus, arsenic or antimony {as complexing atoms, e.g. in pyridine ligands, or in resonance therewith, e.g. in isocyanide ligands C=N-R or as complexed central atoms (double metal cyanides [B01J 27/26](#); N-heterocyclic carbenes [B01J 31/2265](#))}
- 31/1805 . . . {the ligands containing nitrogen}
- 31/181 {Cyclic ligands, including e.g. non-condensed polycyclic ligands, comprising at least one complexing nitrogen atom as ring member, e.g. pyridine}
- 31/1815 {with more than one complexing nitrogen atom, e.g. bipyridyl, 2-aminopyridine}
- 31/182 {comprising aliphatic or saturated rings}
- 31/1825 {Ligands comprising condensed ring systems, e.g. acridine, carbazole}
- 31/183 {with more than one complexing nitrogen atom, e.g. phenanthroline}
- 31/1835 {comprising aliphatic or saturated rings}

31/184	. . . . . {mixed aromatic/aliphatic ring systems, e.g. indoline}	31/2273	. . . . . {with only nitrogen as heteroatomic ring members, e.g. 1,3-diarylimidazoline-2-ylidenes}
31/1845	. . . {the ligands containing phosphorus (phosphines B01J 31/24)}	31/2278	. . . . . {Complexes comprising two carbene ligands differing from each other, e.g. Grubbs second generation catalysts}
31/185	. . . . . {Phosphites ((RO)3P), their isomeric phosphonates (R(RO)2P=O) and RO-substitution derivatives thereof}	31/2282	. . . . . {Unsaturated compounds used as ligands}
31/1855	. . . . . {Triamide derivatives thereof}	31/2286	. . . . . {Alkynes, e.g. acetylides}
31/186	. . . . . {Mono- or diamide derivatives thereof}	31/2291	. . . . . {Olefins}
31/1865	. . . . . {Phosphonites (RP(OR)2), their isomeric phosphinates (R2(RO)P=O) and RO-substitution derivatives thereof}	31/2295	. . . . . {Cyclic compounds, e.g. cyclopentadienyls}
31/187	. . . . . {Amide derivatives thereof}	31/24	. . . Phosphines {, i.e. phosphorus bonded to only carbon atoms, or to both carbon and hydrogen atoms, including e.g. sp ² -hybridised phosphorus compounds such as phosphabenzene, phosphole or anionic phospholide ligands}
31/1875	. . . . . {Phosphinites (R ₂ P(OR)), their isomeric phosphine oxides (R ₃ P=O) and RO-substitution derivatives thereof}	31/2404	. . . {Cyclic ligands, including e.g. non-condensed polycyclic ligands, the phosphine-P atom being a ring member or a substituent on the ring}
31/188	. . . . . {Amide derivatives thereof}	31/2409	. . . . . {with more than one complexing phosphine-P atom}
31/1885	. . . . . {Ligands comprising two different formal oxidation states of phosphorus in one at least bidentate ligand, e.g. phosphite/phosphinite}	31/2414	. . . . . {comprising aliphatic or saturated rings}
31/189	. . . {containing both nitrogen and phosphorus as complexing atoms, including e.g. phosphino moieties, in one at least bidentate or bridging ligand}	31/2419	. . . . . {comprising P as ring member}
31/1895	. . . {the ligands containing arsenic or antimony}	31/2423	. . . . . {comprising aliphatic or saturated rings}
31/20	. . Carbonyls	31/2428	. . . . . {with more than one complexing phosphine-P atom}
31/22	. . Organic complexes	31/2433	. . . . . {comprising aliphatic or saturated rings}
31/2204	. . . {the ligands containing oxygen or sulfur as complexing atoms}	31/2438	. . . . . {and further hetero atoms as ring members, excluding the positions adjacent to P}
31/2208	. . . . . {Oxygen, e.g. acetylacetonates}	31/2442	. . . . . {comprising condensed ring systems}
31/2213	. . . . . {At least two complexing oxygen atoms present in an at least bidentate or bridging ligand}	31/2447	. . . . . {and phosphine-P atoms as substituents on a ring of the condensed system or on a further attached ring}
31/2217	. . . . . {At least one oxygen and one nitrogen atom present as complexing atoms in an at least bidentate or bridging ligand}	31/2452	. . . . . {with more than one complexing phosphine-P atom}
31/2221	. . . . . {At least one oxygen and one phosphorous atom present as complexing atoms in an at least bidentate or bridging ligand}	31/2457	. . . . . {comprising aliphatic or saturated rings, e.g. Xantphos}
31/2226	. . . . . {Anionic ligands, i.e. the overall ligand carries at least one formal negative charge}	31/2461	. . . . . {and phosphine-P atoms as ring members in the condensed ring system or in a further ring}
31/223	. . . . . {At least two oxygen atoms present in one at least bidentate or bridging ligand}	31/2466	. . . . . {comprising aliphatic or saturated rings}
31/2234	. . . . . {Beta-dicarbonyl ligands, e.g. acetylacetonates}	31/2471	. . . . . {with more than one complexing phosphine-P atom}
31/2239	. . . . . {Bridging ligands, e.g. OAc in Cr ₂ (OAc) ₄ , Pt ₄ (OAc) ₈ or dicarboxylate ligands}	31/2476	. . . . . {comprising aliphatic or saturated rings}
31/2243	. . . . . {At least one oxygen and one nitrogen atom present as complexing atoms in an at least bidentate or bridging ligand}	31/248	. . . . . {Bridged ring systems, e.g. 9-phosphabicyclononane}
31/2247	. . . . . {At least one oxygen and one phosphorous atom present as complexing atoms in an at least bidentate or bridging ligand}	31/2485	. . . . . {Tricyclic systems, e.g. phosphaadamananes and hetero analogues}
31/2252	. . . . . {Sulfonate ligands}	31/249	. . . . . {Spiro-condensed ring systems}
31/2256	. . . . . {being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional ligands}	31/2495	. . . {Ligands comprising a phosphine-P atom and one or more further complexing phosphorus atoms covered by groups B01J 31/1845 - B01J 31/1885 , e.g. phosphine/phosphinate or phospholyl/phosphonate ligands}
31/226	. . . . . {Sulfur, e.g. thiocarbamates}	31/26	. . . containing in addition, inorganic metal compounds not provided for in groups B01J 31/02 - B01J 31/24
31/2265	. . . {Carbenes or carbynes, i.e.(image)}	31/28	. . . of the platinum group metals, iron group metals or copper
31/2269	. . . . . {Heterocyclic carbenes}	31/30	. . . Halides
		31/32	. . . of manganese, technetium or rhenium
		31/34	. . . of chromium, molybdenum or tungsten

- 31/36 . . of vanadium, niobium or tantalum
- 31/38 . . of titanium, zirconium or hafnium
- 31/40 . Regeneration or reactivation
- 31/4007 . . {of catalysts containing polymers}
- 31/4015 . . {of catalysts containing metals}
- 31/4023 . . . {containing iron group metals, noble metals or copper}
- 31/403 {containing iron group metals or copper}
- 31/4038 {containing noble metals}
- 31/4046 {containing rhodium}
- 31/4053 . . . {with recovery of phosphorous catalyst system constituents}
- 31/4061 . . . {involving membrane separation}
- 31/4069 . . . {involving extraction with coordinating ionic liquids or supercritical fluids, e.g. CO₂}
- 31/4076 . . . {involving electrochemical processes}
- 31/4084 . . . {involving electromagnetic wave energy, e.g. UV or visible light}
- 31/4092 . . . {involving a stripping step, with stripping gas or solvent}
- 32/00 Catalyst carriers in general**
- 33/00 Protection of catalysts, e.g. by coating**
- 35/00 Catalysts, in general, characterised by their form or physical properties**
- 35/0006 . {Catalysts containing parts with different compositions}
- 35/0013 . {Colloids}
- 35/002 . {Catalysts characterised by their physical properties}
- 35/0026 . . {Density}
- 35/0033 . . {Electric or magnetic properties}
- 35/004 . . {Photocatalysts}
- 35/0046 . . {Physical properties of the active metal ingredient}
- 35/0053 . . . {metal surface area}
- 35/006 . . . {metal crystallite size}
- 35/0066 . . . {metal dispersion value, e.g. percentage or fraction}
- 35/0073 . . {Distribution of the active metal ingredient}
- 35/008 . . . {egg-shell like}
- 35/0086 . . . {egg-yolk like}
- 35/0093 . . . {homogeneous throughout the support particle}
- 35/02 . Solids
- 35/023 . . {Catalysts characterised by dimensions, e.g. grain size}
- 35/026 . . {Form of the solid particles ([B01J 35/08](#) takes precedence)}
- 35/04 . . Foraminous structures, sieves, grids, honeycombs
- 35/06 . . Fabrics or filaments
- 35/065 . . . {Membranes}
- 35/08 . . Spheres
- 35/10 . . characterised by their surface properties or porosity
- 35/1004 . . . {Surface area}
- 35/1009 {less than 10 m²/g}
- 35/1014 {10-100 m²/g}
- 35/1019 {100-500 m²/g}
- 35/1023 {500-1000 m²/g}
- 35/1028 {more than 1000 m²/g}
- 35/1033 . . . {Pore volume}
- 35/1038 {less than 0.5 ml/g}
- 35/1042 {0.5-1.0 ml/g}
- 35/1047 {more than 1.0 ml/g}
- 35/1052 . . . {Pore diameter}
- 35/1057 {less than 2 nm}
- 35/1061 {2-50 nm}
- 35/1066 {50-500 nm}
- 35/1071 {500-1000 nm}
- 35/1076 {larger than 1000 nm}
- 35/108 . . . {Pore distribution}
- 35/1085 {monomodal}
- 35/109 {bimodal}
- 35/1095 {polymodal}
- 35/12 . Liquids or melts
- 37/00 Processes, in general, for preparing catalysts; Processes, in general, for activation of catalysts**
- 37/0009 . {Use of binding agents; Moulding; Pressing; Powdering; Granulating; Addition of materials ameliorating the mechanical properties of the product catalyst}
- 37/0018 . . {Addition of a binding agent or of material, later completely removed among others as result of heat treatment, leaching or washing, (e.g. forming of pores; protective layer, desintegrating by heat)}
- 37/0027 . . {Powdering}
- 37/0036 . . . {Grinding}
- 37/0045 . . . {Drying a slurry, e.g. spray drying}
- 37/0054 . . . {Drying of aerosols}
- 37/0063 . . {Granulating}
- 37/0072 . {Preparation of particles, e.g. dispersion of droplets in an oil bath}
- 37/0081 . {Preparation by melting}
- 37/009 . {Preparation by separation, e.g. by filtration, decantation, screening}
- 37/02 . Impregnation, coating or precipitation ([B01J 37/0009](#) and [B01J 37/0018](#) take precedence) ; protection by coating [B01J 33/00](#)
- 37/0201 . . {Impregnation}
- 37/0203 . . . {the impregnation liquid containing organic compounds}
- 37/0205 . . . {in several steps}
- 37/0207 . . . {Pretreatment of the support}
- 37/0209 . . . {involving a reaction between the support and a fluid}
- 37/0211 . . . {using a colloidal suspension}
- 37/0213 . . . {Preparation of the impregnating solution}
- 37/0215 . . {Coating}
- 37/0217 . . . {Pretreatment of the substrate before coating}
- 37/0219 . . . {the coating containing organic compounds}
- 37/0221 . . . {of particles}
- 37/0223 {by rotation}
- 37/0225 . . . {of metal substrates}
- 37/0226 {Oxidation of the substrate, e.g. anodisation}
- 37/0228 . . . {in several steps}
- 37/023 . . . {using molten compounds}
- 37/0232 . . . {by pulverisation}
- 37/0234 . . {Impregnation and coating simultaneously}
- 37/0236 . . {Drying, e.g. preparing a suspension, adding a soluble salt and drying}
- 37/0238 . . {via the gaseous phase-sublimation}
- 37/024 . . {Multiple impregnation or coating}
- 37/0242 . . . {Coating followed by impregnation}

- 37/0244 . . . {Coatings comprising several layers}
 - 37/0246 . . . {Coatings comprising a zeolite}
 - 37/0248 . . . {Coatings comprising impregnated particles}
 - 37/03 . . Precipitation; Co-precipitation
 - 37/031 . . . {Precipitation}
 - 37/033 {Using Hydrolysis}
 - 37/035 {Precipitation on carriers}
 - 37/036 . . . {to form a gel or a cogel}
 - 37/038 . . . {to form slurries or suspensions, e.g. a washcoat}
 - 37/04 . Mixing { (B01J 37/0009, B01J 37/0018 take precedence)}
 - 37/06 . Washing { (B01J 37/0009, B01J 37/0018 take precedence)}
 - 37/08 . Heat treatment { (B01J 37/0009, B01J 37/0018 take precedence)}
 - 37/082 . . {Decomposition and pyrolysis}
 - 37/084 . . . {Decomposition of carbon-containing compounds into carbon}
 - 37/086 . . . {Decomposition of an organometallic compound, a metal complex or a metal salt of a carboxylic acid}
 - 37/088 . . . {Decomposition of a metal salt}
 - 37/10 . . in the presence of water, e.g. steam
 - 37/105 . . . {Hydropyrolysis}
 - 37/12 . Oxidising
 - 37/14 . . with gases containing free oxygen
 - 37/16 . Reducing
 - 37/18 . . with gases containing free hydrogen
 - 37/20 . Sulfiding
 - 37/22 . Halogenating
 - 37/24 . . Chlorinating
 - 37/26 . . Fluorinating
 - 37/28 . Phosphorising
 - 37/30 . Ion-exchange
 - 37/32 . Freeze drying, i.e. lyophilisation
 - 37/34 . Irradiation by, or application of, electric, magnetic or wave energy, e.g. ultrasonic waves {; Ionic sputtering; Flame or plasma spraying; Particle radiation}
 - 37/341 . . {making use of electric or magnetic fields, wave energy or particle radiation (use of flames, plasma or lasers B01J 37/349)}
 - 37/342 . . . {of electric, magnetic or electromagnetic fields, e.g. for magnetic separation}
 - 37/343 . . . {of ultrasonic wave energy}
 - 37/344 . . . {of electromagnetic wave energy}
 - 37/345 {of ultraviolet wave energy}
 - 37/346 {of microwave energy}
 - 37/347 . . . {Ionic or cathodic spraying; Electric discharge}
 - 37/348 . . {Electrochemical processes, e.g. electrochemical deposition or anodisation}
 - 37/349 . . {making use of flames, plasmas or lasers}
 - 37/36 . Biochemical methods
 - 38/00 Regeneration or reactivation of catalysts, in general**
 - 2038/005 . {involving supercritical treatment}
 - 38/02 . Heat treatment
 - 38/04 . Gas or vapour treating; Treating by using liquids vaporisable upon contacting spent catalyst
 - 38/06 . . using steam
 - 38/08 . . using ammonia or derivatives thereof
 - 38/10 . . using elemental hydrogen
 - 38/12 . . Treating with free oxygen-containing gas
 - 38/14 . . . with control of oxygen content in oxidation gas
 - 38/16 . . . Oxidation gas comprising essentially steam and oxygen
 - 38/18 . . . with subsequent reactive gas treating
 - 38/20 . . . Plural distinct oxidation stages
 - 38/22 . . . Moving bed, e.g. vertically or horizontally moving bulk
 - 38/24 having mainly transverse, i.e. lateral, flow of oxygen-containing gas and material
 - 38/26 having mainly counter-current flow of oxygen-containing gas and material
 - 38/28 having mainly concurrent flow of oxygen-containing gas and material
 - 38/30 . . . in gaseous suspension, e.g. fluidised bed
 - 38/32 Indirectly heating or cooling material within regeneration zone or prior to entry into regeneration zone
 - 38/34 with plural distinct serial combustion stages
 - 38/36 and with substantially complete oxidation of carbon monoxide to carbon dioxide within regeneration zone
 - 38/38 . . . and adding heat by solid heat carrier
 - 38/40 . . . and forming useful by-products
 - 38/42 . . using halogen-containing material
 - 38/44 . . . and adding simultaneously or subsequently free oxygen; using oxyhalogen compound
 - 38/46 . . . fluorine-containing
 - 38/48 . Liquid treating or treating in liquid phase, e.g. dissolved or suspended
 - 38/485 . . {Impregnating or reimpregnating with, or deposition of metal compounds or catalytically active elements}
 - 38/50 . . using organic liquids
 - 38/52 . . . oxygen-containing
 - 38/54 . . . halogen-containing
 - 38/56 . . . Hydrocarbons
 - 38/58 . . . and gas addition thereto
 - 38/60 . . using acids
 - 38/62 . . . organic
 - 38/64 . . using alkaline material; using salts
 - 38/66 . . . using ammonia or derivatives thereof
 - 38/68 . . including substantial dissolution or chemical precipitation of a catalyst component in the ultimate reconstitution of the catalyst
 - 38/70 . . Wet oxidation of material submerged in liquid
 - 38/72 . including segregation of diverse particles
 - 38/74 . utilising ion-exchange
- Ion-exchange** (treatment of milk A23C 9/14; separation by liquid ion-exchangers B01D, e.g. B01D 11/00; separation of isotopes B01D 59/00; compounds *er se*, see the relevant classes, e.g. C01, C07, C08; treatment of water C02F 1/42; refining of hydrocarbon oils, in the absence of hydrogen, with solid sorbents C10G 25/00; purification of sugar juices C13B 20/14; extraction of sugar from molasses C13B 35/06; extraction of metal compounds from ores or concentrates by wet processes C22B 3/00; using ion-exchange for investigating or analysing materials G01N 30/96; treating radioactively contaminated material G21F 9/12)
- NOTES**
1. In groups B01J 39/00 - B01J 49/00:

- Ion-exchange covers all processes whereby ions are exchanged between the solid exchanger and the liquid to be treated and wherein the exchanger is not soluble in the liquid to be treated
 - Ion-exchange processes cover also ion-exchange in combination with complex or chelate forming reactions.
2. In groups [B01J 39/00](#) - [B01J 49/00](#), the last place priority rule is applied, i.e. at each hierarchical level, in the absence of an indication to the contrary, classification is made in the last appropriate place.
3. {In groups [B01J 39/00](#) - [B01J 49/00](#), it is desirable to classify other constituents by using Combination sets with symbols chosen from [B01J 39/00](#) and subgroups and [B01J 41/00](#) and subgroups.}

- 39/00 Cation exchange; Use of material as cation exchangers; Treatment of material for improving the cation exchange properties (ion-exchange chromatography processes [B01D 15/36](#))**
- 39/02 . Processes using inorganic exchangers
 - 39/04 . Processes using organic exchangers
 - 39/05 . . in the strongly acidic form
 - 39/07 . . in the weakly acidic form
 - 39/08 . Use of material as cation exchangers; Treatment of material for improving the cation exchange properties
 - 39/09 . . Inorganic material
 - 39/10 . . Oxides or hydroxides
 - 39/12 . . Compounds containing phosphorus
 - 39/14 . . Base exchange silicates, e.g. zeolites
 - 39/16 . . Organic material
 - 39/17 . . . containing also inorganic materials, e.g. inert material coated with an ion-exchange resin
 - 39/18 . . . Macromolecular compounds ([B01J 39/17](#) takes precedence)
 - 39/19 obtained otherwise than by reactions only involving unsaturated carbon-to-carbon bonds
 - 39/20 obtained by reactions only involving unsaturated carbon-to-carbon bonds
 - 39/22 Cellulose or wood; Derivatives thereof
 - 39/24 . . Carbon, coal or tar
 - 39/26 . Cation exchangers for chromatographic processes
- 41/00 Anion exchange; Use of material as anion exchangers; Treatment of material for improving the anion exchange properties (ion-exchange chromatography processes [B01D 15/36](#))**
- 41/02 . Processes using inorganic exchangers
 - 41/04 . Processes using organic exchangers
 - 41/05 . . in the strongly basic form
 - 41/07 . . in the weakly basic form
 - 41/08 . Use of material as anion exchangers; Treatment of material for improving the anion exchange properties
 - 41/09 . . Organic material
 - 41/10 . . Inorganic material
 - 41/12 . . Macromolecular compounds
 - 41/13 . . . obtained otherwise than by reactions only involving unsaturated carbon-to-carbon bonds
 - 41/14 . . . obtained by reactions only involving unsaturated carbon-to-carbon bonds
 - 41/16 . . . Cellulose or wood; Derivatives thereof
 - 41/18 . . Carbon, coal or tar
 - 41/20 . Anion exchangers for chromatographic processes

- 43/00 Amphoteric ion-exchange, i.e. using ion-exchangers having cationic and anionic groups; Use of material as amphoteric ion-exchangers; Treatment of material for improving their amphoteric ion-exchange properties (ion-exchange chromatography processes [B01D 15/36](#))**
- 45/00 Ion-exchange in which a complex or a chelate is formed; Use of material as complex or chelate forming ion-exchangers; Treatment of material for improving the complex or chelate forming ion-exchange properties (ion-exchange chromatography processes [B01D 15/36](#))**
- 47/00 Ion-exchange processes in general; Apparatus therefor (ion-exchange chromatography processes or apparatus [B01D 15/08](#))**
- 47/011 . using batch processes
 - 47/012 . using portable ion-exchange apparatus
 - 47/014 . in which the adsorbent properties of the ion-exchanger are involved, e.g. recovery of proteins or other high-molecular compounds
 - 47/015 . Electron-exchangers
 - 47/016 . Modification or after-treatment of ion-exchangers
 - 47/018 . Granulation; Incorporation of ion-exchangers in a matrix; Mixing with inert materials
 - 47/019 . . Mixtures in form of tablets
 - 47/02 . Column or bed processes
 - 47/022 . . characterised by the construction of the column or container
 - 47/024 . . . where the ion-exchangers are in a removable cartridge
 - 47/026 . . using columns or beds of different ion exchange materials in series
 - 47/028 . . . with alternately arranged cationic and anionic exchangers
 - 47/04 . . Mixed-bed processes
 - 47/06 . . during which the ion-exchange material is subjected to a physical treatment, e.g. heat, electric current, irradiation or vibration ([electrodialysis or electro-osmosis \[B01D 61/42\]\(#\)](#))
 - 47/08 . . . subjected to a direct electric current
 - 47/10 . with moving ion-exchange material; with ion-exchange material in suspension or in fluidised-bed form
 - 47/11 . . in rotating beds
 - 47/12 . characterised by the use of ion-exchange material in the form of ribbons, filaments, fibres or sheets, e.g. membranes ([electrodialysis or electro-osmosis \[B01D 61/42\]\(#\)](#))
 - 47/127 . . in the form of filaments or fibres
 - 47/133 . . Precoat filters
 - 47/14 . Controlling or regulating
 - 47/15 . . for obtaining a solution having a fixed pH
- 49/00 Regeneration or reactivation of ion-exchangers; Apparatus therefor (ion-exchange chromatography processes or apparatus [B01D 15/08](#))**
- 49/05 . of fixed beds
 - 49/06 . . containing cationic exchangers
 - 49/07 . . containing anionic exchangers
 - 49/08 . . containing cationic and anionic exchangers in separate beds
 - 49/09 . . of mixed beds
 - 49/10 . of moving beds

49/12	. . containing cationic exchangers	2208/0007	. . . . . Pressure measurement
49/14	. . containing anionic exchangers	2208/00079	. . . . . Fluid level measurement
49/16	. . containing cationic and anionic exchangers in separate beds	2208/00088	. . . . . Flow rate measurement
49/18	. . of mixed beds	2208/00097	. . . . . Mathematical modelling
49/20	. of membranes	2208/00106	. . . by indirect heat exchange
49/30	. Electrical regeneration	2208/00115	. . . . with heat exchange elements inside the bed of solid particles
49/40	. Thermal regeneration	2208/00123	. . . . . Fingers
49/45	. . of amphoteric ion-exchangers	2208/00132	. . . . . Tubes
49/50	. characterised by the regeneration reagents	2208/00141	. . . . . Coils
49/53	. . for cationic exchangers	2208/0015	. . . . . Plates; Cylinders
49/57	. . for anionic exchangers	2208/00159	. . . . . Radially arranged plates
49/60	. Cleaning or rinsing ion-exchange beds	2208/00168	. . . . with heat exchange elements outside the bed of solid particles
49/70	. for large scale industrial processes or applications	2208/00176	. . . . . outside the reactor
49/75	. of water softeners	2208/00185	. . . . . Fingers
49/80	. Automatic regeneration	2208/00194	. . . . . Tubes
49/85	. . Controlling or regulating devices therefor	2208/00203	. . . . . Coils
49/90	. having devices which prevent back-flow of the ion-exchange mass during regeneration	2208/00212	. . . . . Plates; Jackets; Cylinders
		2208/00221	. . . . . comprising baffles for guiding the flow of the heat exchange medium
		2208/0023	. . . . . with some catalyst tubes being empty, e.g. dummy tubes or flow-adjusting rods
		2208/00238	. . . . . Adjusting the heat-exchange profile by adapting catalyst tubes or the distribution thereof, e.g. by using inserts in some of the tubes or adding external fins
2203/00	Processes utilising sub- or super atmospheric pressure	2208/00247	. . . . . Reflux columns
2203/06	. High pressure synthesis	2208/00256	. . . . . in a heat exchanger for the heat exchange medium separate from the reactor
2203/0605	. . Composition of the material to be processed	2208/00265	. . . . Part of all of the reactants being heated or cooled outside the reactor while recycling
2203/061	. . . Graphite	2208/00274	. . . . . involving reactant vapours
2203/0615	. . . Fullerene	2208/00283	. . . . . involving reactant liquids
2203/062	. . . Diamond	2208/00292	. . . . . involving reactant solids
2203/0625	. . . Carbon	2208/003	. . . . . involving reactant slurries
2203/063	. . . Carbides	2208/00309	. . . . with two or more reactions in heat exchange with each other, such as an endothermic reaction in heat exchange with an exothermic reaction
2203/0635	. . . . Silicon carbide	2208/00318	. . . . Heat exchange inside a feeding nozzle or nozzle reactor
2203/064	. . . Carbonates	2208/00327	. . . by direct heat exchange
2203/0645	. . . Boronitrides	2208/00336	. . . . adding a temperature modifying medium to the reactants
2203/065	. . Composition of the material produced	2208/00345	. . . . . Cryogenic coolants
2203/0655	. . . Diamond	2208/00353	. . . . . Non-cryogenic fluids
2203/066	. . . Boronitrides	2208/00362	. . . . . Liquid
2203/0665	. . . Gallium nitrides	2208/00371	. . . . . gaseous
2203/067	. . . Aluminium nitrides	2208/0038	. . . . . Solids
2203/0675	. . Structural or physico-chemical features of the materials processed	2208/00389	. . . using electric heating or cooling elements
2203/068	. . . Crystal growth	2208/00398	. . . . inside the reactor bed
2203/0685	. . . Crystal sintering	2208/00407	. . . . outside the reactor bed
2203/069	. . . Recrystallisation	2208/00415	. . . . electric resistance heaters
2203/0695	. . . Colour change	2208/00424	. . . . Peltier cooling elements
2204/00	Aspects relating to feed or outlet devices; Regulating devices for feed or outlet devices	2208/00433	. . . using electromagnetic heating
2204/002	. the feeding side being of particular interest	2208/00442	. . . . Microwaves
2204/005	. the outlet side being of particular interest	2208/00451	. . . . Sunlight; Visible light
2204/007	. Aspects relating to the heat-exchange of the feed or outlet devices	2208/0046	. . . . Infrared radiation
2208/00	Processes carried out in the presence of solid particles; Reactors therefor	2208/00469	. . . . Radiofrequency
2208/00008	. Controlling the process	2208/00477	. . . by thermal insulation means
2208/00017	. . Controlling the temperature	2208/00486	. . . . Vacuum spaces
2208/00026	. . . Controlling or regulating the heat exchange system		
2208/00035	. . . . involving measured parameters		
2208/00044	. . . . . Temperature measurement		
2208/00053	. . . . . of the heat exchange medium		
2208/00061	. . . . . of the reactants		

2208/00495	. . . .	using insulating materials or refractories	2208/00955	. . . .	Sampling of the particulate material, the reactants or the products
2208/00504	. . .	by means of a burner	2208/00964	. . . .	Reactants
2208/00513	. . .	using inert heat absorbing solids in the bed	2208/00973	. . . .	Products
2208/00522	. . .	using inert heat absorbing solids outside the bed	2208/00982	. . . .	Particulate material
2208/0053	. . .	Controlling multiple zones along the direction of flow, e.g. pre-heating and after-cooling	2208/00991	. .	Disengagement zone in fluidised-bed reactors
2208/00539	. .	Pressure	2208/02	. .	with stationary particles
2208/00548	. .	Flow	2208/021	. .	comprising a plurality of beds with flow of reactants in parallel
2208/00557	. . .	controlling the residence time inside the reactor vessel	2208/022	. . .	Plate-type reactors filled with granular catalyst
2208/00566	. . .	Pulsated flow	2208/023	. .	Details
2208/00575	. .	Controlling the viscosity	2208/024	. . .	Particulate material
2208/00584	. .	Controlling the density	2208/025	. . . .	Two or more types of catalyst
2208/00592	. .	Controlling the pH	2208/026	. . . .	comprising nanocatalysts
2208/00601	. .	Controlling the conductivity	2208/027	. . .	Beds
2208/0061	. .	Controlling the level	2208/028	. . . .	rotating
2208/00619	. .	Controlling the weight	2208/06	. .	Details of tube reactors containing solid particles
2208/00628	. .	Controlling the composition of the reactive mixture	2208/065	. .	Heating or cooling the reactor
2208/00637	. . .	Means for stopping or slowing down the reaction	2219/00		Chemical, physical or physico-chemical processes in general; Their relevant apparatus
2208/00646	. . .	Means for starting up the reaction	2219/00002	. .	Chemical plants
2208/00654	. .	by measures relating to the particulate material	2219/00004	. .	Scale aspects
2208/00663	. . .	Concentration	2219/00006	. . .	Large-scale industrial plants
2208/00672	. . .	Particle size selection	2219/00009	. . .	Pilot-scale plants
2208/00681	. . .	Agglomeration	2219/00011	. . .	Laboratory-scale plants
2208/0069	. . .	Attrition	2219/00013	. . . .	Miniplants
2208/00699	. . .	Moisture content regulation	2219/00015	. . .	Scale-up
2208/00707	. . .	Fouling	2219/00018	. .	Construction aspects
2208/00716	. .	Means for reactor start-up	2219/0002	. . .	Plants assembled from modules joined together
2208/00725	. .	Mathematical modelling	2219/00022	. . .	Plants mounted on pallets or skids
2208/00734	. .	Controlling static charge	2219/00024	. . .	Revamping, retrofitting or modernisation of existing plants
2208/00743	. .	Feeding or discharging of solids	2219/00027	. .	Process aspects
2208/00752	. .	Feeding	2219/00029	. . .	Batch processes
2208/00761	. .	Discharging	2219/00031	. . .	Semi-batch or fed-batch processes
2208/00769	. .	Details of feeding or discharging	2219/00033	. . .	Continuous processes
2208/00778	. . .	Kinetic energy reducing devices in the flow channel	2219/00036	. . .	Intermittent processes
2208/00787	. . .	Bringing the solid in the form of a slurry before feeding it to the reactor	2219/00038	. . .	Processes in parallel
2208/00796	. .	Details of the reactor or of the particulate material	2219/0004	. . .	Processes in series
2208/00805	. .	Details of the particulate material	2219/00042	. .	Features relating to reactants and process fluids
2208/00814	. . .	the particulate material being provides in prefilled containers	2219/00045	. . .	Green chemistry
2208/00823	. .	Mixing elements	2219/00047	. . .	Ionic liquids
2208/00831	. . .	Stationary elements	2219/00049	. .	Controlling or regulating processes
2208/0084	. . . .	inside the bed, e.g. baffles	2219/00051	. .	Controlling the temperature
2208/00849	. . . .	outside the bed, e.g. baffles	2219/00054	. . .	Controlling or regulating the heat exchange system
2208/00858	. . .	Moving elements	2219/00056	. . . .	involving measured parameters
2208/00867	. . . .	inside the bed, e.g. rotary mixer	2219/00058	. . . .	Temperature measurement
2208/00876	. . . .	outside the bed, e.g. rotary mixer	2219/0006	. . . . .	of the heat exchange medium
2208/00884	. .	Means for supporting the bed of particles, e.g. grids, bars, perforated plates	2219/00063	. . . . .	of the reactants
2208/00893	. .	Feeding means for the reactants	2219/00065	. . . . .	Pressure measurement
2208/00902	. . .	Nozzle-type feeding elements	2219/00067	. . . . .	Liquid level measurement
2208/00911	. . .	Sparger-type feeding elements	2219/00069	. . . . .	Flow rate measurement
2208/0092	. . .	Perforated plates	2219/00072	. . . .	Mathematical modelling
2208/00929	. . .	Provided with baffles	2219/00074	. . .	by indirect heating or cooling employing heat exchange fluids
2208/00938	. .	Flow distribution elements	2219/00076	. . . .	with heat exchange elements inside the reactor
2208/00946	. .	Features relating to the reactants or products	2219/00078	. . . . .	Fingers
			2219/00081	. . . . .	Tubes
			2219/00083	. . . . .	Coils

2219/00085	. . . . .	Plates; Jackets; Cylinders	2219/00193	. . . . .	Sensing a parameter
2219/00087	. . . . .	with heat exchange elements outside the reactor	2219/00195	. . . . .	of the reaction system
2219/0009	. . . . .	Coils	2219/00198	. . . . .	at the reactor inlet
2219/00092	. . . . .	Tubes	2219/002	. . . . .	inside the reactor
2219/00094	. . . . .	Jackets	2219/00202	. . . . .	at the reactor outlet
2219/00096	. . . . .	Plates	2219/00204	. . . . .	of the heat exchange system
2219/00099	. . . . .	the reactor being immersed in the heat exchange medium	2219/00207	. . . . .	other than of the reactor heat exchange system
2219/00101	. . . . .	Reflux columns	2219/00209	. . . . .	transforming a sensed parameter
2219/00103	. . . . .	in a heat exchanger separate from the reactor	2219/00211	. . . . .	comparing a sensed parameter with a pre-set value
2219/00105	. . . . .	part or all of the reactants being heated or cooled outside the reactor while recycling	2219/00213	. . . . .	Fixed parameter value
2219/00108	. . . . .	involving reactant vapours	2219/00216	. . . . .	Parameter value calculated by equations
2219/0011	. . . . .	involving reactant liquids	2219/00218	. . . . .	Dynamically variable (in-line) parameter values
2219/00112	. . . . .	involving reactant solids	2219/0022	. . . . .	calculating difference
2219/00114	. . . . .	involving reactant slurries	2219/00222	. . . . .	taking actions
2219/00117	. . . . .	with two or more reactions in heat exchange with each other, such as an endothermic reaction in heat exchange with an exothermic reaction	2219/00225	. . . . .	stopping the system or generating an alarm
2219/00119	. . . . .	Heat exchange inside a feeding nozzle or nozzle reactor	2219/00227	. . . . .	modifying the operating conditions
2219/00121	. . . . .	by direct heating or cooling	2219/00229	. . . . .	of the reaction system
2219/00123	. . . . .	adding a temperature modifying medium to the reactants	2219/00231	. . . . .	at the reactor inlet
2219/00126	. . . . .	Cryogenic coolants	2219/00234	. . . . .	inside the reactor
2219/00128	. . . . .	by evaporation of reactants	2219/00236	. . . . .	at the reactor outlet
2219/0013	. . . . .	by condensation of reactants	2219/00238	. . . . .	of the heat exchange system
2219/00132	. . . . .	using electric heating or cooling elements	2219/0024	. . . . .	other than of the reactor or heat exchange system
2219/00135	. . . . .	Electric resistance heaters	2219/00243	. . . . .	Mathematical modelling
2219/00137	. . . . .	Peltier cooling elements	2219/00245	. . . . .	Avoiding undesirable reactions or side-effects
2219/00139	. . . . .	using electromagnetic heating	2219/00247	. . . . .	Fouling of the reactor or the process equipment
2219/00141	. . . . .	Microwaves	2219/0025	. . . . .	Foam formation
2219/00144	. . . . .	Sunlight; Visible light	2219/00252	. . . . .	Formation of deposits other than coke
2219/00146	. . . . .	Infrared radiation	2219/00254	. . . . .	Formation of unwanted polymer, such as "pop-corn"
2219/00148	. . . . .	Radiofrequency	2219/00256	. . . . .	Leakage
2219/0015	. . . . .	by thermal insulation means	2219/00259	. . . . .	Preventing runaway of the chemical reaction
2219/00153	. . . . .	Vacuum spaces	2219/00261	. . . . .	Predicting runaway of the chemical reaction
2219/00155	. . . . .	using insulating materials or refractories	2219/00263	. . . . .	Preventing explosion of the chemical mixture
2219/00157	. . . . .	by means of a burner	2219/00265	. . . . .	Preventing flame propagation
2219/00159	. . . . .	controlling multiple zones along the direction of flow, e.g. pre-heating and after-cooling	2219/00268	. . . . .	Detecting faulty operations
2219/00162	. . . . .	controlling the pressure	2219/0027	. . . . .	Pressure relief
2219/00164	. . . . .	controlling the flow	2219/00272	. . . . .	Addition of reaction inhibitor
2219/00166	. . . . .	controlling the residence time inside the reactor vessel	2219/00274	. . . . .	Sequential or parallel reactions; Apparatus and devices for combinatorial chemistry or for making arrays; Chemical library technology
2219/00168	. . . . .	controlling the viscosity	2219/00277	. . . . .	Apparatus
2219/00171	. . . . .	controlling the density	2219/00279	. . . . .	Features relating to reactor vessels
2219/00173	. . . . .	Physical density	2219/00281	. . . . .	Individual reactor vessels
2219/00175	. . . . .	Optical density	2219/00283	. . . . .	Reactor vessels with top opening
2219/00177	. . . . .	controlling the pH	2219/00286	. . . . .	Reactor vessels with top and bottom openings
2219/0018	. . . . .	controlling the conductivity	2219/00288	. . . . .	in the shape of syringes
2219/00182	. . . . .	controlling the level of reactants in the reactor vessel	2219/0029	. . . . .	with pistons or plungers
2219/00184	. . . . .	controlling the weight of reactants in the reactor vessel	2219/00292	. . . . .	in the shape of pipette tips
2219/00186	. . . . .	controlling the composition of the reactive mixture	2219/00295	. . . . .	the reactor vessels having pervious side walls
2219/00189	. . . . .	controlling the stirring velocity	2219/00297	. . . . .	"Tea bags"
2219/00191	. . . . .	Control algorithm	2219/00299	. . . . .	Generally cylindrical reactor vessels
			2219/00301	. . . . .	the reactor vessels having impervious side walls
			2219/00304	. . . . .	Pouches
			2219/00306	. . . . .	Reactor vessels in a multiple arrangement

2219/00308	. . . . .	interchangeably mounted in racks or blocks	2219/0043	. . . . .	for direct application of reagents, e.g. through openings in a shutter
2219/0031	. . . . .	the racks or blocks being mounted in stacked arrangements	2219/00432	. . . . .	Photolithographic masks
2219/00313	. . . . .	the reactor vessels being formed by arrays of wells in blocks	2219/00434	. . . . .	Liquid crystal masks
2219/00315	. . . . .	Microtiter plates	2219/00436	. . . . .	Maskless processes
2219/00317	. . . . .	Microwell devices, i.e. having large numbers of wells	2219/00439	. . . . .	using micromirror arrays
2219/00319	. . . . .	the blocks being mounted in stacked arrangements	2219/00441	. . . . .	using lasers
2219/00322	. . . . .	the individual reactor vessels being arranged serially in stacks	2219/00443	. . . . .	Thin film deposition
2219/00324	. . . . .	the reactor vessels or wells being arranged in plates moving in parallel to each other	2219/00445	. . . . .	Ion implantation
2219/00326	. . . . .	Movement by rotation	2219/00448	. . . . .	using microlens arrays
2219/00328	. . . . .	Movement by linear translation	2219/0045	. . . . .	using optical fibres
2219/00331	. . . . .	Details of the reactor vessels	2219/00452	. . . . .	Means for the recovery of reactants or products
2219/00333	. . . . .	Closures attached to the reactor vessels	2219/00454	. . . . .	by chemical cleavage from the solid support
2219/00335	. . . . .	Septa	2219/00457	. . . . .	Dispensing or evacuation of the solid phase support
2219/00337	. . . . .	Valves	2219/00459	. . . . .	Beads
2219/0034	. . . . .	in the shape of a ball or sphere	2219/00461	. . . . .	Beads and reaction vessel together
2219/00342	. . . . .	rotary	2219/00463	. . . . .	Directed sorting
2219/00344	. . . . .	Caps	2219/00466	. . . . .	in a slurry
2219/00346	. . . . .	Screw-caps	2219/00468	. . . . .	by manipulation of individual beads
2219/00349	. . . . .	Spheres	2219/0047	. . . . .	Pins
2219/00351	. . . . .	Means for dispensing and evacuation of reagents	2219/00472	. . . . .	Replaceable crowns
2219/00353	. . . . .	Pumps	2219/00475	. . . . .	Sheets
2219/00355	. . . . .	peristaltic	2219/00477	. . . . .	Means for pressurising the reaction vessels
2219/00358	. . . . .	electrode driven	2219/00479	. . . . .	Means for mixing reactants or products in the reaction vessels
2219/0036	. . . . .	Nozzles	2219/00481	. . . . .	by the use of moving stirrers within the reaction vessels
2219/00362	. . . . .	Acoustic nozzles	2219/00484	. . . . .	by shaking, vibrating or oscillating of the reaction vessels
2219/00364	. . . . .	Pipettes	2219/00486	. . . . .	by sonication or ultrasonication
2219/00367	. . . . .	capillary	2219/00488	. . . . .	by rotation of the reaction vessels
2219/00369	. . . . .	in multiple or parallel arrangements	2219/0049	. . . . .	by centrifugation
2219/00371	. . . . .	comprising electrodes	2219/00493	. . . . .	by sparging or bubbling with gases
2219/00373	. . . . .	Hollow needles	2219/00495	. . . . .	Means for heating or cooling the reaction vessels
2219/00376	. . . . .	in multiple or parallel arrangements	2219/00497	. . . . .	Features relating to the solid phase supports
2219/00378	. . . . .	Piezo-electric or ink jet dispensers	2219/005	. . . . .	Beads
2219/0038	. . . . .	Drawing	2219/00502	. . . . .	Particles of irregular geometry
2219/00382	. . . . .	Stamping	2219/00504	. . . . .	Pins
2219/00385	. . . . .	Printing	2219/00506	. . . . .	with removable crowns
2219/00387	. . . . .	Applications using probes	2219/00509	. . . . .	Microcolumns
2219/00389	. . . . .	Feeding through valves	2219/00511	. . . . .	Walls of reactor vessels
2219/00391	. . . . .	Rotary valves	2219/00513	. . . . .	Essentially linear supports
2219/00394	. . . . .	in multiple arrangements	2219/00515	. . . . .	in the shape of strings
2219/00396	. . . . .	Membrane valves	2219/00518	. . . . .	in the shape of tapes
2219/00398	. . . . .	in multiple arrangements	2219/0052	. . . . .	in the shape of elongated tubes
2219/004	. . . . .	Pinch valves	2219/00522	. . . . .	in a multiple parallel arrangement
2219/00403	. . . . .	in multiple arrangements	2219/00524	. . . . .	in the shape of fiber bundles
2219/00405	. . . . .	Sliding valves	2219/00527	. . . . .	Sheets
2219/00407	. . . . .	In multiple arrangements	2219/00529	. . . . .	DNA chips
2219/00409	. . . . .	Solenoids in combination with valves	2219/00531	. . . . .	essentially square
2219/00412	. . . . .	In multiple arrangements	2219/00533	. . . . .	essentially rectangular
2219/00414	. . . . .	using suction	2219/00536	. . . . .	in the shape of disks
2219/00416	. . . . .	Vacuum	2219/00538	. . . . .	in the shape of cylinders
2219/00418	. . . . .	using pressure	2219/0054	. . . . .	Means for coding or tagging the apparatus or the reagents
2219/00421	. . . . .	using centrifugation	2219/00542	. . . . .	Alphanumeric characters
2219/00423	. . . . .	using filtration, e.g. through porous frits	2219/00545	. . . . .	Colours
2219/00425	. . . . .	using decantation	2219/00547	. . . . .	Bar codes
2219/00427	. . . . .	using masks	2219/00549	. . . . .	2-dimensional
			2219/00551	. . . . .	3-dimensional

2219/00554	. . . .	Physical means	2219/00662	. . . . .	Two-dimensional arrays within two-dimensional arrays
2219/00556	. . . . .	Perforations	2219/00664	. . . .	Three-dimensional arrays
2219/00558	. . . . .	Cuts-out	2219/00666	. . . . .	One-dimensional arrays within three-dimensional arrays
2219/0056	. . . . .	Raised or sunken areas	2219/00668	. . . . .	Two-dimensional arrays within three-dimensional arrays
2219/00563	. . . . .	Magnetic means	2219/00671	. . . . .	Three-dimensional arrays within three-dimensional arrays
2219/00565	. . . . .	Electromagnetic means	2219/00673	. . . . .	Slice arrays
2219/00567	. . . . .	Transponder chips	2219/00675	. . . . .	In-situ synthesis on the substrate
2219/00569	. . . . .	EEPROM memory devices	2219/00677	. . . . .	Ex-situ synthesis followed by deposition on the substrate
2219/00572	. . . . .	Chemical means	2219/0068	. . .	Means for controlling the apparatus of the process
2219/00574	. . . . .	radioactive	2219/00682	. . .	Manual means
2219/00576	. . . . .	fluorophore	2219/00684	. . .	Semi-automatic means
2219/00578	. . . . .	electrophoric	2219/00686	. . .	Automatic
2219/00581	. . . . .	Mass	2219/00689	. . . .	using computers
2219/00583	. .	Features relative to the processes being carried out	2219/00691	. . . .	using robots
2219/00585	. . .	Parallel processes	2219/00693	. . .	Means for quality control
2219/00587	. . . .	High throughput processes	2219/00695	. . .	Synthesis control routines, e.g. using computer programs
2219/0059	. . .	Sequential processes	2219/00698	. . .	Measurement and control of process parameters
2219/00592	. . .	Split-and-pool, mix-and-divide processes	2219/007	. . .	Simulation or virtual synthesis
2219/00594	. . .	Gas-phase processes	2219/00702	. . .	Processes involving means for analysing and characterising the products
2219/00596	. . .	Solid-phase processes	2219/00704	. . . .	integrated with the reactor apparatus
2219/00599	. . .	Solution-phase processes	2219/00707	. . . .	separated from the reactor apparatus
2219/00601	. . .	High-pressure processes	2219/00709	. .	Type of synthesis
2219/00603	. . .	Making arrays on substantially continuous surfaces	2219/00711	. . .	Light-directed synthesis
2219/00605	. . . .	the compounds being directly bound or immobilised to solid supports	2219/00713	. . .	Electrochemical synthesis
2219/00608	. . . . .	DNA chips	2219/00716	. . .	Heat activated synthesis
2219/0061	. . . . .	The surface being organic	2219/00718	. .	Type of compounds synthesised
2219/00612	. . . . .	the surface being inorganic	2219/0072	. . .	Organic compounds
2219/00614	. . . . .	Delimitation of the attachment areas	2219/00722	. . . .	Nucleotides
2219/00617	. . . . .	by chemical means	2219/00725	. . . .	Peptides
2219/00619	. . . . .	using hydrophilic or hydrophobic regions	2219/00727	. . . .	Glycopeptides
2219/00621	. . . . .	by physical means, e.g. trenches, raised areas	2219/00729	. . . .	Peptide nucleic acids [PNA]
2219/00623	. . . . .	Immobilisation or binding	2219/00731	. . . .	Saccharides
2219/00626	. . . . .	Covalent	2219/00734	. . . .	Lipids
2219/00628	. . . . .	Ionic	2219/00736	. . . .	Non-biologic macromolecules, e.g. polymeric compounds
2219/0063	. . . . .	Other, e.g. van der Waals forces, hydrogen bonding	2219/00738	. . . .	Organic catalysts
2219/00632	. . . . .	Introduction of reactive groups to the surface	2219/0074	. . . .	Biological products
2219/00635	. . . . .	by reactive plasma treatment	2219/00743	. . . . .	Cells
2219/00637	. . . . .	by coating it with another layer	2219/00745	. . .	Inorganic compounds
2219/00639	. . . .	the compounds being trapped in or bound to a porous medium	2219/00747	. . . .	Catalysts
2219/00641	. . . . .	the porous medium being continuous, e.g. porous oxide substrates	2219/0075	. . . .	Metal based compounds
2219/00644	. . . . .	the porous medium being present in discrete locations, e.g. gel pads	2219/00752	. . . . .	Alloys
2219/00646	. . . . .	the compounds being bound to beads immobilised on the solid supports	2219/00754	. . . . .	Metal oxides
2219/00648	. . . . .	by the use of solid beads	2219/00756	. . .	Compositions, e.g. coatings, crystals, formulations
2219/0065	. . . . .	by the use of liquid beads	2219/00759	. .	Purification of compounds synthesised
2219/00653	. . . .	the compounds being bound to electrodes embedded in or on the solid supports	2219/00761	. .	Details of the reactor
2219/00655	. . . .	the compounds being bound to magnets embedded in or on the solid supports	2219/00763	. .	Baffles
2219/00657	. . . .	One-dimensional arrays	2219/00765	. . .	Baffles attached to the reactor wall
2219/00659	. . . .	Two-dimensional arrays	2219/00768	. . . .	vertical
			2219/0077	. . . .	inclined
			2219/00772	. . . . .	in a helix
			2219/00774	. . . . .	in the form of cones
			2219/00777	. . . .	horizontal
			2219/00779	. . .	Baffles attached to the stirring means

2219/00781	. Aspects relating to microreactors	2219/00903	. . . Segmented flow
2219/00783	. . Laminate assemblies, i.e. the reactor comprising a stack of plates	2219/00905	. . Separation
2219/00786	. . . Geometry of the plates	2219/00907	. . . using membranes
2219/00788	. . Three-dimensional assemblies, i.e. the reactor comprising a form other than a stack of plates	2219/00909	. . . using filters
2219/0079	. . . Monolith-base structure	2219/00912	. . . by electrophoresis
2219/00792	. . . One or more tube-shaped elements	2219/00914	. . . . by dielectrophoresis
2219/00795	. . . . Spiral-shaped	2219/00916	. . . by chromatography
2219/00797	. . . . Concentric tubes	2219/00918	. . . by adsorption
2219/00799	. . . Cup-shaped	2219/00921	. . . by absorption
2219/00801	. . Means to assemble	2219/00923	. . . by surface tension
2219/00804	. . . Plurality of plates	2219/00925	. . Irradiation
2219/00806	. . . . Frames	2219/00927	. . . Particle radiation or gamma-radiation
2219/00808	. . . . Sealing means	2219/0093	. . . Electric or magnetic energy
2219/0081	. . . Plurality of modules	2219/00932	. . . Sonic or ultrasonic vibrations
2219/00813	. . . . Fluidic connections	2219/00934	. . . Electromagnetic waves
2219/00815	. . . . Electric connections	2219/00936	. . . . UV-radiations
2219/00817	. . . . Support structures	2219/00939	. . . . X-rays
2219/00819	. . Materials of construction	2219/00941	. . . . Microwaves
2219/00822	. . . Metal	2219/00943	. . . . Visible light, e.g. sunlight
2219/00824	. . . Ceramic	2219/00945	. . . . Infra-red light
2219/00826	. . . . Quartz	2219/00948	. . . . Radiofrequency
2219/00828	. . . . Silicon wafers or plates	2219/0095	. . Control aspects
2219/00831	. . . Glass	2219/00952	. . . Sensing operations
2219/00833	. . . Plastic	2219/00954	. . . . Measured properties
2219/00835	. . . Comprising catalytically active material	2219/00957	. . . . . Compositions or concentrations
2219/00837	. . . comprising coatings other than catalytically active coatings	2219/00959	. . . . . Flow
2219/0084	. . . . For changing surface tension	2219/00961	. . . . . Temperature
2219/00842	. . . . For protection channel surface, e.g. corrosion protection	2219/00963	. . . . . Pressure
2219/00844	. . . Comprising porous material	2219/00966	. . . . . pH
2219/00846	. . . comprising nanostructures, e.g. nanotubes	2219/00968	. . . . . Type of sensors
2219/00849	. . . comprising packing elements, e.g. glass beads	2219/0097	. . . . . Optical sensors
2219/00851	. . Additional features	2219/00972	. . . . . . Visible light
2219/00853	. . . Employing electrode arrangements	2219/00975	. . . . . . Ultraviolet light
2219/00855	. . . Surface features	2219/00977	. . . . . . Infrared light
2219/00858	. . . Aspects relating to the size of the reactor	2219/00979	. . . . . . Acoustic sensors
2219/0086	. . . . Dimensions of the flow channels	2219/00981	. . . . . . Gas sensors
2219/00862	. . . . Dimensions of the reaction cavity itself	2219/00984	. . . Residence time
2219/00864	. . . . Channel sizes in the nanometer range, e.g. nanoreactors	2219/00986	. . . Microprocessor
2219/00867	. . . Microreactors placed in series, on the same or on different supports	2219/00988	. . . Leakage
2219/00869	. . . Microreactors placed in parallel, on the same or on different supports	2219/0099	. . Cleaning
2219/00871	. . . Modular assembly	2219/00993	. . Design aspects
2219/00873	. . Heat exchange	2219/00995	. . . Mathematical modeling
2219/00876	. . . Insulation elements	2219/00997	. . . . Strategical arrangements of multiple microreactor systems
2219/00878	. . . . Vacuum spaces	2219/02	. Apparatus characterised by their chemically-resistant properties
2219/0088	. . . Peltier-type elements	2219/0204	. . comprising coatings on the surfaces in direct contact with the reactive components
2219/00882	. . . Electromagnetic heating	2219/0209	. . . of glass
2219/00885	. . . Thin film heaters	2219/0213	. . . of enamel
2219/00887	. . . Deflection means for heat or irradiation	2219/0218	. . . of ceramic
2219/00889	. . Mixing (micromixers B01F 13/0059)	2219/0222	. . . . of porcelain
2219/00891	. . Feeding or evacuation	2219/0227	. . . of graphite
2219/00894	. . . More than two inlets	2219/0231	. . . of diamond
2219/00896	. . . Changing inlet or outlet cross-section, e.g. pressure-drop compensation	2219/0236	. . . Metal based
2219/00898	. . . Macro-to-Micro (M2M)	2219/024	. . . . Metal oxides
2219/009	. . . Pulsating flow	2219/0245	. . . of synthetic organic material
		2219/025	. . characterised by the construction materials of the reactor vessel proper
		2219/0254	. . . Glass
		2219/0259	. . . Enamel
		2219/0263	. . . Ceramic

2219/0268	. . . . Porcelain	2219/0894	. . Processes carried out in the presence of a plasma
2219/0272	. . . Graphite	2219/0896	. . . Cold plasma
2219/0277	. . . Metal based	2219/0898	. . . Hot plasma
2219/0281	. . . . Metal oxides	2219/12	. . Processes employing electromagnetic waves
2219/0286	. . . . Steel	2219/1203	. . . Incoherent waves
2219/029	. . . . Non-ferrous metals	2219/1206	. . . . Microwaves
2219/0295	. . . Synthetic organic materials	2219/1209	. . . . . Features relating to the reactor or vessel
2219/08	. Processes employing the direct application of electric or wave energy, or particle radiation; Apparatus therefor	2219/1212	. . . . . Arrangements of the reactor or the reactors
2219/0801	. . Controlling the process	2219/1215	. . . . . Single reactor
2219/0803	. . employing electric or magnetic energy	2219/1218	. . . . . Multiple reactors
2219/0805	. . . giving rise to electric discharges	2219/1221	. . . . . the reactor <u>per se</u>
2219/0807	. . . . involving electrodes	2219/1224	. . . . . Form of the reactor
2219/0809	. . . . . employing two or more electrodes	2219/1227	. . . . . Reactors comprising tubes with open ends
2219/0811	. . . . . employing three electrodes	2219/123	. . . . . Vessels in the form of a cup
2219/0813	. . . . . employing four electrodes	2219/1233	. . . . . Closure means, such as lids, caps, seals (B01J 3/03 takes precedence; pressure relief systems in the lid, e.g. rupture discs B01J 2219/0027)
2219/0815	. . . . . involving stationary electrodes	2219/1236	. . . . . Frames for holding the lid in place
2219/0816	. . . . . involving moving electrodes	2219/1239	. . . . . Means for feeding and evacuation
2219/0818	. . . . . Rotating electrodes	2219/1242	. . . . . Materials of construction
2219/082	. . . . . Sliding electrodes	2219/1245	. . . . . Parts of the reactor being microwave absorbing, dielectric
2219/0822	. . . . . The electrode being consumed	2219/1248	. . . . . Features relating to the microwave cavity
2219/0824	. . . . . Details relating to the shape of the electrodes	2219/1251	. . . . . Support for the reaction vessel
2219/0826	. . . . . essentially linear	2219/1254	. . . . . Static supports
2219/0828	. . . . . Wires	2219/1257	. . . . . Rotating supports
2219/083	. . . . . cylindrical	2219/126	. . . . . in the form of a closed housing
2219/0832	. . . . . essentially toroidal	2219/1263	. . . . . in the form of an open housing or stand
2219/0833	. . . . . forming part of a full circle	2219/1266	. . . . . Microwave deflecting parts
2219/0835	. . . . . substantially flat	2219/1269	. . . . . Microwave guides
2219/0837	. . . . . Details relating to the material of the electrodes	2219/1272	. . . . . Materials of construction
2219/0839	. . . . . Carbon	2219/1275	. . . . . Controlling the microwave irradiation variables
2219/0841	. . . . . Metal	2219/1278	. . . . . Time
2219/0843	. . . . . Ceramic	2219/1281	. . . . . Frequency
2219/0845	. . . . Details relating to the type of discharge	2219/1284	. . . . . Intensity
2219/0847	. . . . . Glow discharge	2219/1287	. . . . . Features relating to the microwave source
2219/0849	. . . . . Corona pulse discharge	2219/129	. . . . . Arrangements thereof
2219/085	. . . creating magnetic fields	2219/1293	. . . . . Single source
2219/0852	. . . . employing permanent magnets	2219/1296	. . . . . Multiple sources
2219/0854	. . . . employing electromagnets	2219/18	. Details relating to the spatial orientation of the reactor
2219/0856	. . . . employing a combination of permanent and electromagnets	2219/182	. . horizontal
2219/0858	. . . . employing moving elements	2219/185	. . vertical
2219/086	. . . . . Moving (electro)magnets	2219/187	. . inclined at an angle to the horizontal or to the vertical plane
2219/0862	. . . . employing multiple (electro)magnets	2219/19	. Details relating to the geometry of the reactor
2219/0864	. . . . . Three (electro)magnets	2219/192	. . polygonal
2219/0866	. . . . . Four (electro)magnets	2219/1921	. . . triangular
2219/0867	. . . . . Six or more (electro)magnets	2219/1923	. . . square or square-derived
2219/0869	. . Feeding or evacuating the reactor	2219/1925	. . . . prismatic
2219/0871	. . Heating or cooling of the reactor	2219/1926	. . . . pyramidal
2219/0873	. . Materials to be treated	2219/1928	. . . hexagonal
2219/0875	. . . Gas	2219/194	. . round
2219/0877	. . . Liquid	2219/1941	. . . circular or disk-shaped
2219/0879	. . . Solid	2219/1942	. . . . spherical
2219/0881	. . . Two or more materials	2219/1943	. . . . cylindrical
2219/0883	. . . . Gas-gas		
2219/0884	. . . . Gas-liquid		
2219/0886	. . . . Gas-solid		
2219/0888	. . . . Liquid-liquid		
2219/089	. . . . Liquid-solid		
2219/0892	. . . involving catalytically active material		

2219/1944	. . . . spiral	2219/2453	. . . . . Plates arranged in parallel
2219/1945	. . . . toroidal	2219/2454	. . . . . Plates arranged concentrically
2219/1946	. . . . conical	2219/2455	. . . . . Plates arranged radially
2219/1947	. . . . oval or ellipsoidal	2219/2456	. . . . . Geometry of the plates
2219/1948	. . . . ovoid or egg-shaped	2219/2458	. . . . . Flat plates, i.e. plates which are not corrugated or otherwise structured, e.g. plates with cylindrical shape
2219/24	. Stationary reactors without moving elements inside	2219/2459	. . . . . Corrugated plates
2219/2401	. . Reactors comprising multiple separate flow channels	2219/246	. . . . . Perforated plates
2219/2402	. . . Monolithic-type reactors	2219/2461	. . . . Heat exchange aspects
2219/2403	. . . . Geometry of the channels	2219/2462	. . . . . the reactants being in indirect heat exchange with a non reacting heat exchange medium
2219/2404	. . . . . Polygonal	2219/2464	. . . . . Independent temperature control in various sections of the reactor
2219/2406	. . . . . Rectangular	2219/2465	. . . . . Two reactions in indirect heat exchange with each other
2219/2407	. . . . . Square	2219/2466	. . . . . The same reactant stream undergoing different reactions, endothermic or exothermic
2219/2408	. . . . . Circular or ellipsoidal	2219/2467	. . . . . Additional heat exchange means, e.g. electric resistance heaters, coils
2219/2409	. . . . Heat exchange aspects	2219/2469	. . . . Feeding means
2219/2411	. . . . . The reactant being in indirect heat exchange with a non reacting heat exchange medium	2219/247	. . . . . Feeding means for the reactants
2219/2412	. . . . . Independent temperature control in various sections of the monolith	2219/2471	. . . . . Feeding means for the catalyst
2219/2413	. . . . . Two reactions in indirect heat exchange	2219/2472	. . . . . the catalyst being exchangeable on inserts other than plates, e.g. in bags
2219/2414	. . . . . The same reactant stream undergoing different reactions, endothermic or exothermic	2219/2474	. . . . Mixing means, e.g. fins or baffles attached to the plates
2219/2416	. . . . . Additional heat exchange means, e.g. electric resistance heater, coils	2219/2475	. . . . Separation means, e.g. membranes inside the reactor
2219/2417	. . . . . Direct heat exchange	2219/2476	. . . . Construction materials
2219/2418	. . . . Feeding means	2219/2477	. . . . . of the catalysts
2219/2419	. . . . . for the reactants	2219/2479	. . . . . Catalysts coated on the surface of plates or inserts
2219/242	. . . . . for the catalysts	2219/248	. . . . . Nanocatalysts
2219/2422	. . . . Mixing means, e.g. fins or baffles attached to the monolith or placed in the channel	2219/2481	. . . . . Catalysts in granular form between plates
2219/2423	. . . . Separation means, e.g. membrane inside the reactor	2219/2482	. . . . . Catalytically active foils; Plates having catalytically activity on their own
2219/2424	. . . . . Wall-flow filter, e.g. adjacent cells closed alternatively at their end to force the reactant stream through the walls of the monolith	2219/2483	. . . . . of the plates
2219/2425	. . . . Construction materials	2219/2485	. . . . . Metals or alloys
2219/2427	. . . . . Catalysts	2219/2486	. . . . . Steel
2219/2428	. . . . . Catalysts coated on the surface of the monolith channels	2219/2487	. . . . . Ceramics
2219/2429	. . . . . Nanocatalysts	2219/2488	. . . . . Glass
2219/243	. . . . . Catalyst in granular form in the channels	2219/249	. . . . . Plastics
2219/2432	. . . . . Monoliths having catalytic activity on its own	2219/2491	. . . . Other constructional details
2219/2433	. . . . . of the monoliths	2219/2492	. . . . Assembling means
2219/2434	. . . . . Metals or alloys	2219/2493	. . . . . Means for assembling plates together, e.g. sealing means, screws, bolts
2219/2435	. . . . . Steel	2219/2495	. . . . . the plates being assembled interchangeably or in a disposable way
2219/2437	. . . . . Metal oxides	2219/2496	. . . . . Means for assembling modules together, e.g. casings, holders, fluidic connectors
2219/2438	. . . . . Ceramics	2219/2497	. . . . Size aspects, i.e. concrete sizes are being mentioned in the classified document
2219/2439	. . . . . Glass	2219/2498	. . . . . Additional structures inserted in the channels, e.g. plates, catalyst holding meshes
2219/244	. . . . . Plastics	2219/30	. Details relating to random packing elements
2219/2441	. . . . Other constructional details	2219/302	. . Basic shape of the elements
2219/2443	. . . . Assembling means of monolith modules	2219/30203	. . . Saddle
2219/2444	. . . . Size aspects		
2219/2445	. . . . . Sizes		
2219/2446	. . . . . Cell density		
2219/2448	. . . . . Additional structures inserted in the channels		
2219/2449	. . . . . Moving elements in the monolith reactor		
2219/245	. . . Plate-type reactors		
2219/2451	. . . . Geometry of the reactor		

2219/30207	. . . Sphere	2219/322	. . Basic shape of the elements
2219/30211	. . . . Egg, ovoid or ellipse	2219/32203	. . . Sheets
2219/30215	. . . Toroid or ring	2219/32206	. . . . Flat sheets
2219/30219	. . . Disk	2219/3221	. . . . Corrugated sheets
2219/30223	. . . Cylinder	2219/32213	. . . . Plurality of essentially parallel sheets
2219/30226	. . . Cone or truncated cone	2219/32217	. . . . . with sheets having corrugations which intersect at an angle of 90 degrees
2219/3023	. . . Triangle	2219/3222	. . . . . with sheets having corrugations which intersect at an angle different from 90 degrees
2219/30234	. . . . Hexagon	2219/32224	. . . . . characterised by the orientation of the sheet
2219/30238	. . . Tetrahedron	2219/32227	. . . . . Vertical orientation
2219/30242	. . . Star	2219/32231	. . . . . Horizontal orientation
2219/30246	. . . Square or square-derived	2219/32234	. . . . . Inclined orientation
2219/30249	. . . . Cube	2219/32237	. . . . Sheets comprising apertures or perforations
2219/30253	. . . . Pyramid	2219/32241	. . . . . Louvres
2219/30257	. . . Wire	2219/32244	. . . . . Essentially circular apertures
2219/30261	. . . . twisted	2219/32248	. . . . Sheets comprising areas that are raised or sunken from the plane of the sheet
2219/30265	. . . . Spiral	2219/32251	. . . . . Dimples, bossages, protrusions
2219/30269	. . . Brush	2219/32255	. . . . Other details of the sheets
2219/30273	. . . Cross	2219/32258	. . . . . Details relating to the extremities of the sheets, such as a change in corrugation geometry or sawtooth edges
2219/30276	. . . Sheet	2219/32262	. . . . . Dimensions or size aspects
2219/3028	. . . . stretched	2219/32265	. . . . . characterised by the orientation of blocks of sheets
2219/30284	. . . . twisted	2219/32268	. . . . . relating to blocks in the same horizontal level
2219/30288	. . . . folded	2219/32272	. . . . . relating to blocks in superimposed layers
2219/30292	. . . . rolled up	2219/32275	. . . . . Mounting or joining of the blocks or sheets within the column or vessel
2219/30296	. . . Other shapes	2219/32279	. . . Tubes or cylinders
2219/304	. . Composition or microstructure of the elements	2219/32282	. . . Rods or bars
2219/30408	. . . Metal	2219/32286	. . . Grids or lattices
2219/30416	. . . Ceramic	2219/32289	. . . . Stretched materials
2219/30425	. . . . Carbon	2219/32293	. . . Cubes or cubic blocks
2219/30433	. . . Glass	2219/32296	. . . Honeycombs
2219/30441	. . . Wood	2219/324	. . Composition or microstructure of the elements
2219/3045	. . . Cork	2219/32408	. . . Metal
2219/30458	. . . Rubber	2219/32416	. . . . fibrous
2219/30466	. . . Plastics	2219/32425	. . . Ceramic
2219/30475	. . . comprising catalytically active material	2219/32433	. . . . Carbon
2219/30483	. . . Fibrous materials	2219/32441	. . . Glass
2219/30491	. . . Foam like materials	2219/3245	. . . Wood
2219/308	. . filling or discharging the elements into or from packed columns	2219/32458	. . . Paper
2219/3081	. . . Orientation of the packing elements within the column or vessel	2219/32466	. . . comprising catalytically active material
2219/3083	. . . . Random or dumped packing elements	2219/32475	. . . . involving heat exchange
2219/3085	. . . . Ordered or stacked packing elements	2219/32483	. . . Plastics
2219/3086	. . . Filling of the packing elements into the column or vessel, e.g. using a tube	2219/32491	. . . Woven or knitted materials
2219/3088	. . . Emptying of the packing elements from the column or vessel, e.g. using a tube	2219/326	. . Mathematical modelling
2219/31	. . Size details	2219/328	. . Manufacturing aspects
2219/312	. . . Sizes	2219/3281	. . . Pleating
2219/315	. . . Two or more types of packing elements or packing elements of different sizes present in the column	2219/3282	. . . Molding
2219/318	. . Manufacturing aspects	2219/3284	. . . Pressing
2219/3181	. . . Pleating	2219/3285	. . . Sintering
2219/3183	. . . Molding	2219/3287	. . . Extruding
2219/3185	. . . Pressing	2219/3288	. . . Punching
2219/3186	. . . Sintering	2219/33	. . Details relating to the packing elements in general
2219/3188	. . . Extruding	2219/3306	. . . Dimensions or size aspects
2219/319	. . Mathematical modelling	2219/3313	. . . Revamping
2219/32	. Details relating to packing elements in the form of grids or built-up elements for forming a unit of module inside the apparatus for mass or heat transfer	2219/332	. . Details relating to the flow of the phases

- 2219/3322 . . . Co-current flow
- 2219/3325 . . . Counter-current flow
- 2219/3327 . . . Cross-current flow
- 2220/00 Aspects relating to sorbent materials**
- 2220/40 . Aspects relating to the composition of sorbent or filter aid materials
- 2220/42 . . Materials comprising a mixture of inorganic materials ([materials coated or impregnated on a carrier B01J 20/32](#))
- 2220/44 . . Materials comprising a mixture of organic materials ([materials coated or impregnated on a carrier B01J 20/32](#))
- 2220/445 . . . comprising a mixture of polymers
- 2220/46 . . Materials comprising a mixture of inorganic and organic materials ([materials coated or impregnated on a carrier B01J 20/32](#))
- 2220/48 . . Sorbents characterised by the starting material used for their preparation
- 2220/4806 . . . the starting material being of inorganic character
- 2220/4812 . . . the starting material being of organic character
- 2220/4818 Natural rubber
- 2220/4825 Polysaccharides or cellulose materials, e.g. starch, chitin, sawdust, wood, straw, cotton
- 2220/4831 having been subjected to further processing, e.g. paper, cellulose pulp
- 2220/4837 Lignin
- 2220/4843 Algae, aquatic plants or sea vegetals, e.g. seaweeds, eelgrass
- 2220/485 Plants or land vegetals, e.g. cereals, wheat, corn, rice, sphagnum, peat moss
- 2220/4856 Proteins, DNA
- 2220/4862 Feathers
- 2220/4868 Cells, spores, bacteria
- 2220/4875 . . . the starting material being a waste, residue or of undefined composition
- 2220/4881 Residues from shells, e.g. eggshells, mollusk shells
- 2220/4887 Residues, wastes, e.g. garbage, municipal or industrial sludges, compost, animal manure; fly-ashes
- 2220/4893 Residues derived from used synthetic products, e.g. rubber from used tyres
- 2220/49 . . Materials comprising an indicator, e.g. colour indicator, pH-indicator
- 2220/50 . Aspects relating to the use of sorbent or filter aid materials
- 2220/52 . . Sorbents specially adapted for preparative chromatography
- 2220/54 . . Sorbents specially adapted for analytical or investigative chromatography
- 2220/56 . . Use in the form of a bed
- 2220/58 . . Use in a single column
- 2220/60 . . Use in several different columns
- 2220/603 . . . serially disposed columns
- 2220/606 . . . parallel disposed columns
- 2220/62 . . In a cartridge
- 2220/64 . . In a syringe, pipette, e.g. tip or in a tube, e.g. test-tube or u-shape tube ([in columns B01J 2220/58](#))
- 2220/66 . . Other type of housings or containers not covered by [B01J 2220/58](#) - [B01J 2220/64](#)
- 2220/68 . . Superabsorbents
- 2220/80 . Aspects related to sorbents specially adapted for preparative, analytical or investigative chromatography
- 2220/82 . . Shaped bodies, e.g. monoliths, plugs, tubes, continuous beds
- 2220/825 . . . comprising a cladding or external coating
- 2220/84 . . Capillaries
- 2220/86 . . Sorbents applied to inner surfaces of columns or capillaries
- 2229/00 Aspects of molecular sieve catalysts not covered by B01J 29/00**
- 2229/10 . After treatment, characterised by the effect to be obtained
- 2229/12 . . to alter the outside of the crystallites, e.g. selectivation
- 2229/123 . . . in order to deactivate outer surface
- 2229/126 . . . in order to reduce the pore-mouth size
- 2229/14 . . to alter the inside of the molecular sieve channels
- 2229/16 . . to increase the Si/Al ratio; Dealumination
- 2229/18 . . to introduce other elements into or onto the molecular sieve itself
- 2229/183 . . . in framework positions
- 2229/186 . . . not in framework positions
- 2229/20 . . to introduce other elements in the catalyst composition comprising the molecular sieve, but not specially in or on the molecular sieve itself
- 2229/22 . . to destroy the molecular sieve structure or part thereof
- 2229/24 . . to stabilize the molecular sieve structure
- 2229/26 . . to stabilize the total catalyst structure
- 2229/30 . After treatment, characterised by the means used
- 2229/32 . . Reaction with silicon compounds, e.g. TEOS, siliconfluoride
- 2229/34 . . Reaction with organic or organometallic compounds ([with organo-silicium compounds B01J 2229/32](#))
- 2229/36 . . Steaming
- 2229/37 . . Acid treatment
- 2229/38 . . Base treatment
- 2229/40 . . Special temperature treatment, i.e. other than just for template removal
- 2229/42 . . Addition of matrix or binder particles
- 2229/60 . Synthesis on support
- 2229/62 . . in or on other molecular sieves
- 2229/64 . . in or on refractory materials
- 2229/66 . . on metal supports
- 2231/00 Catalytic reactions performed with catalysts classified in B01J 31/00**
- NOTE**
- In this group indexing is done according to the specific catalytic reaction. In case of multiple catalytic activities only those are indexed which are specifically exemplified, i.e. by ways of worked examples, specific claims or explicit alternatives therein.
- 2231/005 . General concepts, e.g. reviews, relating to methods of using catalyst systems, the concept being defined by a common method or theory, e.g. microwave heating or multiple stereoselectivity

- 2231/10 . Polymerisation reactions involving at least dual use catalysts, e.g. for both oligomerisation and polymerisation
- 2231/12 . . Olefin polymerisation or copolymerisation
- 2231/122 . . . Cationic (co)polymerisation, e.g. single-site or Ziegler-Natta type
- 2231/125 . . . Radical (co)polymerisation, e.g. mediators therefor
- 2231/127 . . . Anionic (co)polymerisation
- 2231/14 . . Other (co) polymerisation, e.g. of lactides, epoxides ("ROMP", i.e. ring-opening metathesis polymerisation B01J 2231/54)
- 2231/20 . Olefin oligomerisation or telomerisation
- 2231/30 . Addition reactions at carbon centres, i.e. to either C-C or C-X multiple bonds
- 2231/32 . . Addition reactions to C=C or C-C triple bonds
- 2231/321 . . . Hydroformylation, metalformylation, carbonylation or hydroaminomethylation
- 2231/322 . . . Hydrocyanation
- 2231/323 . . . Hydrometalation, e.g. bor-, alumin-, silyl-, zirconation or analogous reactions like carbometalation, hydrocarbation
- 2231/324 . . . Cyclisations via conversion of C-C multiple to single or less multiple bonds, e.g. cycloadditions
- 2231/325 Cyclopropanations
- 2231/326 Diels-Alder or other [4+2] cycloadditions, e.g. hetero-analogues
- 2231/327 Dipolar cycloadditions
- 2231/328 Cycloadditions involving more than 2 components or moieties, e.g. intra-/intermolecular [2+2+2] or [2+2+1], e.g. Pauson-Khand type
- 2231/34 . . Other additions, e.g. Monsanto-type carbonylations, addition to 1,2-C=X or 1,2-C-X triplebonds, additions to 1,4-C=C-C=X or 1,4-C=C-C-X triple bonds with X, e.g. O, S, NH/N
- 2231/341 . . . 1,2-additions, e.g. aldol or Knoevenagel condensations
- 2231/342 Aldol type reactions, i.e. nucleophilic addition of C-H acidic compounds, their R₃Si- or metal complex analogues, to aldehydes or ketones
- 2231/343 to prepare cyanhydrines, e.g. by adding HCN or TMSCN
- 2231/344 Boronation, e.g. by adding R-B(OR)₂
- 2231/345 with organometallic complexes, e.g. by adding ZnR₂
- 2231/346 Mannich type reactions, i.e. nucleophilic addition of C-H acidic compounds, their R₃Si- or metal complex analogues to aldimines or ketimines
- 2231/347 via cationic intermediates, e.g. bisphenol A type processes
- 2231/348 . . . 1,4-additions, e.g. conjugate additions
- 2231/349 . . . 1,2- or 1,4-additions in combination with further or prior reactions by the same catalyst, i.e. tandem or domino reactions, e.g. hydrogenation or further addition reactions
- 2231/40 . Substitution reactions at carbon centres, e.g. C-C or C-X, i.e. carbon-hetero atom, cross-coupling, C-H activation or ring-opening reactions
- 2231/42 . . Catalytic cross-coupling, i.e. connection of previously not connected C-atoms or C- and X-atoms without rearrangement
- 2231/4205 . . . C-C cross-coupling, e.g. metal catalyzed or Friedel-Crafts type
- 2231/4211 Suzuki-type, i.e. RY + R'B(OR)₂, in which R, R' are optionally substituted alkyl, alkenyl, aryl, acyl and Y is the leaving group
- 2231/4216 with R= alkyl
- 2231/4222 with R'= alkyl
- 2231/4227 with Y= Cl
- 2231/4233 Kumada-type, i.e. RY + R'MgZ, in which R is optionally substituted alkyl, alkenyl, aryl, Y is the leaving group and Z is halide
- 2231/4238 Negishi-type, i.e. RY + R'ZnZ, in which R, R' is optionally substituted alkyl, alkenyl, alkynyl, aryl, Y is the leaving group and Z is halide or R'
- 2231/4244 with R= alkyl
- 2231/425 with R'= alkyl
- 2231/4255 Stille-type, i.e. RY + R'₃SnR'', in which R is alkenyl, aryl, R' is alkyl and R'' is alkenyl or aryl
- 2231/4261 Heck-type, i.e. RY + C=C, in which R is aryl
- 2231/4266 Sonogashira-type, i.e. RY + HC-CR' triple bonds, in which R=aryl, alkenyl, alkyl and R'=H, alkyl or aryl
- 2231/4272 via enolates or aza-analogues, added as such or made in-situ, e.g. ArY + R₂C=C(OM)Z -> ArR₂C-C(O)Z, in which R is H or alkyl, M is Na, K or SiMe₃, Y is the leaving group, Z is Ar or OR' and R' is alkyl
- 2231/4277 . . . C-X Cross-coupling, e.g. nucleophilic aromatic amination, alkoxylation or analogues
- 2231/4283 using N nucleophiles, e.g. Buchwald-Hartwig amination
- 2231/4288 using O nucleophiles, e.g. alcohols, carboxylates, esters
- 2231/4294 using S nucleophiles, e.g. thiols
- 2231/44 . . Allylic alkylation, amination, alkoxylation or analogues
- 2231/46 . . C-H or C-C activation
- 2231/48 . . Ring-opening reactions
- 2231/482 . . . asymmetric reactions, e.g. kinetic resolution of racemates
- 2231/485 kinetic resolution of epoxide racemates
- 2231/487 by hydrolysis
- 2231/49 . . Esterification or transesterification
- 2231/50 . Redistribution or isomerisation reactions of C-C, C=C or C-C triple bonds
- 2231/52 . . Isomerisation reactions
- 2231/54 . . Metathesis reactions, e.g. olefin metathesis
- 2231/543 . . . alkene metathesis
- 2231/546 . . . alkyne metathesis
- 2231/60 . Reduction reactions, e.g. hydrogenation
- 2231/62 . . Reductions in general of inorganic substrates, e.g. formal hydrogenation, e.g. of N₂
- 2231/625 . . . of CO₂
- 2231/64 . . Reductions in general of organic substrates, e.g. hydride reductions or hydrogenations
- 2231/641 . . . Hydrogenation of organic substrates, i.e. H₂ or H-transfer hydrogenations, e.g. Fischer-Tropsch processes

2231/643	. . . . of R ₂ C=O or R ₂ C=NR (R= C, H)	2523/39	. . Actinides
2231/645	. . . . of C=C or C-C triple bonds	2523/392	. . . Actinium
2231/646	. . . . of aromatic or heteroaromatic rings	2523/395	. . . Thorium
2231/648	. . . . Fischer-Tropsch-type reactions	2523/397	. . . Uranium
2231/70	. Oxidation reactions, e.g. epoxidation, (di)hydroxylation, dehydrogenation and analogues	2523/40	. of Group IV (IVA or IVB) of the Periodic Table
2231/72	. . Epoxidation	2523/41	. . Silicon
2231/74	. . Aziridination	2523/42	. . Germanium
2231/76	. . Dehydrogenation (transfer-dehydrogenation of CH-XH B01J 2231/641 ; transfer-dehydrogenation of -CH₂CHR- via C-H activation B01J 2231/46)	2523/43	. . Tin
2231/763	. . . of -CH-XH (X= O, NH/N, S) to -C=X or -CX triple bond species	2523/44	. . Lead
2231/766	. . . of -CH-CH- or -C=C- to -C=C- or -C-C- triple bond species	2523/47	. . Titanium
2523/00	Constitutive chemical elements of heterogeneous catalysts	2523/48	. . Zirconium
2523/10	. of Group I (IA or IB) of the Periodic Table	2523/49	. . Hafnium
2523/11	. . Lithium	2523/50	. of Group V (VA or VB) of the Periodic Table
2523/12	. . Sodium	2523/51	. . Phosphorus
2523/13	. . Potassium	2523/52	. . Arsenic
2523/14	. . Rubidium	2523/53	. . Antimony
2523/15	. . Caesium	2523/54	. . Bismuth
2523/16	. . Francium	2523/55	. . Vanadium
2523/17	. . Copper	2523/56	. . Niobium
2523/18	. . Silver	2523/57	. . Tantalum
2523/19	. . Gold	2523/60	. of Group VI (VIA or VIB) of the Periodic Table
2523/20	. of Group II (IIA or IIB) of the Periodic Table	2523/62	. . Sulfur
2523/21	. . Beryllium	2523/63	. . Selenium
2523/22	. . Magnesium	2523/64	. . Tellurium
2523/23	. . Calcium	2523/65	. . Polonium
2523/24	. . Strontium	2523/67	. . Chromium
2523/25	. . Barium	2523/68	. . Molybdenum
2523/26	. . Radium	2523/69	. . Tungsten
2523/27	. . Zinc	2523/70	. of Group VII (VIIB) of the Periodic Table
2523/28	. . Cadmium	2523/72	. . Manganese
2523/29	. . Mercury	2523/73	. . Technetium
2523/30	. of Group III (IIIA or IIIB) of the Periodic Table	2523/74	. . Rhenium
2523/305	. . Boron	2523/80	. of Group VIII of the Periodic Table
2523/31	. . Aluminium	2523/82	. . Metals of the platinum group
2523/32	. . Gallium	2523/821	. . . Ruthenium
2523/33	. . Indium	2523/822	. . . Rhodium
2523/34	. . Thallium	2523/824	. . . Palladium
2523/35	. . Scandium	2523/825	. . . Osmium
2523/36	. . Yttrium	2523/827	. . . Iridium
2523/37	. . Lanthanides	2523/828	. . . Platinum
2523/3706	. . . Lanthanum	2523/84	. . Metals of the iron group
2523/3712	. . . Cerium	2523/842	. . . Iron
2523/3718	. . . Praseodymium	2523/845	. . . Cobalt
2523/3725	. . . Neodymium	2523/847	. . . Nickel
2523/3731	. . . Promethium	2531/00	Additional information regarding catalytic systems classified in B01J 31/00
2523/3737	. . . Samarium		NOTE
2523/3743	. . . Europium		In this group the term "Metals" refers to the central metal in the coordination complexes (B01J 31/16 - B01J 31/24), as used for the respective catalytic reaction, excluding carboxylates (see B01J 31/04) and other simple salts or organometallic compounds (see B01J 31/12). As to components, only those metals or solvents are indexed which are explicitly mentioned in the claims or the worked examples. As to compositional aspects, only those are provided for in the scheme below and are intended to be indexed, which provide additional information regarding the complexes and/or ligands classified in
2523/375	. . . Gadolinium		
2523/3756	. . . Terbium		
2523/3762	. . . Dysprosium		
2523/3768	. . . Holmium		
2523/3775	. . . Erbium		
2523/3781	. . . Thulium		
2523/3787	. . . Ytterbium		
2523/3793	. . . Lutetium		

B01J

B01J 2531/00
(continued)

[B01J 31/16](#) - [B01J 31/24](#); indexing codes [B01J 2531/0286](#) - [B01J 2531/0297](#) are only used if these aspects are described as essential. Indexing codes [B01J 2531/0213](#) - [B01J 2531/0277](#) characterise the complexes on the basis of bond-type (linkage-type) thereby specifying the structural geometry of the complexes, while classification entries [B01J 31/16](#) - [B01J 31/24](#) are purely compositional subdivisions. The individual metals, the compositional aspects of complexes used and the solvents are indexed for each explicit alternative, according to the guideline above

- 2531/001 . . General concepts, e.g. reviews, relating to catalyst systems and methods of making them, the concept being defined by a common material or method/theory

NOTE

When indexing in this group, only the focus is indexed in [B01J 2531/004](#) - [B01J 2531/007](#) and only if groups with closely related members are concerned, e.g. N-heterocyclic carbenes ([B01J 2531/004](#)), Pd-complexes ([B01J 2531/005](#)), added halide ([B01J 2531/007](#)). Otherwise the main code [B01J 2531/002](#) is used.

- 2531/002 . . Materials
2531/004 . . . Ligands
2531/005 . . . Catalytic metals
2531/007 . . . Promoter-type Additives
2531/008 . . Methods or theories
2531/02 . . Compositional aspects of complexes used, e.g. polynuclearity
2531/0202 . . Polynuclearity
2531/0205 . . . Bi- or polynuclear complexes, i.e. comprising two or more metal coordination centres, without metal-metal bonds, e.g. Cp(Lx)Zr-imidazole-Zr(Lx)Cp
2531/0208 . . . Bimetallic complexes, i.e. comprising one or more units of two metals, with metal-metal bonds but no all-metal (M)_n rings, e.g. Cr₂(OAc)₄
2531/0211 . . . Metal clusters, i.e. complexes comprising 3 to about 1000 metal atoms with metal-metal bonds to provide one or more all-metal (M)_n rings, e.g. Rh₄(CO)₁₂
2531/0213 . . Complexes without C-metal linkages
2531/0216 . . . Bi- or polynuclear complexes, i.e. comprising two or more metal coordination centres, without metal-metal bonds, e.g. Cp(Lx)Zr-imidazole-Zr(Lx)Cp
2531/0219 . . . Bimetallic complexes, i.e. comprising one or more units of two metals, with metal-metal bonds but no all-metal (M)_n rings, e.g. Cr₂(OAc)₄
2531/0222 . . . Metal clusters, i.e. complexes comprising 3 to about 1000 metal atoms with metal-metal bonds to provide one or more all-metal (M)_n rings, e.g. Rh₄(CO)₁₂
2531/0225 . . Complexes comprising pentahapto-cyclopentadienyl analogues
2531/0227 . . . Carbollide ligands, i.e. [nido-CnB(11-n)H11](4-n)- in which n is 1-3

- 2531/023 . . . Phospholyl ligands, i.e. [CnP(5-n)Rn]- in which n is 0-4 and R is H or hydrocarbyl, or analogous condensed ring systems
2531/0233 . . . Aza-Cp ligands, i.e. [CnN(5-n)Rn]- in which n is 0-4 and R is H or hydrocarbyl, or analogous condensed ring systems
2531/0236 . . . Azaborolyl ligands, e.g. 1,2-azaborolyl
2531/0238 . . Complexes comprising multidentate ligands, i.e. more than 2 ionic or coordinative bonds from the central metal to the ligand, the latter having at least two donor atoms, e.g. N, O, S, P
2531/0241 . . . Rigid ligands, e.g. extended sp²-carbon frameworks or geminal di- or trisubstitution
2531/0244 Pincer-type complexes, i.e. consisting of a tridentate skeleton bound to a metal, e.g. by one to three metal-carbon sigma-bonds
2531/0247 Tripodal ligands, e.g. comprising the tris(pyrazolyl)borate skeleton, "tpz", neutral analogues thereof by CH/BH exchange or anionic analogues of the latter by exchange of one of the pyrazolyl groups for an anionic complexing group such as carboxylate or -R-Cp
2531/025 Ligands with a porphyrin ring system or analogues thereof, e.g. phthalocyanines, corroles
2531/0252 Salen ligands or analogues, e.g. derived from ethylenediamine and salicylaldehyde
2531/0255 Ligands comprising the N₂S₂ or N₂P₂ donor atom set, e.g. diiminodithiolates or diiminodiphosphines with complete pi-conjugation between all donor centres
2531/0258 . . . Flexible ligands, e.g. mainly sp³-carbon framework as exemplified by the "tedicyp" ligand, i.e. cis-cis-cis-1,2,3,4-tetrakis(diphenylphosphinomethyl)cyclopentane
2531/0261 . . Complexes comprising ligands with non-tetrahedral chirality
2531/0263 . . . Planar chiral ligands, e.g. derived from donor-substituted paracyclophanes and metallocenes or from substituted arenes
2531/0266 . . . Axially chiral or atropisomeric ligands, e.g. bulky biaryls such as donor-substituted binaphthalenes, e.g. "BINAP" or "BINOL"
2531/0269 . . Complexes comprising ligands derived from the natural chiral pool or otherwise having a characteristic structure or geometry
2531/0272 . . . derived from carbohydrates, including e.g. tartrates or DIOP
2531/0275 . . . derived from amino acids
2531/0277 . . . derived from fullerenes and analogues, e.g. buckybowls or Cp₅Cp
2531/028 . . . comprising affinity tags, e.g. for recovery ([self-associating or modular catalysts](#) [B01J 2531/0291](#))
2531/0283 The bonding to the affinity counterpart occurring via hydrogen bonding
2531/0286 . . Complexes comprising ligands or other components characterized by their function
2531/0288 . . . Sterically demanding or shielding ligands
2531/0291 . . . Ligands adapted to form modular catalysts, e.g. self-associating building blocks as exemplified in the patent document EP-A-1 479 439

- 2531/0294 . . . "Non-innocent" or "non-spectator" ligands, i.e. ligands described as, or evidently, taking part in the catalytic reaction beyond merely stabilizing the central metal as spectator or ancillary ligands, e.g. by electron transfer to or from the central metal or by intra-/intermolecular chemical reactions, e.g. disulfide coupling, H-abstraction
- 2531/0297 . . . Non-coordinating anions
- 2531/10 . Complexes comprising metals of Group I (IA or IB) as the central metal
- 2531/11 . . Lithium
- 2531/12 . . Sodium
- 2531/13 . . Potassium
- 2531/14 . . Rubidium
- 2531/15 . . Caesium
- 2531/16 . . Copper
- 2531/17 . . Silver
- 2531/18 . . Gold
- 2531/20 . Complexes comprising metals of Group II (IIA or IIB) as the central metal
- 2531/21 . . Beryllium
- 2531/22 . . Magnesium
- 2531/23 . . Calcium
- 2531/24 . . Strontium
- 2531/25 . . Barium
- 2531/26 . . Zinc
- 2531/27 . . Cadmium
- 2531/28 . . Mercury
- 2531/30 . Complexes comprising metals of Group III (IIIA or IIIB) as the central metal
- 2531/31 . . Aluminium
- 2531/32 . . Gallium
- 2531/33 . . Indium
- 2531/34 . . Thallium
- 2531/35 . . Scandium
- 2531/36 . . Yttrium
- 2531/37 . . Lanthanum
- 2531/38 . . Lanthanides other than lanthanum
- 2531/39 . . Actinides
- 2531/40 . Complexes comprising metals of Group IV (IVA or IVB) as the central metal
- 2531/42 . . Tin
- 2531/44 . . Lead
- 2531/46 . . Titanium
- 2531/48 . . Zirconium
- 2531/49 . . Hafnium
- 2531/50 . Complexes comprising metals of Group V (VA or VB) as the central metal
- 2531/52 . . Antimony
- 2531/54 . . Bismuth
- 2531/56 . . Vanadium
- 2531/57 . . Niobium
- 2531/58 . . Tantalum
- 2531/60 . Complexes comprising metals of Group VI (VIA or VIB) as the central metal
- 2531/62 . . Chromium
- 2531/64 . . Molybdenum
- 2531/66 . . Tungsten
- 2531/70 . Complexes comprising metals of Group VII (VIIB) as the central metal
- 2531/72 . . Manganese
- 2531/74 . . Rhenium
- 2531/80 . Complexes comprising metals of Group VIII as the central metal
- 2531/82 . . Metals of the platinum group
- 2531/821 . . . Ruthenium
- 2531/822 . . . Rhodium
- 2531/824 . . . Palladium
- 2531/825 . . . Osmium
- 2531/827 . . . Iridium
- 2531/828 . . . Platinum
- 2531/84 . . Metals of the iron group
- 2531/842 . . . Iron
- 2531/845 . . . Cobalt
- 2531/847 . . . Nickel
- 2531/90 . Catalytic systems characterized by the solvent or solvent system used
- 2531/92 . . Supercritical solvents
- 2531/922 . . . Carbon dioxide (scCO₂)
- 2531/925 . . . Supercritical water (scH₂O)
- 2531/927 . . . Mixtures of ionic liquids with supercritical solvents
- 2531/94 . . Fluorinated solvents
- 2531/96 . . Water
- 2531/98 . . Phase-transfer catalysis in a mixed solvent system containing at least 2 immiscible solvents or solvent phases
- 2531/985 . . . in a water / organic solvent system
- 2540/00 Compositional aspects of coordination complexes or ligands in catalyst systems**
- 2540/10 . Non-coordinating groups comprising only oxygen beside carbon or hydrogen
- 2540/12 . . Carboxylic acid groups
- 2540/20 . Non-coordinating groups comprising halogens
- 2540/22 . . comprising fluorine, e.g. trifluoroacetate
- 2540/225 . . . comprising perfluoroalkyl groups or moieties
- 2540/30 . Non-coordinating groups comprising sulfur
- 2540/32 . . Sulfonic acid groups or their salts
- 2540/325 . . . being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional groups
- 2540/34 . . Sulfonyl groups
- 2540/345 . . . being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional groups
- 2540/40 . Non-coordinating groups comprising nitrogen
- 2540/42 . . Quaternary ammonium groups
- 2540/44 . . being derivatives of carboxylic or carbonic acids, e.g. amide (RC(=O)-NR₂, RC(=O)-NR-C(=O)R), nitrile, urea (R₂N-C(=O)-NR₂), guanidino (R₂N-C(=NR)-NR₂) groups
- 2540/442 . . . Amide groups or imidato groups (R-C=NR(OR))
- 2540/444 . . . Nitrile groups
- 2540/446 . . . Urea groups
- 2540/448 . . . Guanidino groups
- 2540/50 . Non-coordinating groups comprising phosphorus
- 2540/52 . . Phosphorus acid or phosphorus acid ester groups
- 2540/522 . . . being phosphoric acid mono-, di- or triester groups ((RO)(R'O)P=O), i.e. R= C, R'= C, H

- 2540/525 . . . being phosphorous acid (-ester) groups
((RO)P(OR')₂) or the isomeric phosphonic acid
(-ester) groups (R(R'O)₂P=O), i.e. R= C, R'= C, H
- 2540/527 . . . being phosphonous acid (-ester) groups
(RP(OR')₂) or the isomeric phosphinic acid (-
ester) groups (R₂(R'O)P=O), i.e. R= C, R'= C,
H
- 2540/54 . . Quaternary phosphonium groups
- 2540/60 . Groups characterized by their function
- 2540/62 . . Activating groups
- 2540/64 . . Solubility enhancing groups
- 2540/66 . . Linker or spacer groups
- 2540/68 . . Associating groups, e.g. with a second ligand or a
substrate molecule via non-covalent interactions
such as hydrogen bonds