

CPC**COOPERATIVE PATENT CLASSIFICATION****C01B**

NON-METALLIC ELEMENTS ; COMPOUNDS THEREOF; { METALLOIDS OR COMPOUNDS THEREOF NOT COVERED BY SUBCLASS [C01C](#) }

NOTE

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.

Attention is drawn to the definitions of groups of chemical elements following the title of section C.

WARNING

The following IPC groups are not used in the CPC system. Subject matter covered by these groups is classified in the following CPC groups:

[C01B 31/16](#) covered by [B01J 39/24](#) , [B01J 41/18](#)
[C01B 35/16](#) , [C01B 35/18](#) covered by [C01B 35/00](#) + s.gr.

General concordance IPC4 or IPC5 to IPC6 groups is as follows:

[C01B 25/37](#) (partly) : [C01B 37/002](#)
[C01B 25/453](#) : [C01B 37/00](#) , [C01B 39/54](#)
[C01B 33/185](#) : [C01B 37/02](#)
[C01B 33/28](#) and subgroups : [C01B 37/00](#) , [C01B 39/00](#)
[C01B 35/1009](#) : [C01B 37/06](#) , [C01B 39/12](#) , [C01B 39/54](#)

Guidance heading: Hydrogen ; Hydrides ; Water ; Synthesis gas from hydrocarbons

C01B 3/00

Hydrogen ; Gaseous mixtures containing hydrogen ; Separation of hydrogen from mixtures containing it (separation of gases by physical means [B01D](#)) ; Purification of hydrogen (production of water gas or synthesis gas from solid carbonaceous material [C10J](#) ; purifying or modifying the chemical compositions of combustible technical gases containing carbon monoxide [C10K](#))

NOTE

1. In this group it is desirable to add the indexing codes of groups [B01J 2208/00](#) and [B01J 2219/00](#) , for details relating to the reactors used in the generation of hydrogen or synthesis gas. 2. In groups [C01B 3/12](#) to [C01B 3/18](#) and in groups [C01B 3/22](#) to [C01B 3/586](#) it is desirable to add the indexing codes of group [C01B 2203/00](#) , for aspects relating to hydrogen or synthesis gas generation processes.

C01B 3/0005

- . { Reversible uptake of hydrogen by an appropriate medium, i.e. based on physical or chemical sorption phenomena or on reversible chemical reactions, e.g. for hydrogen storage purposes (purification of hydrogen [C01B 3/508](#)) ; Reversible gettering of hydrogen; Reversible uptake of hydrogen by electrodes }

C01B 3/001

- .. { characterised by the uptaking medium; Treatment thereof }

C01B 3/0015

- ... { Organic compounds; Solutions thereof }

- C01B 3/0021 ... { Carbon, e.g. active carbon, carbon nanotubes, fullerenes; Treatment thereof }
- C01B 3/0026 ... { of one single metal or a rare earth metal; Treatment thereof }

NOTE

In all of the groups [C01B 3/0026](#) to [C01B 3/0084](#) , the metallic storage materials may contain minor quantities of non-metals such as B, C, O, S, Se, Si; e.g. [C01B 3/0036](#) "only containing iron and titanium" includes Fe-Ti compositions comprising non-metals

In the groups [C01B 3/0026](#) and [C01B 3/0047](#) to [C01B 3/0068](#) a "rare-earth metal" means one single metal or a combination of metals selected from the lanthanides, Sc or Y

- C01B 3/0031 ... { Intermetallic compounds; Metal alloys; Treatment thereof }
- C01B 3/0036 { only containing iron and titanium; Treatment thereof }
- C01B 3/0042 { only containing magnesium and nickel; Treatment thereof }
- C01B 3/0047 { containing a rare earth metal; Treatment thereof }
- C01B 3/0052 { also containing titanium }
- C01B 3/0057 { also containing nickel }
- C01B 3/0063 { only containing a rare earth metal and only one other metal }
- C01B 3/0068 { the other metal being nickel }
- C01B 3/0073 ... { Slurries, Suspensions }
- C01B 3/0078 ... { Composite solid storage mediums, i.e. coherent or loose mixtures of different solid constituents, chemically or structurally heterogeneous solid masses, coated solids or solids having a chemically modified surface region }
- C01B 3/0084 ... { Solid storage mediums characterised by their shape, e.g. pellets, sintered shaped bodies, sheets, porous compacts, spongy metals, hollow particles, solids with cavities, layered solids }
- C01B 3/0089 . { Ortho-para conversion }
- C01B 3/0094 . { Atomic hydrogen }
- C01B 3/02 . Production of hydrogen or of gaseous mixtures containing { a substantial proportion of } hydrogen
- C01B 3/025 .. { Preparation or purification of gas mixtures for ammonia synthesis }
- C01B 3/04 .. by decomposition of inorganic compounds, e.g. ammonia { ([C01B 3/0005](#) takes precedence) }
- C01B 3/042 ... { Decomposition of water }
- C01B 3/045 { in gaseous phase }
- C01B 3/047 ... { Decomposition of ammonia }
- C01B 3/06 .. by reaction of inorganic compounds containing electro-positively bound hydrogen, e.g. water, acids, bases, ammonia, with inorganic reducing agents (by electrolysis of water [C25B 1/04](#))
- C01B 3/061 ... { by reaction of metal oxides with water }
- C01B 3/063 { Cyclic methods }
- C01B 3/065 ... { from a hydride }
- C01B 3/066 ... { by reaction of water with phosphorus }

- C01B 3/068 . . . { the hydrogen being generated from the water as a result of a cyclus of reactions, not covered by groups [C01B 3/063](#) or [C01B 3/105](#) }
- C01B 3/08 . . . with metals
- C01B 3/10 . . . by reaction of water vapour with metals
- C01B 3/105 { Cyclic methods }
- C01B 3/12 . . . by reaction of water vapour with carbon monoxide
- C01B 3/14 Handling of heat and steam
- C01B 3/16 using catalysts
- C01B 3/18 using moving solid particles
- C01B 3/20 . . . by reaction of metal hydroxides with carbon monoxide
- C01B 3/22 . . by decomposition of gaseous or liquid organic compounds ({ [C01B 3/0005](#) takes precedence } ; coking liquid carbonaceous materials [C10B 55/00](#))
- C01B 3/24 . . . of hydrocarbons
- C01B 3/26 using catalysts
- C01B 3/28 using moving solid particles
- C01B 3/30 using the fluidised bed technique
- C01B 3/32 . . by reaction of gaseous or liquid organic compounds with gasifying agents, e.g. water, carbon dioxide, air
- C01B 3/323 . . . { Catalytic reaction of gaseous or liquid organic compounds other than hydrocarbons with gasifying agents }
- C01B 3/326 { characterised by the catalyst }
- C01B 3/34 . . . by reaction of hydrocarbons with gasifying agents
- C01B 3/342 { with the aid of electrical means, electromagnetic or mechanical vibrations, or particle radiations }
- C01B 3/344 { using non-catalytic solid particles }
- C01B 3/346 { using heat generated by superheated steam }
- C01B 3/348 { by direct contact with heat accumulating liquids, e.g. molten metals, molten salts }
- C01B 3/36 using oxygen or mixtures containing oxygen as gasifying agents
- C01B 3/363 { characterised by the burner used }
- C01B 3/366 { Partial combustion in internal-combustion engines }
- C01B 3/38 using catalysts
- C01B 3/382 { Multi-step processes }
- C01B 3/384 { the catalyst being continuously externally heated }
- C01B 3/386 { Catalytic partial combustion }
- C01B 3/388 { the heat being generated by superheated steam }
- C01B 3/40 characterised by the catalyst
- C01B 3/42 using moving solid particles
- C01B 3/44 using the fluidised bed technique
- C01B 3/46 using discontinuously preheated non-moving solid materials, e.g. blast and run
- C01B 3/48 followed by reaction of water vapour with carbon monoxide
- C01B 3/50 . . Separation of hydrogen or hydrogen containing gases from gaseous mixtures, e.g. purification ([C01B 3/14](#) takes precedence)

- C01B 3/501 . . { by diffusion }
- C01B 3/503 . . . { characterised by the membrane }
- C01B 3/505 { Membranes containing palladium }
- C01B 3/506 . . { at low temperatures }
- C01B 3/508 . . { by selective and reversible uptake by an appropriate medium, i.e. the uptake being based on physical or chemical sorption phenomena or on reversible chemical reactions (the appropriate mediums per se [C01B 3/0005](#)) }
- C01B 3/52 . . by contacting with liquids ; Regeneration of used liquids { ([C01B 3/508](#) takes precedence) }
- C01B 3/54 . . . including a catalytic reaction
- C01B 3/56 . . by contacting with solids ; Regeneration of used solids { ([C01B 3/508](#) takes precedence) }
- C01B 3/58 . . . including a catalytic reaction
- C01B 3/583 { the reaction being the selective oxidation of carbon monoxide }
- C01B 3/586 { the reaction being a methanation reaction }

- C01B 4/00** **Hydrogen isotopes ; Inorganic compounds thereof prepared by isotope exchange, e.g. $\text{NH}_3 + \text{D}_2 \rightarrow \text{NH}_2\text{D} + \text{HD}$ (separation of isotopes [B01D 59/00](#) ; other chemical reactions to form compounds of hydrogen isotopes, see the relevant groups for hydrogen compounds in class [C01](#))**

- C01B 5/00** **Water**
- C01B 5/02 . Heavy water ; Preparation by chemical reaction of hydrogen isotopes or their compounds, e.g. $4\text{ND}_3 + 7\text{O}_2 \rightarrow 4\text{NO}_2 + 6\text{D}_2\text{O}$, $2\text{D}_2 + \text{O}_2 \rightarrow 2\text{D}_2\text{O}$

- C01B 6/00** **Hydrides of metals { including fully or partially hydrided metals, alloys or intermetallic compounds (use of some thereof for reversible sorption of hydrogen [C01B 3/0005](#) , [C01B 3/508](#)) ; Compounds containing at least one metal-hydrogen bond, e.g. $(\text{GeH}_3)_2\text{S}$, SiH GeH } ; Monoborane or diborane ; Addition complexes thereof (higher hydrides of boron, substituted hydrides of boron [C01B 35/00](#))**
- C01B 6/003 . { Hydrides containing only one metal and one or several non-metals }
- C01B 6/006 . . { only one metal and one or several halogens }
- C01B 6/02 . Hydrides of transition elements ; Addition complexes thereof
- C01B 6/04 . Hydrides of alkali metals, alkaline earth metals, beryllium or magnesium ; Addition complexes thereof
- C01B 6/06 . Hydrides of aluminium, gallium, indium, thallium, germanium, tin, lead, arsenic, antimony, bismuth or polonium ; Monoborane ; Diborane ; Addition complexes thereof
- C01B 6/065 . . { Hydrides of arsenic or antimony }
- C01B 6/10 . . Monoborane ; Diborane ; Addition complexes thereof
- C01B 6/11 . . . Preparation from boron or inorganic compounds containing boron and oxygen
- C01B 6/13 . . . Addition complexes of monoborane or diborane, e.g. with phosphine, arsine or hydrazine
- C01B 6/15 Metal borohydrides ; Addition complexes thereof

- C01B 6/17 Preparation from boron or inorganic compounds containing boron and oxygen
- C01B 6/19 Preparation from other compounds of boron
- C01B 6/21 Preparation of borohydrides of alkali metals, alkaline earth metals, magnesium or beryllium ; Addition complexes thereof, e.g. $\text{LiBH}_4 \cdot 2\text{N}_2\text{H}_4$, NaB_2H_7
- C01B 6/23 Preparation of borohydrides of other metals, e.g. aluminium borohydride ; Addition complexes thereof, e.g. $\text{Li}[\text{Al}(\text{BH}_4)_3\text{H}]$
- C01B 6/24 . Hydrides containing at least two metals ; Addition complexes thereof ([C01B 6/13 to C01B 6/23](#) take precedence)
- C01B 6/243 .. { containing only hydrogen, aluminium and alkali metals, e.g. $\text{Li}(\text{AlH}_4)$ }
- C01B 6/246 .. { also containing non-metals other than hydrogen }
- C01B 6/26 .. Preparation from the metal with the highest valency or from its oxides or salts of its oxyacids
- C01B 6/34 . Purification ; Stabilisation

Guidance heading: Halogens, compounds thereof

C01B 7/00 Halogens ; Halogen acids (oxyacids [C01B 11/00](#))

- C01B 7/01 . Chlorine ; Hydrogen chloride
- C01B 7/012 .. { Preparation of hydrogen chloride from the elements }
- C01B 7/015 .. { Chlorine hydrates; Obtaining chlorine therefrom }
- C01B 7/017 .. { Preparation of hydrogen chloride by reacting together chlorine, water and carbon or carbon monoxide (the carbon not acting only as catalyst) }
- C01B 7/03 .. Preparation from chlorides
- C01B 7/035 ... { Preparation of hydrogen chloride from chlorides }
- C01B 7/04 ... Preparation of chlorine from hydrogen chloride
- C01B 7/05 ... Preparation from ammonium chloride
- C01B 7/055 { Preparation of hydrogen chloride from ammonium chloride }
- C01B 7/07 .. Purification; { Separation ([C01B 7/015](#) takes precedence) }
- C01B 7/0706 ... { of hydrogen chloride }
- C01B 7/0712 { by distillation }
- C01B 7/0718 { by adsorption }
- C01B 7/0725 { by active carbon }
- C01B 7/0731 { by extraction }
- C01B 7/0737 { hydrogen chloride being extracted }
- C01B 7/0743 ... { of gaseous or dissolved chlorine }
- C01B 7/075 ... of liquid chlorine
- C01B 7/09 . Bromine ; Hydrogen bromide
- C01B 7/093 .. { Hydrogen bromide }
- C01B 7/096 .. { Bromine }

- C01B 7/13 . Iodine ; Hydrogen iodide
- C01B 7/135 .. { Hydrogen iodide }
- C01B 7/14 .. Iodine
- C01B 7/16 ... Preparation from seaweed

- C01B 7/19 . Fluorine ; Hydrogen fluoride
- C01B 7/191 .. { Hydrogen fluoride }
- C01B 7/192 ... { Preparation from fluorspar }
- C01B 7/193 ... { Preparation from silicon tetrafluoride, fluosilicic acid or fluosilicates }
- C01B 7/194 ... { Preparation from ammonium fluoride }
- C01B 7/195 ... { Separation; Purification }
- C01B 7/196 { by distillation }
- C01B 7/197 { by adsorption }
- C01B 7/198 { by solid ion-exchangers }
- C01B 7/20 .. Fluorine

- C01B 7/24 . Inter-halogen compounds

- C01B 9/00** **General methods of preparing halides** (particular individual halides, see the relevant groups in [C01B](#) to [C01G](#) according to the element combined with the halogen; electrolytic production of inorganic compounds [C25B](#))

- C01B 9/02 . Chlorides
- C01B 9/04 . Bromides
- C01B 9/06 . Iodides
- C01B 9/08 . Fluorides

- C01B 11/00** **Oxides or oxyacids of halogens ; Salts thereof**

- C01B 11/02 . Oxides of chlorine
- C01B 11/021 .. { Chlorine hemioxide (Cl₂O) }
- C01B 11/022 .. { Chlorine dioxide (ClO₂) }
- C01B 11/023 ... { Preparation from chlorites or chlorates }
- C01B 11/024 { from chlorites }
- C01B 11/025 { from chlorates without any other reaction reducing agent than chloride ions }
- C01B 11/026 { from chlorate ions in the presence of a peroxidic compound, e.g. hydrogen peroxide, ozone, peroxysulfates }
- C01B 11/027 { from chlorate ions in the presence of a nitrogen compound selected from nitrogen dioxide, nitrate or nitrite ions, nitrosylchloride, hydrazine or hydrazine compounds }
- C01B 11/028 ... { Separation; Purification }

- C01B 11/029 .. { Chlorine trioxide (ClO₃); Chlorine hexoxide (Cl₂O₆); Chlorine heptoxide (Cl₂O₇) }
- C01B 11/04 . Hypochlorous acid
- C01B 11/06 .. Hypochlorites
- C01B 11/062 ... { Hypochlorites of alkali metals }
- C01B 11/064 ... { Hypochlorites of alkaline-earth metals }
- C01B 11/066 ... { Magnesium hypochlorite }
- C01B 11/068 ... { Stabilisation by additives other than oxides, hydroxides, carbonates of alkali or alkaline-earth metals; Coating of particles; Shaping; Granulation }
- C01B 11/08 . Chlorous acid
- C01B 11/10 .. Chlorites
- C01B 11/12 . Chloric acid
- C01B 11/14 .. Chlorates
- C01B 11/145 ... { Separation; Crystallisation; Purification, After-treatment; Stabilisation by additives }
- C01B 11/16 . Perchloric acid
- C01B 11/18 .. Perchlorates
- C01B 11/185 ... { Ammonium perchlorate }
- C01B 11/20 . Oxygen compounds of bromine
- C01B 11/22 . Oxygen compounds of iodine
- C01B 11/24 . Oxygen compounds of fluorine

Guidance heading: Oxygen ; Oxides or hydroxides in general ; Per-compounds

C01B 13/00 Oxygen ; Ozone ; Oxides or hydroxides in general

- C01B 13/02 . Preparation of oxygen ({ enrichment of a gaseous mixture, in particular air, in oxygen or separation of oxygen from a gaseous mixture by an adsorption process [B01D 63/03](#) } ; by liquefying [F25J](#))
- C01B 13/0203 .. { from inorganic compounds }
- C01B 13/0207 ... { Water }
- C01B 13/0211 ... { Peroxy compounds }
- C01B 13/0214 { Hydrogen peroxide }
- C01B 13/0218 ... { Chlorate }
- C01B 13/0222 .. { from organic compounds }
- C01B 13/0225 ... { Peroxy compounds }
- C01B 13/0229 .. { Purification or separation processes }

NOTE

In groups [C01B 13/0229](#) to [C01B 13/0288](#) , additional features relating to the

purification or separation processes are indexed with codes chosen from [C01B 2210/0026](#) to [M210/00W90](#).

C01B 13/0233	...	{ Chemical processing only }
C01B 13/0237	....	{ by oxidation }
C01B 13/024	....	{ by reduction }
C01B 13/0244	....	{ by complexation }
C01B 13/0248	...	{ Physical processing only }
C01B 13/0251	....	{ by making use of membranes }
C01B 13/0255	.....	{ characterised by the type of membrane }
C01B 13/0259	....	{ by adsorption on solids }
C01B 13/0262	.....	{ characterised by the adsorbent }
C01B 13/0266	.....	{ Carbon based materials }
C01B 13/027	.....	{ Zeolites }
C01B 13/0274	.....	{ Other molecular sieve materials }
C01B 13/0277	.....	{ Temperature swing adsorption }
C01B 13/0281	.....	{ in getters }
C01B 13/0285	....	{ by absorption in liquids }
C01B 13/0288	...	{ Combined chemical and physical processing }

NOTE

In this group, processing steps are indexed with codes chosen from [C01B 2210/0001](#) to [C01B 2210/0025](#)

C01B 13/0292	..	{ Preparation from air using a molten phase containing alkali metal nitrite, optionally together with other oxygen acceptors }
C01B 13/0296	..	{ Generators releasing in a self-sustaining way pure oxygen from a solid charge, without interaction of it with a fluid nor external heating, e.g. chlorate candles or canisters containing them (charges per se C01B 13/02) }
C01B 13/08	..	from air with the aid of metal oxides, e.g. barium oxide, manganese oxide { (C01B 13/0292 takes precedence) }
C01B 13/083	...	{ with barium oxide }
C01B 13/086	...	{ with manganese oxide }
C01B 13/10	.	Preparation of ozone
C01B 13/11	..	by electric discharge

NOTE

In groups [C01B 13/11](#) and [C01B 13/11 B](#), additional features relating to the preparation of ozone by electrical discharge are indexed with codes chosen from [C01B 2201/00](#) to [C01B 2201/90](#) .

C01B 13/115	...	{ characterised by the electrical circuits producing the electrical discharge }
C01B 13/14	.	Methods for preparing oxides or hydroxides in general (particular individual oxides or hydroxides, see the relevant groups of subclasses C01B to C01G or C25B , according to the element combined with the oxygen or hydroxy group)

- C01B 13/145 .. { After-treatment of oxides or hydroxides, e.g. pulverising, drying, decreasing the acidity }
- C01B 13/16 .. Purification
- C01B 13/18 .. by thermal decomposition of compounds, e.g. of salts or hydroxides
- C01B 13/185 ... { Preparing mixtures of oxides }
- C01B 13/20 .. by oxidation of elements in the gaseous state ; by oxidation or hydrolysis of compounds in the gaseous state
 - C01B 13/22 ... of halides or oxyhalides
 - C01B 13/24 in the presence of hot combustion gases
 - C01B 13/26 in the presence of a fluidised bed
 - C01B 13/28 using a plasma or an electric discharge
 - C01B 13/30 Removal and cooling of the oxide-containing suspension
- C01B 13/32 .. by oxidation or hydrolysis of elements or compounds in the liquid or solid state { or in non-aqueous solution, e.g. sol-gel process }
 - C01B 13/322 ... { of elements or compounds in the solid state }
 - C01B 13/324 { by solid combustion synthesis }
 - C01B 13/326 ... { of elements or compounds in the liquid state }
 - C01B 13/328 ... { by processes making use of emulsions, e.g. the kerosine process }
- C01B 13/34 .. by oxidation or hydrolysis of sprayed or atomised solutions
- C01B 13/36 .. by precipitation reactions in { aqueous } solutions { ([C01B 13/328](#) takes precedence) }
 - C01B 13/363 ... { Mixtures of oxides or hydroxides by precipitation }
 - C01B 13/366 ... { by hydrothermal processing }

C01B 15/00 Peroxides ; Peroxyhydrates ; Peroxyacids or salts thereof ; Superoxides ; Ozonides

- C01B 15/005 . { Stabilisation of the solid compounds subsequent to the preparation or to the crystallisation, by additives or by coating }
- C01B 15/01 . Hydrogen peroxide
 - C01B 15/013 .. Separation ; Purification ; Concentration
 - C01B 15/0135 ... { Purification by solid ion-exchangers or solid chelating agents }
 - C01B 15/017 ... Anhydrous hydrogen peroxide ; Anhydrous solutions or gaseous mixtures containing hydrogen peroxide
- C01B 15/022 .. Preparation from organic compounds
 - C01B 15/023 ... by the alkyl-anthraquinone process
 - C01B 15/024 ... from hydrocarbons
 - C01B 15/026 ... from alcohols
- C01B 15/027 .. Preparation from water
 - C01B 15/0275 ... { Preparation by reaction of water, carbon monoxide and oxygen }
- C01B 15/029 .. Preparation from hydrogen and oxygen
 - C01B 15/0295 ... { by electrical discharge }
- C01B 15/03 .. Preparation from inorganic peroxy compounds, e.g. from peroxysulfate
 - C01B 15/032 ... from metal peroxides

- C01B 15/037 .. Stabilisation by additives
- C01B 15/04 . Metal peroxides or peroxyhydrates thereof; { Metal } superoxides; { Metal } ozonides; { Peroxyhydrates thereof }
- C01B 15/043 .. of alkali metals, alkaline earth metals or magnesium { or beryllium or aluminium }
- C01B 15/0435 ... { of alkali metals }
- C01B 15/047 .. of heavy metals
- C01B 15/0475 ... { of actinides }
- C01B 15/055 . Peroxyhydrates ([C01B 15/04](#) takes precedence) ; Peroxyacids or salts thereof
- C01B 15/06 .. containing sulfur
- C01B 15/08 ... Peroxysulfates
- C01B 15/085 { Stabilisation of the solid compounds, subsequent to the preparation or to the crystallisation, by additives or by coating }
- C01B 15/10 .. containing carbon
- C01B 15/103 ... { containing only alkali metals as metals }
- C01B 15/106 ... { Stabilisation of the solid compounds, subsequent to the preparation or to the crystallisation, by additives or by coating }
- C01B 15/12 .. containing boron
- C01B 15/123 ... { Stabilisation of the solid compounds, subsequent to the preparation or to the crystallisation, by additives or by coating }
- C01B 15/126 ... { Dehydration of solid hydrated peroxyborates to less hydrated or anhydrous products }
- C01B 15/14 .. containing silicon
- C01B 15/16 .. containing phosphorus
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- C01B 17/00 Sulfur ; Compounds thereof**
- C01B 17/02 . Preparation of sulfur ; Purification
- C01B 17/0205 .. { Separation of sulfur from liquids, e.g. by coalescence }
- C01B 17/021 .. { Separation of sulfur from gases }
- C01B 17/0216 .. { Solidification or cooling of liquid sulfur }
- C01B 17/0221 .. { Melting }
- C01B 17/0226 .. { Vaporising or superheating }
- C01B 17/0232 .. { Purification, e.g. degassing }
- C01B 17/0237 .. { Converting into particles, e.g. by granulation, milling }
- C01B 17/0243 .. { Other after-treatment of sulfur }
- C01B 17/0248 ... { of particulate sulfur }
- C01B 17/0253 .. { from non-gaseous sulfur compounds other than sulfides or materials containing such sulfides }
- C01B 17/0259 ... { by reduction of sulfates }
- C01B 17/0264 { of calcium sulfates }
- C01B 17/027 .. Recovery of sulfur from material containing elemental sulfur, e.g. luxmasses { or sulfur containing ores } ; Purification { of the recovered sulfur }
- C01B 17/033 ... using a liquid extractant

- C01B 17/04 .. from gaseous sulfur compounds including gaseous sulfides
- C01B 17/0404 ... { by processes comprising a dry catalytic conversion of hydrogen sulfide-containing gases, e.g. the Claus process }
- C01B 17/0408 { Pretreatment of the hydrogen sulfide containing gases }
- C01B 17/0413 { characterised by the combustion step }
- C01B 17/0417 { Combustion reactors }
- C01B 17/0421 { Multistage combustion }
- C01B 17/0426 { characterised by the catalytic conversion }
- C01B 17/043 { Catalytic converters }
- C01B 17/0434 { Catalyst compositions }
- C01B 17/0439 { at least one catalyst bed operating below the dew-point of sulfur }
- C01B 17/0443 { in a moving bed }
- C01B 17/0447 { Separation of the obtained sulfur }
- C01B 17/0452 { Process control; Start-up or cooling-down procedures of the Claus process }
- C01B 17/0456 { the hydrogen sulfide-containing gas being a Claus process tail gas }
- C01B 17/046 { without intermediate formation of sulfur dioxide }
- C01B 17/0465 { Catalyst compositions }
- C01B 17/0469 { at least one catalyst bed operating below the dew-point of sulfur }
- C01B 17/0473 ... { by reaction of sulfur dioxide or sulfur trioxide containing gases with reducing agents other than hydrogen sulfide }
- C01B 17/0478 { with hydrocarbons or mixtures containing them }
- C01B 17/0482 { with carbon or solid carbonaceous materials }
- C01B 17/0486 { with carbon monoxide or carbon monoxide containing mixtures }
- C01B 17/0491 { with hydrogen or hydrogen-containing mixtures, e.g. synthesis gas }
- C01B 17/0495 ... { by dissociation of hydrogen sulfide into the elements }
- C01B 17/05 ... by wet processes
- C01B 17/06 .. from non-gaseous sulfides or materials containing such sulfides, e.g. ores
- C01B 17/10 .. Finely divided sulfur, e.g. sublimed sulfur, flowers of sulfur
- C01B 17/12 .. Insoluble sulfur (mu-sulfur)
- C01B 17/125 ... { Sulfur isotopes other than ^{32}S }
- C01B 17/16 . Hydrogen sulfides
- C01B 17/161 .. { Preparation from elemental sulfur }
- C01B 17/162 ... { from elemental sulfur and hydrogen }
- C01B 17/164 .. { Preparation by reduction of oxidic sulfur compounds }
- C01B 17/165 .. { Preparation from sulfides, oxysulfides or polysulfides }
- C01B 17/167 .. { Separation }
- C01B 17/168 .. { Purification }
- C01B 17/18 .. Hydrogen polysulfides
- C01B 17/20 . Methods for preparing sulfides or polysulfides, in general (ammonium sulfides or polysulfides [C01C](#) ; sulfides or polysulfides of metals, other than alkali metals, magnesium, calcium, strontium and barium, see the relevant groups of subclasses [C01F](#) or [C01G](#) , according to the metal)

- C01B 17/22 . Alkali metal sulfides or polysulfides
- C01B 17/24 .. Preparation by reduction
- C01B 17/26 ... with carbon
- C01B 17/28 ... with reducing gases
- C01B 17/30 .. Preparation from sodium or potassium amalgam with sulfur or sulfides
- C01B 17/32 .. Hydrosulfides of sodium or potassium
- C01B 17/34 .. Polysulfides of sodium or potassium
- C01B 17/36 .. Purification
- C01B 17/38 .. Dehydration
- C01B 17/40 .. Making shaped products, e.g. granules

- C01B 17/42 . Sulfides or polysulfides of magnesium, calcium, strontium, or barium
- C01B 17/43 .. from oxides or hydroxides with sulfur or hydrogen sulfide
- C01B 17/44 .. by reduction of sulfates

- C01B 17/45 . Compounds containing sulfur and halogen, with or without oxygen
- C01B 17/4507 .. { containing sulfur and halogen only }
- C01B 17/4515 ... { containing sulfur and fluorine only }
- C01B 17/4523 { Sulfur tetrafluoride }
- C01B 17/453 { Sulfur hexafluoride }
- C01B 17/4538 ... { containing sulfur and chlorine only }
- C01B 17/4546 { Sulfur dichloride }
- C01B 17/4553 { Sulfur hexachloride }
- C01B 17/4561 .. { Compounds containing sulfur, halogen and oxygen only }
- C01B 17/4569 ... { Thionyl fluoride (SOF₂) }
- C01B 17/4576 ... { Sulfuryl fluoride (SO₂F₂) }
- C01B 17/4584 ... { Thionyl chloride (SOCl₂) }
- C01B 17/4592 ... { Sulfuryl chloride (SO₂Cl₂) }

- C01B 17/46 . Compounds containing sulfur, halogen, hydrogen, and oxygen
- C01B 17/463 .. { Fluorosulfonic acid (FSO₃H) }
- C01B 17/466 .. { Chlorosulfonic acid (ClSO₃H) }

- C01B 17/48 . Sulfur dioxide ; Sulfurous acid
- C01B 17/50 .. Preparation of sulfur dioxide
- C01B 17/501 ... { by reduction of sulfur compounds }
- C01B 17/502 { of sulfur trioxide }
- C01B 17/503 { of sulfuric acid }
- C01B 17/504 { of ammonium sulfates (of ammonium sulfates containing sulfuric acid solutions [C01B 17/585](#)) }
- C01B 17/505 { of alkali metal sulfates }
- C01B 17/506 { of calcium sulfates }
- C01B 17/507 { of iron sulfates }

- C01B 17/508 . . . { by oxidation of sulfur compounds }
- C01B 17/52 . . . by roasting sulfides ([C22B 1/00](#) takes precedence)
- C01B 17/54 . . . by burning elemental sulfur
- C01B 17/56 . . . Separation ; Purification
- C01B 17/58 . . . Recovery of sulfur dioxide from acid tar or the like { or from any waste sulfuric acid }
- C01B 17/585 { from ammonium sulfate containing sulfuric acid solutions }
- C01B 17/60 . . . Isolation of sulfur dioxide from gases
- C01B 17/62 . . Methods of preparing sulfites in general (particular individual sulfites, see the relevant groups of subclasses [C01B](#) to [C01G](#) , according to the cation)
- C01B 17/625 . . { metabisulfites or pyrosulfites }
- C01B 17/64 . . Thiosulfates ; Dithionites ; Polythionates
- C01B 17/66 . . Dithionites { or hydrosulfites ([S204 2-](#)) }
- C01B 17/665 . . . { Stabilisation by additives subsequent to preparation; Dust prevention by additives }
- C01B 17/69 . . Sulfur trioxide ; Sulfuric acid
- C01B 17/70 . . Stabilisation of gamma-form sulfur trioxide
- C01B 17/74 . . Preparation
- C01B 17/745 . . . { from sulfates }
- C01B 17/76 . . . by contact processes
- C01B 17/762 { High pressure processes }
- C01B 17/765 Multi-stage SO₃-conversion
- C01B 17/7655 { with intermediate absorption }
- C01B 17/77 Fluidised-bed processes
- C01B 17/775 Liquid phase contacting processes or wet catalysis processes
- C01B 17/78 characterised by the catalyst used
- C01B 17/79 containing vanadium
- C01B 17/80 Apparatus
- C01B 17/803 { Converters }
- C01B 17/806 { Absorbers; Heat exchangers }
- C01B 17/82 . . . of sulfuric acid using a nitrogen oxide process
- C01B 17/84 . . . Chamber process
- C01B 17/86 . . . Tower process
- C01B 17/88 . . Concentration of sulfuric acid
- C01B 17/90 . . Separation ; Purification
- C01B 17/901 . . . { Recovery from spent acids containing metallic ions, e.g. hydrolysis acids, pickling acids (obtaining sulfur dioxide as an intermediate in sulfur trioxide recovery from sulfates, e.g. iron sulfates [C01B 17/501](#) , from spent acids [C01B 17/58](#)) }
- C01B 17/902 { by dialysis }
- C01B 17/903 { by liquid-liquid extraction }
- C01B 17/904 { by ion-exchange }

- C01B 17/905 ... { Removal of organic impurities }
- C01B 17/906 ... { Removal of mercury }
- C01B 17/907 ... { Removal of arsenic }
- C01B 17/908 ... { Removal of antimony or bismuth }
- C01B 17/92 ... Recovery from acid tar or the like, { e.g. alkylation acids (obtaining sulfur dioxide as an intermediate in sulfur trioxide recovery therefrom [C01B 17/58](#)) }
- C01B 17/925 { by processes involving a liquid-liquid extraction }
- C01B 17/94 ... Recovery from nitration acids

- C01B 17/96 . Methods for the preparation of sulfates in general (particular individual sulfates, see the relevant groups of subclasses [C01B](#) to [C01G](#) , according to the cation)
- C01B 17/965 .. { Pyrosulfates }

- C01B 17/98 . Other compounds containing sulfur and oxygen (persulfuric acids [C01B 15/06](#) ; persulfates [C01B 15/08](#))

- C01B 19/00 Selenium ; Tellurium ; Compounds thereof (phosphorus compounds [C01B 25/14](#))**

- C01B 19/001 . { Preparation involving a liquid-liquid extraction, an adsorption or an ion-exchange }
- C01B 19/002 . { Compounds containing, besides selenium or tellurium, more than one other element, with -O- and -OH not being considered as anions }
- C01B 19/004 . { Oxides; Hydroxides }
- C01B 19/005 . { Halides }
- C01B 19/007 . { Tellurides or selenides of metals ([C01B 19/002](#) takes precedence) }
- C01B 19/008 . { Salts of oxyacids of selenium or tellurium }
- C01B 19/02 . Elemental selenium or tellurium
- C01B 19/04 . Binary compounds { including binary selenium-tellurium compounds ([C01B 19/004](#) , [C01B 19/005](#) , [C01B 19/007](#) take precedence) }

- C01B 21/00 Nitrogen ; Compounds thereof**

- C01B 21/02 . Preparation of nitrogen (by decomposition of ammonia { [C01B 3/047](#) })
- C01B 21/04 . Purification or separation of nitrogen (by liquefying [F25J](#))
- C01B 21/0405 .. { Purification or separation processes }

NOTE

In this group, additional features relating to the purification or separation processes are indexed with codes chosen from [C01B 2210/0026](#) to [C01B 2210/0098](#)

- C01B 21/0411 ... { Chemical processing only }

C01B 21/0416	....	{ by oxidation }
C01B 21/0422	....	{ by reduction }
C01B 21/0427	....	{ by complexation }
C01B 21/0433	...	{ Physical processing only }
C01B 21/0438	....	{ by making use of membranes }
C01B 21/0444	.....	{ characterised by the membrane }
C01B 21/045	....	{ by adsorption in solids }
C01B 21/0455	.....	{ characterised by the adsorbent }
C01B 21/0461	.....	{ Carbon based materials }
C01B 21/0466	.....	{ Zeolites }
C01B 21/0472	.....	{ Other molecular sieve materials }
C01B 21/0477	.....	{ Temperature swing adsorption }
C01B 21/0483	.....	{ in getters }
C01B 21/0488	....	{ by absorption in liquids }
C01B 21/0494	...	{ Combined chemical and physical processing }

NOTE

In this group, processing steps are indexed with codes chosen from [C01B 2210/0001](#) to [C01B 2210/0025](#)

C01B 21/06	.	Binary compounds of nitrogen with metals, with silicon, or with boron, { or with carbon, i.e. nitrides; Compounds of nitrogen with more than one metal, silicon or boron } (azides C01B 21/08)
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NOTE

Binary compounds, i.e. compounds of nitrogen with only one other element chosen from metals, silicon, boron or carbon, are classified in groups [C01B 21/06](#) or [C01B 21/0605](#) to [C01B 21/076](#) . Compounds of nitrogen with more than one element chosen from metals, silicon or boron are classified in [C01B 21/0602](#)

Documents relating to several specific binary compounds are classified in 21/06 only and receive the indexing codes chosen from [C01B 21/0602](#) to [C01B 21/076](#) to identify the specific compounds

C01B 21/0602	..	{ with two or more other elements chosen from metals, silicon or boron }
C01B 21/0605	..	{ Binary compounds of nitrogen with carbon }
C01B 21/0607	..	{ with alkali metals }
C01B 21/061	...	{ with lithium }
C01B 21/0612	..	{ with alkaline-earth metals, beryllium or magnesium }
C01B 21/0615	..	{ with transition metals other than titanium, zirconium or hafnium }
C01B 21/0617	...	{ with vanadium, niobium or tantalum }
C01B 21/062	...	{ with chromium, molybdenum or tungsten }
C01B 21/0622	...	{ with iron, cobalt or nickel }
C01B 21/0625	...	{ with copper }
C01B 21/0627	...	{ with one or more rare earth metals }

- C01B 21/063 ... { with one or more actinides, e.g. UN, PuN }
- C01B 21/0632 .. { with gallium, indium or thallium }
- C01B 21/0635 .. { with germanium, tin or lead }
- C01B 21/0637 .. { with metals not specified in groups [C01B 21/0607](#) to [C01B 21/0635](#) , other than aluminium, titanium, zirconium or hafnium }
- C01B 21/064 .. with boron
 - C01B 21/0641 ... { Preparation by direct nitridation of elemental boron }
 - C01B 21/0643 ... { Preparation from boron halides }
 - C01B 21/0645 ... { Preparation by carboreductive nitridation }
 - C01B 21/0646 ... { Preparation by pyrolysis of boron and nitrogen containing compounds }
 - C01B 21/0648 ... { After-treatment, e.g. grinding, purification (transformation of hexagonal into cubic or wurtzitic boron nitride [C04B 35/5831](#)) }
- C01B 21/068 .. with silicon
 - C01B 21/0682 ... { Preparation by direct nitridation of silicon }
 - C01B 21/0685 ... { Preparation by carboreductive nitridation }
 - C01B 21/0687 ... { After-treatment, e.g. grinding, purification }
- C01B 21/072 .. with aluminium
 - C01B 21/0722 ... { Preparation by direct nitridation of aluminium }
 - C01B 21/0724 { using a plasma }
 - C01B 21/0726 ... { Preparation by carboreductive nitridation }
 - C01B 21/0728 ... { After-treatment, e.g. grinding, purification }
- C01B 21/076 .. with titanium or zirconium { or hafnium }
 - C01B 21/0761 ... { Preparation by direct nitridation of titanium, zirconium or hafnium }
 - C01B 21/0763 ... { Preparation from titanium, zirconium or hafnium halides }
 - C01B 21/0765 ... { Preparation by carboreductive nitridation }
 - C01B 21/0766 ... { Preparation by pyrolysis of nitrogen containing titanium, zirconium or hafnium compounds }
 - C01B 21/0768 ... { After-treatment, e.g. grinding, purification }
- C01B 21/08 . Hydrazoic acid ; Azides ; Halogen azides
- C01B 21/082 . Compounds containing nitrogen and non-metals { and optionally metals } ([C01B 21/06](#) , [C01B 21/08](#) take precedence)
- C01B 21/0821 .. { Oxynitrides of metals, boron or silicon }
- C01B 21/0823 ... { Silicon oxynitrides }
- C01B 21/0825 ... { Aluminium oxynitrides }
- C01B 21/0826 ... { Silicon aluminium oxynitrides, i.e. sialons }
- C01B 21/0828 .. { Carbonitrides or oxycarbonitrides of metals, boron or silicon }
- C01B 21/083 .. containing one or more halogen atoms
 - C01B 21/0832 ... { Binary compounds of nitrogen with halogens }
 - C01B 21/0835 { Nitrogen trifluoride }
 - C01B 21/0837 { Purification }
- C01B 21/084 ... containing also one or more oxygen atoms, e.g. nitrosyl halides
- C01B 21/0842 { Halides of nitrogen oxides }

C01B 21/0844	.....	{ Nitrosyl fluoride }
C01B 21/0846	.....	{ Nitrosyl chloride }
C01B 21/0848	....	{ Nitrosyl perchlorate }
C01B 21/086	..	containing one or more sulfur atoms
C01B 21/0865	...	{ Binary compounds of nitrogen with sulfur }
C01B 21/087	..	containing one or more hydrogen atoms
C01B 21/088	...	containing also one or more halogen atoms
C01B 21/09	....	Halogeno-amines, e.g. chloramine
C01B 21/091	.....	{ Chloramine, i.e. NH_2Cl or dichloramine, i.e. NHCl_2 }
C01B 21/092	...	containing also one or more metal atoms
C01B 21/0923	....	{ Metal imides or amides (silicon imides or amides C01B 21/087) }
C01B 21/0926	.....	{ of alkali metals }
C01B 21/093	...	containing also one or more sulfur atoms
C01B 21/0935	....	{ Imidodisulfonic acid; Nitrilotrisulfonic acid; Salts thereof }
C01B 21/094	....	Nitrosyl containing acids
C01B 21/096	....	Amidosulfonic acid ; Salts thereof
C01B 21/097	..	containing phosphorus atoms
C01B 21/0975	...	{ containing also one or more sulfur atoms }
C01B 21/098	...	Phosphonitrilic dihalides ; Polymers thereof
C01B 21/0983	....	{ Phosphonitrilic difluorides; Polymers thereof }
C01B 21/0986	....	{ Phosphonitrilic dichlorides; Polymers thereof }
C01B 21/12	..	Carbamic acid { or thiocarbamic acid } ; Salts thereof
C01B 21/125	...	{ Metal carbamates }
C01B 21/14	..	Hydroxylamine ; Salts thereof
C01B 21/1409	...	{ Preparation }
C01B 21/1418	....	{ by catalytic reduction of nitrogen oxides or nitrates with hydrogen }
C01B 21/1427	....	{ by reduction of nitrogen oxides or nitrites with bisulfite or sulfur dioxide, e.g. by the Raschig process }
C01B 21/1436	....	{ by reaction in the gas phase, e.g. of nitrogen, hydrogen and oxygen }
C01B 21/1445	....	{ of hydroxylamine from its salts }
C01B 21/1454	....	{ of hydroxylamine salts by processes not covered by one or more of groups C01B 21/1418 to C01B 21/1445 , e.g. by conversion of one salt into another }
C01B 21/1463	...	{ Concentration }
C01B 21/1472	...	{ Separation }
C01B 21/1481	...	{ Purification }
C01B 21/149	...	{ Stabilisation }
C01B 21/16	..	Hydrazine ; Salts thereof
C01B 21/20	.	Nitrogen oxides ; Oxyacids of nitrogen ; Salts thereof
C01B 21/203	..	{ Preparation of nitrogen oxides using a plasma or an electric discharge }
C01B 21/206	..	{ Nitric anhydride (N_2O_5) (C01B 21/203 takes precedence) }
C01B 21/22	..	Nitrous oxide (N_2O) { (C01B 21/203 takes precedence) }

C01B 21/24	.. Nitric oxide (NO) { (C01B 21/203 takes precedence) }
C01B 21/26	... Preparation by catalytic { or non-catalytic } oxidation of ammonia
C01B 21/262	.... { obtaining nitrogen dioxide or tetroxide }
C01B 21/265	.... { characterised by the catalyst }
C01B 21/267	.... { Means for preventing deterioration or loss of catalyst or for recovering lost catalyst }
C01B 21/28	.... Apparatus
C01B 21/30	... Preparation by oxidation of nitrogen { (C01B 21/26 takes precedence) }
C01B 21/32	.... Apparatus
C01B 21/34	.. Nitrogen trioxide (N ₂ O ₃) { (C01B 21/203 takes precedence) }
C01B 21/36	.. Nitrogen dioxide (NO ₂ , N ₂ O ₄) ({ C01B 21/203 } , C01B 21/26 , C01B 21/30 take precedence)
C01B 21/38	.. Nitric acid
C01B 21/40	... Preparation by absorption of oxides of nitrogen { (C01B 21/26 takes precedence) }
C01B 21/42	... Preparation from nitrates
C01B 21/44	... Concentration { (C01B 21/40 takes precedence) }
C01B 21/46	... Purification ; Separation; { Stabilisation (C01B 21/40 takes precedence) }
C01B 21/48	.. Methods for the preparation of nitrates in general (particular individual nitrates, see the relevant groups of subclasses C01B to C01G , according to the cation)
C01B 21/50	.. Nitrous acid ; Salts thereof

C01B 23/00 **Noble gases ; Compounds thereof** (liquefying [F25J](#) ; { noble gases obtained by rectification [F25J 3/028](#) })

C01B 23/0005	. { Compounds of noble gases }
C01B 23/001	. { Purification or separation processes of noble gases }
C01B 23/0015	.. { Chemical processing only }
C01B 23/0021	... { by oxidation }
C01B 23/0026	... { by reduction }
C01B 23/0031	... { by complexation }
C01B 23/0036	.. { Physical processing only }
C01B 23/0042	... { by making use of membranes }
C01B 23/0047	.... { characterised by the membrane }
C01B 23/0052	... { by adsorption in solids }
C01B 23/0057	.... { characterised by the adsorbent }
C01B 23/0063	..... { Carbon based materials }
C01B 23/0068	..... { Zeolites }
C01B 23/0073	..... { Other molecular sieve materials }
C01B 23/0078	.... { Temperature swing adsorption }
C01B 23/0084	.... { in getters }
C01B 23/0089	... { by absorption in liquids }
C01B 23/0094	.. { Combined chemical and physical processing }

NOTE

In this group, processing steps are indexed with codes chosen from [C01B 2210/0001](#) to [C01B 2210/0025](#)

- C01B 25/00** **Phosphorus ; Compounds thereof** ({ [C01B 6/00](#) } , [C01B 21/00](#) , [C01B 23/00](#) take precedence; perphosphates [C01B 15/16](#))
- [C01B 25/003](#) . { Phosphorus }
- [C01B 25/006](#) .. { Stabilisation ([C01B 25/04](#) takes precedence) }
- [C01B 25/01](#) . Treating phosphate ores or other raw phosphate materials to obtain phosphorus or phosphorus compounds
- [C01B 25/02](#) . Preparation of phosphorus
- [C01B 25/023](#) .. of red phosphorus
- [C01B 25/027](#) .. of yellow phosphorus
- [C01B 25/04](#) . Purification of phosphorus
- [C01B 25/043](#) .. of red phosphorus
- [C01B 25/047](#) .. of yellow phosphorus
- [C01B 25/06](#) . Hydrogen phosphides
- [C01B 25/08](#) . Other phosphides
- [C01B 25/081](#) .. { of alkali metals, alkaline-earth metals or magnesium }
- [C01B 25/082](#) .. { of boron, aluminium, gallium or indium }
- [C01B 25/084](#) ... { of boron }
- [C01B 25/085](#) ... { of aluminium }
- [C01B 25/087](#) ... { of gallium or indium }
- [C01B 25/088](#) .. { containing plural metal }
- [C01B 25/10](#) . Halides or oxyhalides of phosphorus
- [C01B 25/12](#) . Oxides of phosphorus
- [C01B 25/14](#) . Sulfur, selenium, or tellurium compounds of phosphorus
- [C01B 25/16](#) . Oxyacids of phosphorus ; Salts thereof (peroxyacids or salts thereof [C01B 15/00](#))
- [C01B 25/161](#) .. { containing at least one phosphorus atom with an oxidation number less than five, other than those mentioned below; Salts thereof }
- [C01B 25/163](#) .. Phosphorous acid ; Salts thereof
- [C01B 25/165](#) .. Hypophosphorous acid ; Salts thereof
- [C01B 25/168](#) .. Pyrophosphorous acid ; Salts thereof
- [C01B 25/18](#) .. Phosphoric acid
- [C01B 25/185](#) ... { Preparation neither from elemental phosphorus or phosphoric anhydride nor

		by reacting phosphate-containing material with an acid, e.g. by reacting phosphate-containing material with an ion-exchange resin or an acid salt used alone }
C01B 25/20	...	Preparation from elemental phosphorus or phosphoric anhydride
C01B 25/22	...	Preparation by reacting phosphate-containing material with an acid, e.g. wet process
C01B 25/2204	....	{ Arrangements of vessels used in reacting phosphate-containing material in wet process }
C01B 25/2208	....	{ with an acid or a mixture of acids other than sulfuric acid }
C01B 25/2212	.....	{ with hydrochloric acid or hydrogen chloride in aqueous medium }
C01B 25/2216	.....	{ with nitric acid or nitrous vapours in aqueous medium }
C01B 25/222	....	with sulfuric acid, a mixture of acids mainly consisting of sulfuric acid or a mixture of compounds forming it in situ, e.g. a mixture of sulfur dioxide, water and oxygen
C01B 25/223	.....	only one form of calcium sulfate being formed
C01B 25/2235	.....	{ Anhydrite processes }
C01B 25/225	.....	Dihydrate process
C01B 25/226	.....	Hemihydrate process
C01B 25/228	.....	one form of calcium sulfate being formed and then converted to another form
C01B 25/2285	.....	{ Dihydrate-anhydrite or hemihydrate-anhydrite process }
C01B 25/229	.....	Hemihydrate-dihydrate process
C01B 25/2295	.....	{ the conversion being performed in one or more vessels different from those used for reaction after separation of phosphoric acid }
C01B 25/231	.....	Dihydrate-hemihydrate process
C01B 25/232	.....	Preparation by reacting phosphate containing material with concentrated sulfuric acid and subsequently lixiviating the obtained mass, e.g. clinker process
C01B 25/234	...	Purification ; Stabilisation ; Concentration (purification concomitant with preparation C01B 25/22 ; preparation involving solvent-solvent extraction C01B 25/46)
C01B 25/2343	....	{ Concentration concomitant with purification, e.g. elimination of fluorine }
C01B 25/2346	.....	{ Concentration }
C01B 25/235	....	Clarification ; Stabilisation to prevent post-precipitation of dissolved impurities
C01B 25/237	....	Selective elimination of impurities { (C01B 25/2343 takes precedence) }
C01B 25/2372	.....	{ Anionic impurities, e.g. silica or boron compounds }
C01B 25/2375	.....	{ Fluoride or fluosilicate anion }
C01B 25/2377	.....	{ Sulfate }
C01B 25/238	.....	Cationic impurities, { e.g. arsenic compounds }
C01B 25/24	..	Condensed phosphoric acids
C01B 25/26	..	Phosphates (perphosphates C01B 15/16)
C01B 25/265	...	{ General methods for obtaining phosphates }
C01B 25/28	...	Ammonium phosphates
C01B 25/30	...	Alkali metal phosphates
C01B 25/301	....	{ Preparation from liquid orthophosphoric acid or from an acid solution or

		suspension of orthophosphates (using ion-exchangers C01B 25/30) }
C01B 25/303	.....	{ with elimination of impurities }
C01B 25/305	....	{ Preparation from phosphorus-containing compounds by alkaline treatment }
C01B 25/306	.....	{ from phosphates }
C01B 25/308	....	{ Methods for converting an alkali metal orthophosphate into another one; Purification; Decolorasing; Dehydrating; Drying }
C01B 25/32	...	Phosphates of magnesium, calcium, strontium, or barium
C01B 25/321	....	{ Methods for converting an alkaline earth metal ortho-phosphate into another ortho-phosphate (by reaction, e.g. of phosphate rock with phosphoric acid C01B 25/322) }
C01B 25/322	....	{ Preparation by neutralisation of orthophosphoric acid }
C01B 25/324	....	{ Preparation from a reaction solution obtained by acidifying with an acid other than orthophosphoric acid }
C01B 25/325	....	{ Preparation by double decomposition }
C01B 25/327	....	{ After-treatment (increasing the phosphate content of ores C01B 25/32) }
C01B 25/328	....	{ Defluorination during or after the preparation }
C01B 25/34	....	Magnesium phosphates
C01B 25/36	...	Aluminium phosphates
C01B 25/37	...	Phosphates of heavy metals
C01B 25/372	....	{ of titanium, vanadium, zirconium, niobium, hafnium or tantalum }
C01B 25/375	....	{ of iron }
C01B 25/377	....	{ of manganese }
C01B 25/38	...	Condensed phosphates
C01B 25/385	....	{ of alkaline-earth metals or magnesium }
C01B 25/39	....	of alkali metals
C01B 25/395	.....	{ Preparation and dehydrating }
C01B 25/40	....	Polyphosphates
C01B 25/405	.....	{ of ammonium }
C01B 25/41	.....	of alkali metals
C01B 25/412	.....	{ Preparation from alkali metal orthophosphates }
C01B 25/414	.....	{ Apparatus }
C01B 25/416	.....	{ Pure alkali metal polyphosphates from impure starting materials }
C01B 25/418	.....	{ After-treatment }
C01B 25/42	....	Pyrophosphates
C01B 25/425	.....	{ of alkali metals }
C01B 25/44	....	Metaphosphates
C01B 25/445	.....	of alkali metals
C01B 25/45	...	containing plural metal, or metal and ammonium
C01B 25/451	....	{ containing metal and ammonium }
C01B 25/453	....	{ having molecular-sieve properties }

WARNING

Group [C01B 25/453](#) is no longer used for the classification of new documents from May, 1995. The backlog of this groups is continuously being reclassified to the appropriate subgroups of [C01B 37/00](#) and [C01B 39/00](#).

- C01B 25/455 ... containing halogen { (completely halogenated alkali metal phosphates [C01D](#) , e.g. lithium hexafluorophosphate [C01D 15/005](#)) }
- C01B 25/4555 { Hypochlorite-phosphate double salts, e.g. 4(Na3PO4·11H2O). NaOCl or so-called chlorinated trisodium phosphate }
- C01B 25/46 .. Preparation involving solvent-solvent extraction ([solvent extraction in general B01D 11/00](#))
- C01B 25/461 ... { the phosphoric acid present in the medium obtained after reaction being first extracted from the liquid phase formed or separated then re-extracted as free acid by using water or as a phosphate by using a basic compound ([selective extraction of impurities contained in acid C01B 25/237](#)) }

NOTE

The extracting agent may be diluted with a compound or a mixture of compounds which are not solvents for phosphoric acid, e.g. a hydrocarbon

Documents which belong to more than one subgroup of [C01B 25/462](#) to [C01B 25/466](#) are classified by a combination, e.g. [C01B 25/462](#) +B4+B8

- C01B 25/462 { the extracting agent being alcohol or a mixture of alcohols }
- C01B 25/463 { the extracting agent being a ketone or a mixture of ketones }
- C01B 25/464 { the extracting agent being an ether or a mixture of ethers }
- C01B 25/465 { the extracting agent being an ester or a mixture of esters }
- C01B 25/466 { the extracting agent being a nitrogenous solvent or a mixture of nitrogenous solvents such as amines or amides }
- C01B 25/467 ... { the extracting agent being already present during the phosphate-containing material reaction step }
- C01B 25/468 ... { the extraction being performed on the reaction slurry itself, i.e. without separating the acid ([C01B 25/232](#) takes precedence) }

C01B 31/00 **Carbon ; Compounds thereof** ({ [C01B 6/00](#) } , [C01B 21/00](#) , [C01B 23/00](#) take precedence; percarbonates [C01B 15/10](#) ; carbon black [C09C 1/48](#) ; gas carbon production [C10B](#))

- C01B 31/005 . { Carbon fluorides, e.g. (CF) n or (C2F)n (preparation of intercalation compounds of graphite with fluorine [C01B 31/0415](#)) }
- C01B 31/02 . Preparation of carbon (by using ultra high pressure, e.g. for the formation of diamonds, [B01J 3/06](#) ; by crystal growth [C30B](#)) ; Purification; { After-treatment }
- C01B 31/0206 .. { Nanosized carbon materials ([graphene C01B 31/0438](#)) }
- C01B 31/0213 ... { Fullerenes }
- C01B 31/022 ... { Carbon nanotubes }

NOTE

In groups [C01B 31/022](#) to [C01B 31/0293](#) it is desirable to add indexing

codes for structural aspects or properties of carbon nanotubes. The indexing codes are chosen from [C01B 2202/00](#) to [C01B 2202/36](#)

C01B 31/0226	....	{ Preparation }
C01B 31/0233	.....	{ characterized by the catalyst }
C01B 31/024	.....	{ being a continuous process }
C01B 31/0246	.....	{ in the liquid phase }
C01B 31/0253	....	{ After-treatments }
C01B 31/026	.....	{ Purification }
C01B 31/0266	.....	{ Sorting }
C01B 31/0273	.....	{ Derivatisation, solubilisation or dispersion in solvents }
C01B 31/028	.....	{ Cutting }
C01B 31/0286	.....	{ Opening or filling }
C01B 31/0293	...	{ Other structures, e.g. nano-onions, nano-scrolls, nano-horns, nano-cones or nano-walls }
C01B 31/04	..	Graphite, including modified graphite e.g. graphitic oxides, intercalated graphite, expanded graphite or graphene

NOTE

In groups [C01B 31/04](#) to [C01B 31/0492](#) it is desirable to add indexing codes for structural aspects or properties of graphene. The indexing codes are chosen from [C01B 2204/00](#) to [C01B 2204/32](#)

C01B 31/0407	...	{ Purification; Recovery or purification of graphite formed in iron making, e.g. kish graphite }
C01B 31/0415	...	{ Intercalation }

WARNING

Group [C01B 31/0415](#) is not complete pending a reclassification. See also group [C01B 31/00 D](#)

C01B 31/0423	...	{ Expanded or exfoliated graphite }
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WARNING

Groups [C01B 31/043](#) to [C01B 31/0492](#) are not complete pending a reclassification. See also groups [C01B 31/00B](#) and [C01B 31/04](#)

C01B 31/043	...	{ Graphitic oxides, graphitic acids or salts thereof }
C01B 31/0438	...	{ Graphene }
C01B 31/0446	.....	{ Preparation }
C01B 31/0453	.....	{ by CVD }
C01B 31/0461	.....	{ by epitaxial growth }
C01B 31/0469	.....	{ by exfoliation }
C01B 31/0476	.....	{ starting from graphitic oxide }
C01B 31/0484	....	{ After-treatments }

- C01B 31/0492 { Purification }
- C01B 31/06 . . Diamond
- C01B 31/065 . . . { After-treatment, e.g. purification, irradiation }

- C01B 31/08 . Active carbon
- C01B 31/081 . . { from waste materials, e.g. tyres, spent sulfite pulp liquor }
- C01B 31/082 . . { from distillation residues of coal or petroleum; from petroleum acid sludge }
- C01B 31/083 . . { After-treatment, e.g. purification ([granulation C01B 31/14](#)) }
- C01B 31/084 . . { Coating; Grafting; Microencapsulation }
- C01B 31/085 . . { with "molecular sieve" properties }
- C01B 31/086 . . { Preparation, reactivation or regeneration by a physical process, e.g. by irradiation, by using electric current passing through a carbonaceous feedstock, by using recyclable inert heating bodies }
- C01B 31/087 . . { Reactivation or regeneration (by a physical process [C01B 31/086](#)) }
- C01B 31/088 . . { Apparatus ([C01B 31/086](#) takes precedence) }
- C01B 31/089 . . { Making shaped products, e.g. fibres, spheres, membranes, foam, or the like ([granulation C01B 31/14](#)) }
- C01B 31/10 . . Preparation by using gaseous activating agents { ([C01B 31/086](#) , [C01B 31/088](#) take precedence) }
- C01B 31/12 . . Preparation by using non-gaseous activating agents { ([C01B 31/086](#) , [C01B 31/088](#) take precedence) }
- C01B 31/125 . . . { Preparation by impregnation with a metallic compound }
- C01B 31/14 . . Granulation (apparatus [B01J 2/00](#))

NOTE

In this group, the term granulation covers the methods of preparation of active carbon using carbonaceous precursors per se and binders, e.g. pitch, and producing the granules

- C01B 31/18 . Carbon monoxide (metal carbonyls [C01G](#))
- C01B 31/20 . Carbon dioxide
- C01B 31/22 . . Solidifying

- C01B 31/24 . Methods for the preparation of carbonates or bicarbonates in general ([percarbonates C15/10](#); particular individual carbonates, see the relevant groups in [C01B](#) to [C01G](#) according to the cation)

- C01B 31/26 . Compounds containing carbon and sulfur, e.g. carbon disulfide, carbon oxysulfide ; Thiophosgene
- C01B 31/262 . . { Carbon disulfide }
- C01B 31/265 . . . { Preparation by reacting sulfur or a sulfur compound with a hydrocarbon }
- C01B 31/267 . . { Carbon oxysulfide }

- C01B 31/28 . Phosgene

- C01B 31/30 . Carbides (alloys [C22](#))

- C01B 31/301 .. { Oxycarbides, sulfocarbides or mixtures of carbides with other bodies, e.g. graphite; Carbides of other non-metals, e.g. silicocarbides, borocarbides }

NOTE

Mixtures of carbides, other than those covered by group [C01B 31/308](#) , and belonging to more than one of the groups [C01B 31/303](#) to [C01B 31/36](#) are classified in [C01B 31/301](#)

- C01B 31/303 .. { Simple carbides of elements not covered below }
- C01B 31/305 .. { Titanium carbides }
- C01B 31/306 .. { Carbides of actinides }
- C01B 31/308 .. { Carbides of alkali metals, strontium, barium or magnesium; Mixtures thereof with calcium carbide }
- C01B 31/32 .. Calcium carbide
- C01B 31/34 .. Tungsten or molybdenum carbides
- C01B 31/36 .. Carbides of silicon or boron

C01B 33/00 **Silicon ; Compounds thereof** ({ [C01B 6/00](#) } , [C01B 21/00](#) , [C01B 23/00](#) take precedence; persilicates [C01B 15/14](#) ; carbides [C01B 31/36](#))

- C01B 33/02 . Silicon (forming single crystals or homogeneous polycrystalline material with defined structure [C30B](#))
- C01B 33/021 .. Preparation (chemical coating from the vapour phase [C23C 16/00](#))
- C01B 33/023 ... by reduction of silica or { free } silica-containing material
- C01B 33/025 with carbon or a solid carbonaceous material, i.e. carbo-thermal process
- C01B 33/027 ... by decomposition or reduction of gaseous or vaporised silicon compounds other than silica or silica-containing material
- C01B 33/029 by decomposition of monosilane
- C01B 33/03 by decomposition of silicon halides or halosilanes or reduction thereof with hydrogen as the only reducing agent
- C01B 33/031 by decomposition of silicon tetraiodide
- C01B 33/033 by reduction of silicon halides or halosilanes with a metal or a metallic alloy as the only reducing agents
- C01B 33/035 by decomposition or reduction of gaseous or vaporised silicon compounds in the presence of heated filaments of silicon, carbon or a refractory metal, e.g. tantalum or tungsten, or in the presence of heated silicon rods on which the formed silicon is deposited, a silicon rod being obtained, e.g. Siemens process
- C01B 33/037 .. Purification (by zone-melting [C30B 13/00](#))
- C01B 33/039 ... by conversion of the silicon into a compound, optional purification of the compound, and reconversion into silicon
- C01B 33/04 . Hydrides of silicon
- C01B 33/043 .. { Monosilane }
- C01B 33/046 .. { Purification }
- C01B 33/06 . Metal silicides (alloys [C22](#))
- C01B 33/08 . Compounds containing halogen

C01B 33/10	..	Compounds containing silicon, fluorine, and other elements
C01B 33/103	...	{ Fluosilicic acid; Salts thereof }
C01B 33/107	..	Halogenated silanes
C01B 33/10705	...	{ Tetrafluoride }
C01B 33/1071	...	{ Tetrachloride, trichlorosilane or silicochloroform, dichlorosilane, monochlorosilane or mixtures thereof }
C01B 33/10715	....	{ prepared by reacting chlorine with silicon or a silicon-containing material }
C01B 33/10721	.....	{ with the preferential formation of tetrachloride }
C01B 33/10726	.....	{ from silicon }
C01B 33/10731	.....	{ with the preferential formation of trichlorosilane }
C01B 33/10736	.....	{ from silicon }
C01B 33/10742	....	{ prepared by hydrochlorination of silicon or of a silicon-containing material }
C01B 33/10747	.....	{ with the preferential formation of tetrachloride }
C01B 33/10752	.....	{ from silicon }
C01B 33/10757	.....	{ with the preferential formation of trichlorosilane }
C01B 33/10763	.....	{ from silicon }
C01B 33/10768	...	{ Tetrabromide; Tetraiodide }
C01B 33/10773	...	{ Halogenated silanes obtained by disproportionation and molecular rearrangement of halogenated silanes }
C01B 33/10778	...	{ Purification }
C01B 33/10784	....	{ by adsorption }
C01B 33/10789	.....	{ the adsorbing material being formed in situ, e.g. by partial hydrolysis }
C01B 33/10794	....	{ by forming addition compounds or complexes, the reactant being possibly contained in an adsorbent }
C01B 33/113	.	Silicon oxides ; Hydrates thereof { (preparing monoxide by reduction of siliceous material C01B 33/182) }
C01B 33/12	..	Silica ; Hydrates thereof, e.g. lepidotic silicic acid
C01B 33/122	...	{ Lepidotic silicic acid }
C01B 33/124	...	{ Preparation of adsorbing porous silica not in gel form and not finely divided, i.e. silicon skeletons, by acidic treatment of siliceous materials }
C01B 33/126	...	{ Preparation of silica of undetermined type }
C01B 33/128	....	{ by acidic treatment of aqueous silicate solutions }
C01B 33/14	...	Colloidal silica, e.g. dispersions, gels, sols
C01B 33/141	....	Preparation of hydrosols or aqueous dispersions
C01B 33/1412	.....	{ by oxidation of silicon in basic medium }
C01B 33/1415	.....	{ by suspending finely divided silica in water }
C01B 33/1417	.....	{ an aqueous dispersion being obtained }
C01B 33/142	.....	by acidic treatment of silicates
C01B 33/143	.....	of aqueous solutions of silicates
C01B 33/1435	.....	{ using ion exchangers }
C01B 33/145	....	Preparation of hydroorganosols, organosols or dispersions in an organic medium
C01B 33/146	....	After-treatment of sols ({ preparation of hydrosols or aqueous dispersions from hydroorganosols, organosols or dispersions in an organic medium }

		C01B 33/141 } ; preparation of hydroorganosols, organosols or dispersions in an organic medium from hydrosols { or aqueous dispersions } C01B 33/145)
C01B 33/1465	.....	{ "Build-up" of particles using only one sol and a "heel" consisting or not of the sol }
C01B 33/148	.....	Concentration ; Drying ; Dehydration ; Stabilisation ; Purification { (C01B 33/1465 takes precedence) }
C01B 33/1485	.....	{ Stabilisation, e.g. prevention of gelling; Purification }
C01B 33/149	.....	Coating
C01B 33/151	.....	by progressively adding a sol to a different sol, i.e. "build-up" of particles using a "heel"
C01B 33/152	....	Preparation of hydrogels
C01B 33/1525	.....	{ from or via fluosilicic acid or salts thereof }
C01B 33/154	.....	by acidic treatment of aqueous silicate solutions
C01B 33/1543	.....	{ using ion exchangers }
C01B 33/1546	.....	{ the first formed hydrosol being converted to a hydrogel by introduction into an organic medium immiscible or only partly miscible with water }
C01B 33/155	....	Preparation of hydroorganogels or organogels
C01B 33/157	....	After-treatment of gels
C01B 33/158	.....	Purification ; Drying ; Dehydrating
C01B 33/1585	.....	{ Dehydration into aerogels }
C01B 33/159	.....	Coating or hydrophobisation
C01B 33/16	...	Preparation of silica xerogels
C01B 33/163	....	{ by hydrolysis of organosilicon compounds, e.g. ethyl orthosilicate }
C01B 33/166	....	{ by acidification of silicate in the presence of an inert organic phase }
C01B 33/18	...	Preparation of finely divided silica neither in sol nor in gel form ; After-treatment thereof (preparation of aerogels by dehydrating gels C01B 33/158 ; treatment to enhance the pigmenting or filling properties C09C)
C01B 33/181	....	{ by a dry process }
C01B 33/182	.....	{ by reduction of a siliceous material, e.g. with a carbonaceous reducing agent and subsequent oxidation of the silicon monoxide formed }
C01B 33/183	.....	{ by oxidation or hydrolysis in the vapour phase of silicon compounds such as halides, trichlorosilane, monosilane }
C01B 33/184	.....	{ by hydrolysis of tetrafluoride }
C01B 33/185	.....	{ of crystalline silica-polymorphs having molecular sieve properties, e.g. silicalites }
C01B 33/186	....	{ from or via fluosilicic acid or salts thereof by a wet process }
C01B 33/187	....	by acidic treatment of silicates
C01B 33/193	.....	of aqueous solutions of silicates
C01B 33/20	.	Silicates (persilicates C01B 15/14 ; { containing aluminium C01B 33/26 })
C01B 33/22	..	Magnesium silicates
C01B 33/24	..	Alkaline-earth metal silicates
C01B 33/26	..	Aluminium-containing silicates, { i.e. silico-aluminates }
C01B 33/28	...	Base exchange silicates, e.g. zeolites (regeneration B01J 49/00)

C01B 33/2807 { Zeolitic silicoaluminates with a tridimensional crystalline structure possessing molecular sieve properties; Isomorphous compounds wherein a part of the aluminium ore of the silicon present may be replaced by other elements such as gallium, germanium, phosphorus; Preparation of zeolitic molecular sieves from molecular sieves of another type or from preformed reacting mixtures ([not used, see subgroups](#)) }

NOTE

Documents which belong to more than one subgroup of [C01B 33/C01B28B2](#) to [C01B 33/C01B28B8](#) will be described by a combination, e.g. [C01B 33/C01B28B2B](#) + B4B. The documents which pertain to the structure of a specific molecular sieve are classified in the relevant subgroup

C01B 33/2815 { of type A ([UNION CARBIDE](#) trade name; corresponds to GRACE`s types Z-12 or Z-12L) }

C01B 33/2823 { from aqueous solutions of an alkali metal aluminate and an alkali metal silicate excluding any other source of alumina or silica }

C01B 33/283 { from a reaction mixture containing at least one aluminium silicate or aluminosilicate of a clay-type, e.g. kaolin or metakaolin or its exotherm modification or allophane (containing a single clay substantially chemically modified with an acid, i.e. beyond the activation state [C01B 33/2815](#)) }

C01B 33/2838 { of faujasite type, or type X or Y ([UNION CARBIDE](#) trade names; correspond to GRACE`s types Z-14 and Z-14HS, respectively) }

C01B 33/2846 { of type X }

C01B 33/2853 { of type Y }

C01B 33/2861 { of mordenite type, e.g. ptilolite or dachiardite }

C01B 33/2869 { of other types characterised by an X-ray spectrum and a definite composition }

C01B 33/2876 { from a reacting mixture containing an amine or an organic cation, e.g. a quaternary onium cation-ammonium, phosphonium, stibonium }

C01B 33/2884 { the aluminium or the silicon in the network being partly replaced }

C01B 33/2892 { containing an element or a compound occluded in the pores of the network, e.g. an oxide already present in the starting reaction mixture }

C01B 33/32 . . Alkali metal silicates ({ [C01B 33/20 B](#) } , [C01B 33/26](#) take precedence) }

C01B 33/325 . . . { After-treatment, e.g. purification or stabilisation of solutions, granulation; Dissolution; Obtaining solid silicate, e.g. from a solution by spray-drying, flashing off water or adding a coagulant }

NOTE

In this group, obtaining solid silicate, e.g. as a hydrate of a crystalline silicate, from a solution or a hydrate melt by heating or cooling with or without seeding, is not considered as after-treatment, but classified in group [C01B 33/32](#)

C01B 33/36 . . having base-exchange properties but not having molecular sieve properties ([regeneration thereof B01J 49/00](#))

C01B 33/38 . . . Layered base-exchange silicates, e.g. clays, micas or alkali metal silicates of kenyaite or magadiite type { ([activation of naturally occurring clays B01J 20/12](#) ; [pillared layered base-exchange silicates B01J 29/049](#)) }

C01B 33/40	....	Clays
C01B 33/405	.....	{ not containing aluminium }
C01B 33/42	....	Micas; { Interstratified clay-mica products (delaminated mica or vermiculite platelets obtained by a process involving cation-exchange C04B 14/208) }
C01B 33/425	.....	{ not containing aluminium }
C01B 33/44	....	Products obtained from layered base-exchange silicates by ion-exchange with organic compounds such as ammonium, phosphonium or sulfonium compounds or by intercalation of organic compounds, e.g. organoclay material
C01B 33/46	...	Amorphous silicates, e.g. so-called "amorphous zeolites" (crystalline zeolites C01B 39/00)

C01B 35/00

Boron ; Compounds thereof (monoborane, diborane, metal borohydrides or addition complexes thereof [C01B 6/00](#) ; perborates [C01B 15/12](#) ; binary compounds with nitrogen [C01B 21/06](#) ; { compounds of noble gases [C01B 23/0005](#) } ; phosphides [C01B 25/08](#) ; carbides [C01B 31/36](#) ; alloys containing boron [C22](#))

C01B 35/02	.	Boron ; Borides
C01B 35/023	..	{ Boron }
C01B 35/026	..	{ Higher boron hydrides, i.e. containing at least three boron atoms }
C01B 35/04	..	Metal borides
C01B 35/06	.	Boron halogen compounds
C01B 35/061	..	{ Halides }
C01B 35/063	..	{ Tetrafluoboric acid; Salts thereof }
C01B 35/065	...	{ Tetrafluoboric acid }
C01B 35/066	...	{ Alkali metal tetrafluoroborates }
C01B 35/068	..	{ Halogenated hydrides }
C01B 35/08	.	Compounds containing boron and nitrogen, phosphorus, oxygen, sulfur, selenium or tellurium
C01B 35/10	..	Compounds containing boron and oxygen (C01B 35/06 takes precedence)
C01B 35/1009	...	{ having molecular-sieve properties }
C01B 35/1018	...	{ Carbonyl compounds derived from boron hydrides }
C01B 35/1027	...	{ Oxides }
C01B 35/1036	....	{ Boric anhydride }
C01B 35/1045	...	{ Oxyacids }
C01B 35/1054	....	{ Orthoboric acid }
C01B 35/1063	.....	{ Preparation from boron ores or borates using acids or salts }
C01B 35/1072	.....	{ by means of ammonia-carbon dioxide }
C01B 35/1081	.....	{ Preparation by working up other natural sources, e.g. seawater }
C01B 35/109	.....	{ Purification; Separation; Concentration }
C01B 35/12	...	Borates { (C01B 35/1063 takes precedence) }
C01B 35/121	....	{ of alkali metal }
C01B 35/122	.....	{ Sodium tetraborates; Hydrates thereof, e.g. borax }
C01B 35/123	.....	{ Preparation from boron ores or other borates }

C01B 35/124	.....	{ Preparation by working up natural brines, e.g. seawater }
C01B 35/125	.....	{ Purification; Concentration; Dehydration; Stabilisation; Other after-treatment }
C01B 35/126	....	{ of alkaline-earth metals, beryllium, aluminium or magnesium }
C01B 35/127	....	{ of heavy metals }
C01B 35/128	....	{ containing plural metal or metal and ammonium }
C01B 35/14	..	Compounds containing boron and nitrogen, phosphorus, sulfur, selenium or tellurium
C01B 35/143	...	{ Phosphates }
C01B 35/146	...	{ Compounds containing boron and nitrogen, e.g. borazoles (ammonium tetrafluoroborates C01B 35/063 ; ammonium borates C01B 35/12) }

Guidance heading: Compounds characterised primarily by their physical or chemical properties, rather than by their chemical constitution

C01B 37/00 Compounds having molecular sieve properties but not having base-exchange properties

NOTE

Compounds classified in main group [C01B 37/00](#) are also classified in other groups of class [C01](#) according to their composition

C01B 37/002	.	{ Metallophosphates not containing aluminium, e.g. gallophosphates or silicogallophosphates }
C01B 37/005	.	{ Silicates, i.e. so-called metasilicalites or metallozeosilites }
C01B 37/007	.	{ Borosilicates }
C01B 37/02	.	Crystalline silica-polymorphs, e.g. silicalites { dealuminated aluminosilicate zeolites }
C01B 37/04	.	Aluminophosphates (APO compounds)
C01B 37/06	.	Aluminophosphates containing other elements, e.g. metals, boron
C01B 37/065	..	{ the other elements being metals only }
C01B 37/08	..	Silicoaluminophosphates (SAPO compounds) , { e.g. CoSAPO }

C01B 39/00 Compounds having molecular sieve and base-exchange properties, e.g. crystalline zeolites ; Their preparation ; After-treatment, e.g. ion-exchange or dealumination (treatment to modify the sorption properties, e.g. shaping using a binder, [B01J 20/10](#) ; treatment to modify the catalytic properties, e.g. combination of treatments to make the zeolites appropriate to their use as a catalyst, [B01J 29/04](#) ; treatment to improve the ion-exchange properties [B01J 39/14](#) ; regeneration or reactivation of ion-exchange properties [B01J 49/00](#) ; preparation of stabilised suspensions used in detergents [C11D 3/12](#))

NOTE

In this group, the following term is used with the meaning indicated:

- "zeolites" means:

- (i) crystalline aluminosilicates with base-exchange and molecular sieve properties, having three dimensional, microporous lattice framework structure of tetrahedral oxide units;
- (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.

Compounds classified in main group [C01B 39/00](#) are also classified in other groups of class [C01](#) according to their composition

- [C01B 39/02](#) . Crystalline aluminosilicate zeolites ; Isomorphous compound thereof ; Direct preparation thereof ; Preparation thereof starting from a reaction mixture containing a crystalline zeolite of another type, or from preformed reactants ; After-treatment thereof
- [C01B 39/023](#) .. { Preparation of physical mixtures or intergrowth products of zeolites chosen from group [C01B 39/04](#) or two or more of groups [C01B 39/14](#) to [C01B 39/48](#) }
- [C01B 39/026](#) .. { After-treatment }
- [C01B 39/04](#) .. using at least one organic template directing agent, e.g. an ionic quaternary ammonium compound or an aminated compound
- [C01B 39/06](#) .. Preparation of isomorphous zeolites characterised by measures to replace the aluminium or silicon atoms in the lattice framework by atoms of other elements, { i.e. by direct or secondary synthesis }
- [C01B 39/065](#) ... { Galloaluminosilicates; Group IVB- metalloaluminosilicates; Ferroaluminosilicates }
- [C01B 39/08](#) ... the aluminium atoms being wholly replaced
- [C01B 39/082](#) { Gallosilicates }
- [C01B 39/085](#) { Group IVB- metasilicates }
- [C01B 39/087](#) { Ferrosilicates }
- [C01B 39/10](#) ... the replacing atoms being { at least } phosphorus atoms
- [C01B 39/12](#) ... the replacing atoms being { at least } boron atoms
- [C01B 39/14](#) .. Type A
- [C01B 39/145](#) ... { using at least one organic template directing agent }
- [C01B 39/16](#) ... from aqueous solutions of an alkali metal aluminate and an alkali metal silicate excluding any other source of alumina or silica but seeds { ([C01B 39/145](#) takes precedence) }
- [C01B 39/18](#) ... from a reaction mixture containing at least one aluminium silicate or aluminosilicate of a clay type, e.g. kaolin or metakaolin or its exotherm modification or allophane { ([C01B 39/145](#) takes precedence) }
- [C01B 39/20](#) .. Faujasite type, e.g. type X or Y
- [C01B 39/205](#) ... { using at least one organic template directing agent; Hexagonal faujasite; Intergrowth products of cubic and hexagonal faujasite }
- [C01B 39/22](#) ... Type X { ([C01B 39/205](#) takes precedence) }
- [C01B 39/24](#) ... Type Y { ([C01B 39/205](#) takes precedence) }

- C01B 39/26 Mordenite type { ([C01B 39/023](#) , [C01B 39/026](#) , [C01B 39/06](#) take precedence) }
- C01B 39/265 { using at least one organic template directing agent }
- C01B 39/28 Phillipsite or harmotome type { ([C01B 39/023](#) , [C01B 39/026](#) , [C01B 39/06](#) take precedence) }
- C01B 39/30 Erionite or offretite type, e.g. zeolite T
- C01B 39/305 { using at least one organic template directing agent }
- C01B 39/32 Type L
- C01B 39/34 Type ZSM-4
- C01B 39/36 Pentasil type, e.g. types ZSM-5, ZSM-8 or ZSM-11
- C01B 39/365 { Type ZSM-8; Type ZSM-11; ZSM 5/11 intermediate }
- C01B 39/38 Type ZSM-5
- C01B 39/40 using at least one organic template directing agent
- C01B 39/42 Type ZSM-12
- C01B 39/44 Ferrierite type, e.g. types ZSM-21, ZSM-35 or ZSM-38
- C01B 39/445 { using at least one organic template directing agent }
- C01B 39/46 Other types characterised by their X-ray diffraction pattern and their defined composition { ([C01B 39/023](#) , [C01B 39/026](#) , [C01B 39/06](#) take precedence) }
- C01B 39/48 using at least one organic template directing agent
- C01B 39/50 Zeolites wherein inorganic bases or salts occlude channels in the lattice framework, e.g. sodalite, cancrinite, nosean, hauynite { ([ultramarine C09C 1/32](#)) }
- C01B 39/52 Sodalites
- C01B 39/54 Phosphates, e.g. APO or SAPO compounds

NOTE

Phosphates having either a poorly defined or a weak base-exchange capacity such as MAPO's, SAPO's or BAPO's are classified in [C01B 37/00](#)

Guidance heading:**C01B 2201/00 Preparation of ozone by electrical discharge**

- C01B 2201/10 . . . Dischargers used for production of ozone
- C01B 2201/12 . . . Plate-type dischargers
- C01B 2201/14 . . . Concentric/tubular dischargers
- C01B 2201/20 . . . Electrodes used for obtaining electrical discharge
- C01B 2201/22 . . . Constructional details of the electrodes
- C01B 2201/24 . . . Composition of the electrodes
- C01B 2201/30 . . . Dielectrics used in the electrical dischargers
- C01B 2201/32 . . . Constructional details of the dielectrics
- C01B 2201/34 . . . Composition of the dielectrics

- C01B 2201/40 . using several dischargers in series
- C01B 2201/50 . Part of the product being recycled
- C01B 2201/60 . Feed streams for electrical dischargers
- C01B 2201/62 . . Air
- C01B 2201/64 . . Oxygen
- C01B 2201/66 . . Pretreatment of the feed
- C01B 2201/70 . Cooling of the discharger ; Means for making cooling unnecessary
- C01B 2201/72 . . by air
- C01B 2201/74 . . by liquid
- C01B 2201/76 . . . Water
- C01B 2201/80 . Additional processes occurring alongside the electrical discharges, e.g. catalytic processes
- C01B 2201/82 . . Treatment with ultraviolet light
- C01B 2201/84 . . Treatment with magnetic fields
- C01B 2201/90 . Control of the process

Guidance heading:

C01B 2202/00 Structure or properties of carbon nanotubes

- C01B 2202/02 . Single-walled nanotubes
- C01B 2202/04 . Nanotubes with a specific amount of walls
- C01B 2202/06 . Multi-walled nanotubes
- C01B 2202/08 . Aligned nanotubes
- C01B 2202/10 . Filled nanotubes
- C01B 2202/20 . Nanotubes characterized by their properties
- C01B 2202/22 . . Electronic properties
- C01B 2202/24 . . Thermal properties
- C01B 2202/26 . . Mechanical properties
- C01B 2202/28 . . Solid content in solvents
- C01B 2202/30 . . Purity
- C01B 2202/32 . . Specific surface area
- C01B 2202/34 . . Length
- C01B 2202/36 . . Diameter

C01B 2203/00 Integrated processes for the production of hydrogen or synthesis gas ([reactors or details thereof B01J 2208/00 to B01J 2219/00](#))

- C01B 2203/02 . Processes for making hydrogen or synthesis gas
- C01B 2203/0205 .. containing a reforming step
- C01B 2203/0211 ... containing a non-catalytic reforming step
- C01B 2203/0216 containing a non-catalytic steam reforming step
- C01B 2203/0222 containing a non-catalytic carbon dioxide reforming step
- C01B 2203/0227 ... containing a catalytic reforming step
- C01B 2203/0233 the reforming step being a steam reforming step
- C01B 2203/0238 the reforming step being a carbon dioxide reforming step
- C01B 2203/0244 the reforming step being an autothermal reforming step, e.g. secondary reforming processes
- C01B 2203/025 .. containing a partial oxidation step
- C01B 2203/0255 ... containing a non-catalytic partial oxidation step
- C01B 2203/0261 ... containing a catalytic partial oxidation step (CPO)
- C01B 2203/0266 .. containing a decomposition step
- C01B 2203/0272 ... containing a non-catalytic decomposition step
- C01B 2203/0277 ... containing a catalytic decomposition step
- C01B 2203/0283 .. containing a CO-shift step, i.e. a water gas shift step
- C01B 2203/0288 ... containing two CO-shift steps
- C01B 2203/0294 ... containing three or more CO-shift steps
- C01B 2203/04 . containing a purification step for the hydrogen or the synthesis gas
- C01B 2203/0405 .. Purification by membrane separation
- C01B 2203/041 ... In-situ membrane purification during hydrogen production
- C01B 2203/0415 .. Purification by absorption in liquids
- C01B 2203/042 .. Purification by adsorption on solids
- C01B 2203/0425 ... In-situ adsorption process during hydrogen production
- C01B 2203/043 ... Regenerative adsorption process in two or more beds, one for adsorption, the other for regeneration
- C01B 2203/0435 .. Catalytic purification
- C01B 2203/044 ... Selective oxidation of carbon monoxide
- C01B 2203/0445 ... Selective methanation
- C01B 2203/045 ... Purification by catalytic desulfurisation
- C01B 2203/0455 .. Purification by non-catalytic desulfurisation
- C01B 2203/046 .. Purification by cryogenic separation
- C01B 2203/0465 .. Composition of the impurity
- C01B 2203/047 ... the impurity being carbon monoxide
- C01B 2203/0475 ... the impurity being carbon dioxide
- C01B 2203/048 ... the impurity being an organic compound
- C01B 2203/0485 ... the impurity being a sulfur compound
- C01B 2203/049 ... the impurity being carbon
- C01B 2203/0495 ... the impurity being water
- C01B 2203/06 . Integration with other chemical processes

- C01B 2203/061 .. Methanol production
- C01B 2203/062 .. Hydrocarbon production, e.g. Fischer-Tropsch process
- C01B 2203/063 .. Refinery processes
- C01B 2203/065 ... using hydrotreating, e.g. hydrogenation, hydrodesulfurisation
- C01B 2203/066 .. with fuel cells
- C01B 2203/067 ... the reforming process taking place in the fuel cell
- C01B 2203/068 .. Ammonia synthesis

- C01B 2203/08 . Methods of heating or cooling
- C01B 2203/0805 .. Methods of heating the process for making hydrogen or synthesis gas
- C01B 2203/0811 ... by combustion of fuel
- C01B 2203/0816 Heating by flames
- C01B 2203/0822 the fuel containing hydrogen
- C01B 2203/0827 at least part of the fuel being a recycle stream
- C01B 2203/0833 ... Heating by indirect heat exchange with hot fluids, other than combustion gases, product gases or non-combustive exothermic reaction product gases
- C01B 2203/0838 ... by heat exchange with exothermic reactions, other than by combustion of fuel
- C01B 2203/0844 the non-combustive exothermic reaction being another reforming reaction as defined in groups [C01B 2203/02](#) to [C01B 2203/0294](#)
- C01B 2203/085 ... by electric heating
- C01B 2203/0855 ... by electromagnetic heating
- C01B 2203/0861 ... by plasma
- C01B 2203/0866 ... by combination of different heating methods
- C01B 2203/0872 .. Methods of cooling
- C01B 2203/0877 ... by direct injection of fluid
- C01B 2203/0883 ... by indirect heat exchange
- C01B 2203/0888 ... by evaporation of a fluid
- C01B 2203/0894 Generation of steam

- C01B 2203/10 . Catalysts for performing the hydrogen forming reactions
- C01B 2203/1005 .. Arrangement or shape of catalyst
- C01B 2203/1011 ... Packed bed of catalytic structures, e.g. particles, packing elements
- C01B 2203/1017 characterised by the form of the structure
- C01B 2203/1023 ... Catalysts in the form of a monolith or honeycomb
- C01B 2203/1029 ... Catalysts in the form of a foam
- C01B 2203/1035 ... Catalyst coated on equipment surfaces, e.g. reactor walls
- C01B 2203/1041 .. Composition of the catalyst
- C01B 2203/1047 ... Group VIII metal catalysts
- C01B 2203/1052 Nickel or cobalt catalysts
- C01B 2203/1058 Nickel catalysts
- C01B 2203/1064 Platinum group metal catalysts
- C01B 2203/107 Platinum catalysts
- C01B 2203/1076 ... Copper or zinc-based catalysts

C01B 2203/1082	...	Composition of support materials
C01B 2203/1088	...	Non-supported catalysts
C01B 2203/1094	...	Promotors or activators
C01B 2203/12	.	Feeding the process for making hydrogen or synthesis gas
C01B 2203/1205	..	Composition of the feed
C01B 2203/1211	...	Organic compounds or organic mixtures used in the process for making hydrogen or synthesis gas
C01B 2203/1217	....	Alcohols
C01B 2203/1223	.....	Methanol
C01B 2203/1229	.....	Ethanol
C01B 2203/1235	....	Hydrocarbons
C01B 2203/1241	.....	Natural gas or methane
C01B 2203/1247	.....	Higher hydrocarbons
C01B 2203/1252	.....	Cyclic or aromatic hydrocarbons
C01B 2203/1258	..	Pre-treatment of the feed
C01B 2203/1264	...	Catalytic pre-treatment of the feed
C01B 2203/127	....	Catalytic desulfurisation
C01B 2203/1276	..	Mixing of different feed components
C01B 2203/1282	...	using static mixers
C01B 2203/1288	..	Evaporation of one or more of the different feed components
C01B 2203/1294	...	Evaporation by heat exchange with hot process stream
C01B 2203/14	.	Details of the flowsheet
C01B 2203/141	..	At least two reforming, decomposition or partial oxidation steps in parallel
C01B 2203/142	..	At least two reforming, decomposition or partial oxidation steps in series
C01B 2203/143	...	Three or more reforming, decomposition or partial oxidation steps in series
C01B 2203/145	..	At least two purification steps in parallel
C01B 2203/146	..	At least two purification steps in series
C01B 2203/147	...	Three or more purification steps in series
C01B 2203/148	..	involving a recycle stream to the feed of the process for making hydrogen or synthesis gas
C01B 2203/16	.	Controlling the process
C01B 2203/1604	..	Starting up the process
C01B 2203/1609	..	Shutting down the process
C01B 2203/1614	..	Controlling the temperature
C01B 2203/1619	...	Measuring the temperature
C01B 2203/1623	...	Adjusting the temperature
C01B 2203/1628	..	Controlling the pressure
C01B 2203/1633	...	Measuring the pressure
C01B 2203/1638	...	Adjusting the pressure
C01B 2203/1642	..	Controlling the product
C01B 2203/1647	...	Controlling the amount of the product

- C01B 2203/1652 Measuring the amount of product
- C01B 2203/1657 the product being hydrogen
- C01B 2203/1661 the product being carbon monoxide
- C01B 2203/1666 the product being carbon dioxide
- C01B 2203/1671 . . . Controlling the composition of the product
- C01B 2203/1676 Measuring the composition of the product
- C01B 2203/168 Adjusting the composition of the product
- C01B 2203/1685 . . Control based on demand of downstream process
- C01B 2203/169 . . Controlling the feed
- C01B 2203/1695 . . Adjusting the feed of the combustion

- C01B 2203/80 . Aspect of integrated processes for the production of hydrogen or synthesis gas not covered by groups [C01B 2203/02](#) to [C01B 2203/1695](#)
- C01B 2203/82 . . Several process steps of [C01B 2203/02](#) to [C01B 2203/08](#) integrated into a single apparatus
- C01B 2203/84 . . Energy production
- C01B 2203/86 . . Carbon dioxide sequestration

C01B 2204/00 Structure or properties of graphene

- C01B 2204/02 . Single layer graphene
- C01B 2204/04 . Specific amount of layers or specific thickness
- C01B 2204/06 . Graphene nanoribbons
- C01B 2204/065 . . characterized by their width or by their aspect ratio
- C01B 2204/20 . Graphene characterized by its properties
- C01B 2204/22 . . Electronic properties
- C01B 2204/24 . . Thermal properties
- C01B 2204/26 . . Mechanical properties
- C01B 2204/28 . . Solid content in solvents
- C01B 2204/30 . . Purity
- C01B 2204/32 . . Size or surface area

C01B 2210/00 Purification or separation of specific gases

- C01B 2210/0001 . Separation or purification processing
- C01B 2210/0003 . . Chemical processing
- C01B 2210/0004 . . . by oxidation
- C01B 2210/0006 . . . by reduction
- C01B 2210/0007 . . . by complexation
- C01B 2210/0009 . . Physical processing
- C01B 2210/001 . . . by making use of membranes

C01B 2210/0012	....	characterised by the membrane
C01B 2210/0014	...	by adsorption in solids
C01B 2210/0015	....	characterised by the adsorbent
C01B 2210/0017	.....	Carbon-based materials
C01B 2210/0018	.....	Zeolites
C01B 2210/002	.....	Other molecular sieve materials
C01B 2210/0021	....	Temperature swing adsorption
C01B 2210/0023	....	in getters
C01B 2210/0025	...	by absorption in liquids
C01B 2210/0026	.	Isotopes of the specific gas
C01B 2210/0028	.	Separation of the specific gas from gas mixtures containing a minor amount of this specific gas
C01B 2210/0029	.	Obtaining noble gases
C01B 2210/0031	..	Helium
C01B 2210/0032	..	Neon
C01B 2210/0034	..	Argon
C01B 2210/0035	..	Krypton
C01B 2210/0037	..	Xenon
C01B 2210/0039	..	Radon
C01B 2210/004	..	Separation of a mixture of noble gases
C01B 2210/0042	.	Making ultrapure specific gas
C01B 2210/0043	.	Impurity removed
C01B 2210/0045	..	Oxygen
C01B 2210/0046	..	Nitrogen
C01B 2210/0048	..	Air
C01B 2210/005	..	Carbon monoxide
C01B 2210/0051	..	Carbon dioxide
C01B 2210/0053	..	Hydrogen
C01B 2210/0054	..	Hydrogen halides
C01B 2210/0056	...	Hydrogen fluoride
C01B 2210/0057	...	Hydrogen chloride
C01B 2210/0059	...	Hydrogen bromide
C01B 2210/006	...	Hydrogen iodide
C01B 2210/0062	..	Water
C01B 2210/0064	..	Hydrogen sulfide
C01B 2210/0065	..	Ammonia
C01B 2210/0067	..	Hydrogen cyanide
C01B 2210/0068	..	Organic compounds
C01B 2210/007	...	Hydrocarbons

C01B 2210/0071	..	Sulfur oxides
C01B 2210/0073	..	Sulfur halides
C01B 2210/0075	..	Nitrogen oxides
C01B 2210/0076	..	Nitrogen halides
C01B 2210/0078	..	Noble gases
C01B 2210/0079	...	Helium
C01B 2210/0081	...	Neon
C01B 2210/0082	...	Argon
C01B 2210/0084	...	Krypton
C01B 2210/0085	...	Xenon
C01B 2210/0087	...	Radon
C01B 2210/0089	..	Peroxides
C01B 2210/009	...	Hydrogen peroxide
C01B 2210/0092	..	Ozone
C01B 2210/0093	..	Metals or metal compounds
C01B 2210/0095	...	Metals
C01B 2210/0096	...	Metal hydrides
C01B 2210/0098	..	Other impurities