

ECLA EUROPEAN CLASSIFICATION

C01B NON-METALLIC ELEMENTS; COMPOUNDS THEREOF; [N: METALLOIDS OR COMPOUNDS THEREOF NOT COVERED BY SUBCLASS C01C] [C9510]

[N: **WARNING** [C2011.07]

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Notes

1. 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.
2. Attention is drawn to the definitions of groups of chemical elements following the title of section C.

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

C01B3/00 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)

[N: **Notes**

[C1111] 1. In this group it is desirable to add the indexing codes of groups [L01J208/00](#) and [L01J219/00](#), for details relating to the reactors used in the generation of hydrogen or synthesis gas. 2. In groups [C01B3/12](#) to [C01B3/18](#) and in groups [C01B3/22](#) to [C01B3/58D](#) it is desirable to add the indexing codes of group [M01B203/00](#), for aspects relating to hydrogen or synthesis gas generation processes.

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C01B3/00D . [N: 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 C01B3/50G**); Reversible gettering of hydrogen; Reversible uptake of hydrogen by electrodes] [C9508]

C01B3/00D2 . . [N: characterised by the uptaking medium; Treatment thereof]

C01B3/00D2B . . . [N: Organic compounds; Solutions thereof]

C01B3/00D2C . . . [N: Carbon, e.g. active carbon, carbon nanotubes, fullerenes; Treatment thereof][N0301]

C01B3/00D2D . . . [N: of one single metal or a rare earth metal; Treatment thereof]

[N: **Notes**

1. In all of the groups [C01B3/00D2D](#) to [C01B3/00D2J](#), the metallic storage materials may contain minor quantities of non-metals such as B, C, O, S, Se, Si; e.g. [C01B3/00D2F2](#) "only containing iron and titanium" includes Fe-Ti compositions comprising non-metals
2. In the groups [C01B3/00D2D](#) and [C01B3/00D2F6](#) to [C01B3/00D2F6G2](#) a "rare-earth metal" means one single metal or a combination of metals

- selected from the lanthanides, Sc or Y
-]
- C01B3/00D2F . . . [N: Intermetallic compounds; Metal alloys; Treatment thereof]
 - C01B3/00D2F2 [N: only containing iron and titanium; Treatment thereof]
 - C01B3/00D2F4 [N: only containing magnesium and nickel; Treatment thereof]
 - C01B3/00D2F6 [N: containing a rare earth metal; Treatment thereof]
 - C01B3/00D2F6B [N: also containing titanium]
 - C01B3/00D2F6D [N: also containing nickel]
 - C01B3/00D2F6G [N: only containing a rare earth metal and only one other metal]
 - C01B3/00D2F6G2 [N: the other metal being nickel]
 - C01B3/00D2G . . . [N: Slurries, Suspensions]
 - C01B3/00D2H . . . [N: 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]
 - C01B3/00D2J . . . [N: 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]

 - C01B3/00P . [N: Ortho-para conversion]

 - C01B3/00Q . [N: Atomic hydrogen]

 - C01B3/02 . Production of hydrogen or of gaseous mixtures containing [N: a substantial proportion of] hydrogen
 - C01B3/02B . . [N: Preparation or purification of gas mixtures for ammonia synthesis]
 - C01B3/04 . . by decomposition of inorganic compounds, e.g. ammonia [N: ([C01B3/00D](#) takes precedence)] [C9508]
 - C01B3/04B . . . [N: Decomposition of water]
 - C01B3/04B2 [N: in gaseous phase]
 - C01B3/04C . . . [N: Decomposition of ammonia]
 - C01B3/06 . . by reaction of inorganic compounds containing electro-positively bound hydrogen, e.g. water, acids, bases, ammonia, with inorganic reducing agents (by electrolysis of water [C25B1/04](#))
 - C01B3/06A . . . [N: by reaction of metal oxides with water]
 - C01B3/06A2 [N: Cyclic methods]
 - C01B3/06C . . . [N: from a hydride] [N1107]
 - C01B3/06E . . . [N: by reaction of water with phosphorus]
 - C01B3/06F . . . [N: the hydrogen being generated from the water as a result of a cyclus of reactions, not covered by groups [C01B3/06A2](#) or [C01B3/10A](#)]

 - C01B3/08 . . . with metals
 - C01B3/10 . . . by reaction of water vapour with metals
 - C01B3/10A [N: Cyclic methods]
 - C01B3/12 . . . by reaction of water vapour with carbon monoxide
 - C01B3/14 Handling of heat and steam

- C01B3/16 using catalysts
- C01B3/18 using moving solid particles
- C01B3/20 by reaction of metal hydroxides with carbon monoxide
- C01B3/22 by decomposition of gaseous or liquid organic compounds ([N: [C01B3/00D](#) takes precedence]; coking liquid carbonaceous materials [C10B55/00](#)) [C9508]
- C01B3/24 of hydrocarbons
- C01B3/26 using catalysts
- C01B3/28 using moving solid particles
- C01B3/30 using the fluidised bed technique
- C01B3/32 by reaction of gaseous or liquid organic compounds with gasifying agents, e.g. water, carbon dioxide, air
- C01B3/32B [N: Catalytic reaction of gaseous or liquid organic compounds other than hydrocarbons with gasifying agents] [N9610]
- C01B3/32B2 [N: characterised by the catalyst] [N9610]
- C01B3/34 by reaction of hydrocarbons with gasifying agents
- C01B3/34G [N: with the aid of electrical means, electromagnetic or mechanical vibrations, or particle radiations]
- C01B3/34M [N: using non-catalytic solid particles]
- C01B3/34S [N: using heat generated by superheated steam]
- C01B3/34T [N: by direct contact with heat accumulating liquids, e.g. molten metals, molten salts]
- C01B3/36 using oxygen or mixtures containing oxygen as gasifying agents
- C01B3/36B [N: characterised by the burner used] [N0002]
- C01B3/36M [N: Partial combustion in internal-combustion engines]
- C01B3/38 using catalysts
- C01B3/38A [N: Multi-step processes]
- C01B3/38B [N: the catalyst being continuously externally heated]
- C01B3/38D [N: Catalytic partial combustion]
- C01B3/38S [N: the heat being generated by superheated steam]
- C01B3/40 characterised by the catalyst
- C01B3/42 using moving solid particles
- C01B3/44 using the fluidised bed technique
- C01B3/46 using discontinuously preheated non-moving solid materials, e.g. blast and run
- C01B3/48 followed by reaction of water vapour with carbon monoxide
- C01B3/50 Separation of hydrogen or hydrogen containing gases from gaseous mixtures, e.g. purification ([C01B3/14](#) takes precedence)
- C01B3/50B [N: by diffusion]
- C01B3/50B2 [N: characterised by the membrane] [N9610]
- C01B3/50B2B [N: Membranes containing palladium] [N9610]
- C01B3/50D [N: at low temperatures]
- C01B3/50G [N: 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 [C01B3/00D](#))]

- C01B3/52 . . by contacting with liquids; Regeneration of used liquids [N: (C01B3/50G takes precedence)] [C9508]
- C01B3/54 . . . including a catalytic reaction
- C01B3/56 . . by contacting with solids; Regeneration of used solids [N: (C01B3/50G takes precedence)] [C9508]
- C01B3/58 . . . including a catalytic reaction
- C01B3/58B [N: the reaction being the selective oxidation of carbon monoxide] [N0009]
- C01B3/58D [N: the reaction being a methanation reaction] [N0009]
- C01B4/00** **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 B01D59/00; other chemical reactions to form compounds of hydrogen isotopes, see the relevant groups for hydrogen compounds in class C01)**
- C01B5/00** **Water**
- C01B5/02 . Heavy water; Preparation by chemical reaction of hydrogen isotopes or their compounds, e.g. $4\text{ND}_3 + 7\text{O}_2 \rightarrow 4\text{NO}_2 + 6\text{D}_2\text{O}$, $2\text{D}_2 + \text{O}_2 \rightarrow 2\text{D}_2\text{O}$
- C01B6/00** **Hydrides of metals** [N: including fully or partially hydrided metals, alloys or intermetallic compounds (use of some thereof for reversible sorption of hydrogen C01B3/00D, C01B3/50G); 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 C01B35/00)
- C01B6/00B . [N: Hydrides containing only one metal and one or several non-metals]
- C01B6/00B2 . . [N: only one metal and one or several halogens]
- C01B6/02 . Hydrides of transition elements; Addition complexes thereof
- C01B6/04 . Hydrides of alkali metals, alkaline earth metals, beryllium or magnesium; Addition complexes thereof
- C01B6/06 . Hydrides of aluminium, gallium, indium, thallium, germanium, tin, lead, arsenic, antimony, bismuth or polonium; Monoborane; Diborane; Addition complexes thereof
- C01B6/06B . . [N: Hydrides of arsenic or antimony]
- C01B6/10 . . Monoborane; Diborane; Addition complexes thereof
- C01B6/11 . . . Preparation from boron or inorganic compounds containing boron and oxygen
- C01B6/13 . . . Addition complexes of monoborane or diborane, e.g. with phosphine, arsine or hydrazine
- C01B6/15 Metal borohydrides; Addition complexes thereof
- C01B6/17 Preparation from boron or inorganic compounds containing boron and oxygen
- C01B6/19 Preparation from other compounds of boron
- C01B6/21 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
- C01B6/23 Preparation of borohydrides of other metals, e.g. aluminium

borohydride; Addition complexes thereof, e.g. $\text{Li}[\text{Al}(\text{BH}_4)_3\text{H}]$

- C01B6/24 . Hydrides containing at least two metals; Addition complexes thereof ([C01B6/13](#) to [C01B6/23](#) take precedence)
- C01B6/24B . . [N: containing only hydrogen, aluminium and alkali metals, e.g. $\text{Li}(\text{AlH}_4)$]
- C01B6/24K . . [N: also containing non-metals other than hydrogen]
- C01B6/26 . . Preparation from the metal with the highest valency or from its oxides or salts of its oxyacids
- C01B6/34 . Purification; Stabilisation

Guide heading: **Halogens, compounds thereof**

C01B7/00 **Halogens; Halogen acids (oxyacids [C01B11/00](#))**

- C01B7/01 . Chlorine; Hydrogen chloride
- C01B7/01B . . [N: Preparation of hydrogen chloride from the elements]
- C01B7/01D . . [N: Chlorine hydrates; Obtaining chlorine therefrom]
- C01B7/01F . . [N: Preparation of hydrogen chloride by reacting together chlorine, water and carbon or carbon monoxide (the carbon not acting only as catalyst)]
- C01B7/03 . . Preparation from chlorides
- C01B7/03B . . . [N: Preparation of hydrogen chloride from chlorides]
- C01B7/04 . . . Preparation of chlorine from hydrogen chloride
- C01B7/05 . . . Preparation from ammonium chloride
- C01B7/05B [N: Preparation of hydrogen chloride from ammonium chloride]
- C01B7/07 . . Purification; [N: Separation ([C01B7/01D](#) takes precedence)]
- C01B7/07B . . . [N: of hydrogen chloride]
- C01B7/07B2 [N: by distillation]
- C01B7/07B4 [N: by adsorption]
- C01B7/07B4B [N: by active carbon]
- C01B7/07B6 [N: by extraction]
- C01B7/07B6B [N: hydrogen chloride being extracted]
- C01B7/07D . . . [N: of gaseous or dissolved chlorine]
- C01B7/075 . . . of liquid chlorine
- C01B7/09 . Bromine; Hydrogen bromide
- C01B7/09B . . [N: Hydrogen bromide]
- C01B7/09D . . [N: Bromine]
- C01B7/13 . Iodine; Hydrogen iodide
- C01B7/13B . . [N: Hydrogen iodide]
- C01B7/14 . . Iodine
- C01B7/16 . . . Preparation from seaweed
- C01B7/19 . Fluorine; Hydrogen fluoride

- C01B7/19B . . [N: Hydrogen fluoride]
- C01B7/19B2 . . . [N: Preparation from fluorspar]
- C01B7/19B4 . . . [N: Preparation from silicon tetrafluoride, fluosilicic acid or fluosilicates]
- C01B7/19B6 . . . [N: Preparation from ammonium fluoride]
- C01B7/19B10 . . . [N: Separation; Purification]
- C01B7/19B10D [N: by distillation]
- C01B7/19B10F [N: by adsorption]
- C01B7/19B10F2 [N: by solid ion-exchangers]
- C01B7/20 . . Fluorine

- C01B7/24 . Inter-halogen compounds

C01B9/00 **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](#))

- C01B9/02 . Chlorides
- C01B9/04 . Bromides
- C01B9/06 . Iodides
- C01B9/08 . Fluorides

C01B11/00 **Oxides or oxyacids of halogens; Salts thereof**

- C01B11/02 . Oxides of chlorine
- C01B11/02B . . [N: Chlorine hemioxide (Cl₂O)]
- C01B11/02D . . [N: Chlorine dioxide (ClO₂)]
- C01B11/02D2 . . . [N: Preparation from chlorites or chlorates]
- C01B11/02D2B [N: from chlorites]
- C01B11/02D2D [N: from chlorates without any other reaction reducing agent than chloride ions]
- C01B11/02D2H [N: from chlorate ions in the presence of a peroxidic compound, e.g. hydrogen peroxide, ozone, peroxyulfates]
- C01B11/02D2K [N: from chlorate ions in the presence of a nitrogen compound selected from nitrogen dioxide, nitrate or nitrite ions, nitrosylchloride, hydrazine or hydrazine compounds]
- C01B11/02D8 . . . [N: Separation; Purification]
- C01B11/02F . . [N: Chlorine trioxide (ClO₃); Chlorine hexoxide (Cl₂O₆); Chlorine heptoxide (Cl₂O₇)]

- C01B11/04 . Hypochlorous acid
- C01B11/06 . . Hypochlorites
- C01B11/06A . . . [N: Hypochlorites of alkali metals]
- C01B11/06B . . . [N: Hypochlorites of alkaline-earth metals]

- C01B11/06F . . . [N: Magnesium hypochlorite]
- C01B11/06H . . . [N: Stabilisation by additives other than oxides, hydroxides, carbonates of alkali or alkaline-earth metals; Coating of particles; Shaping; Granulation]
- C01B11/08 . Chlorous acid
- C01B11/10 . . Chlorites
- C01B11/12 . Chloric acid
- C01B11/14 . . Chlorates
- C01B11/14B . . . [N: Separation; Crystallisation; Purification, After-treatment; Stabilisation by additives]
- C01B11/16 . Perchloric acid
- C01B11/18 . . Perchlorates
- C01B11/18B . . . [N: Ammonium perchlorate]
- C01B11/20 . Oxygen compounds of bromine
- C01B11/22 . Oxygen compounds of iodine
- C01B11/24 . Oxygen compounds of fluorine

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

C01B13/00 **Oxygen; Ozone; Oxides or hydroxides in general**

- C01B13/02 . Preparation of oxygen ([N: enrichment of a gaseous mixture, in particular air, in oxygen or separation of oxygen from a gaseous mixture by an adsorption process [B01D63/03](#); by liquefying [F25J](#)])
 - C01B13/02B . . [N: from inorganic compounds] [C9511]
 - C01B13/02B2 . . . [N: Water] [N9511]
 - C01B13/02B4 . . . [N: Peroxy compounds] [N9511]
 - C01B13/02B4B [N: Hydrogen peroxide] [N9511]
 - C01B13/02B6 . . . [N: Chlorate] [N9511]
 - C01B13/02C . . [N: from organic compounds] [N9511]
 - C01B13/02C2 . . . [N: Peroxy compounds] [N9511]
 - C01B13/02D . . [N: Purification or separation processes] [C9511]
- [N: **Notes**
 [N1110] In groups [C01B13/02D](#) to [C01B13/02D6](#), additional features relating to the purification or separation processes are indexed with codes chosen from [M01B210/00Q](#) to M210/00W90.
]
- C01B13/02D2 . . . [N: Chemical processing only] [N9511]
 - C01B13/02D2B [N: by oxidation] [N9511]
 - C01B13/02D2D [N: by reduction] [N9511]
 - C01B13/02D2F [N: by complexation] [N9511]

- C01B13/02D4 . . . [N: Physical processing only] [N9511]
 - C01B13/02D4B [N: by making use of membranes] [N9511]
 - C01B13/02D4B2 [N: characterised by the type of membrane] [N9511]
 - C01B13/02D4D [N: by adsorption on solids] [N9511]
 - C01B13/02D4D2 [N: characterised by the adsorbent] [N9511]
 - C01B13/02D4D2C [N: Carbon based materials] [N9511]
 - C01B13/02D4D2F [N: Zeolites] [N9511]
 - C01B13/02D4D2K [N: Other molecular sieve materials] [N9511]
 - C01B13/02D4D8 [N: Temperature swing adsorption] [N9511]
 - C01B13/02D4D12 [N: in getters] [N9511]
 - C01B13/02D4F [N: by absorption in liquids] [N9511]
 - C01B13/02D6 [N: Combined chemical and physical processing] [N9511]
- [N: **Note**
[N9605]In this group, processing steps are indexed with codes chosen from [M01B210/00D](#) to [M01B210/00D4F](#)
]
- C01B13/02F . . . [N: Preparation from air using a molten phase containing alkali metal nitrite, optionally together with other oxygen acceptors]
 - C01B13/02K . . . [N: 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** [C01B13/02](#))]
 - C01B13/08 . . . from air with the aid of metal oxides, e.g. barium oxide, manganese oxide [N: ([C01B13/02F](#) **takes precedence**)]
 - C01B13/08B [N: with barium oxide]
 - C01B13/08D [N: with manganese oxide]
 - C01B13/10 . . . Preparation of ozone
 - C01B13/11 . . . by electric discharge
- [N: **Notes**
[N1110] In groups [C01B13/11](#) and [C01B13/11B](#), additional features relating to the preparation of ozone by electrical discharge are indexed with codes chosen from [M01B201/00](#) to [M01B201/90](#).
]
- C01B13/11B [N: characterised by the electrical circuits producing the electrical discharge] [N9409]
 - C01B13/14 . . . 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)
 - C01B13/14B . . . [N: After-treatment of oxides or hydroxides, e.g. pulverising, drying, decreasing the acidity]
 - C01B13/16 . . . Purification
 - C01B13/18 . . . by thermal decomposition of compounds, e.g. of salts or hydroxides
 - C01B13/18B [N: Preparing mixtures of oxides]
 - C01B13/20 . . . by oxidation of elements in the gaseous state; by oxidation or hydrolysis of compounds in the gaseous state
 - C01B13/22 of halides or oxyhalides

- C01B13/24 in the presence of hot combustion gases
- C01B13/26 in the presence of a fluidised bed
- C01B13/28 using a plasma or an electric discharge
- C01B13/30 Removal and cooling of the oxide-containing suspension
- C01B13/32 . . by oxidation or hydrolysis of elements or compounds in the liquid or solid state [N: or in non-aqueous solution, e.g. sol-gel process] [C1110]
- C01B13/32B . . . [N: of elements or compounds in the solid state]
- C01B13/32B4 [N: by solid combustion synthesis]
- C01B13/32C . . . [N: of elements or compounds in the liquid state]
- C01B13/32P . . . [N: by processes making use of emulsions, e.g. the kerosine process]
- C01B13/34 . . by oxidation or hydrolysis of sprayed or atomised solutions
- C01B13/36 . . by precipitation reactions in [N: aqueous] solutions [N: (C01B13/32P takes precedence)]
- C01B13/36B . . . [N: Mixtures of oxides or hydroxides by precipitation]
- C01B13/36H . . . [N: by hydrothermal processing]

C01B15/00 Peroxides; Peroxyhydrates; Peroxyacids or salts thereof; Superoxides; Ozonides

- C01B15/00D . [N: Stabilisation of the solid compounds subsequent to the preparation or to the crystallisation, by additives or by coating]
- C01B15/01 . Hydrogen peroxide
- C01B15/013 . . Separation; Purification; Concentration
- C01B15/013D . . . [N: Purification by solid ion-exchangers or solid chelating agents]
- C01B15/017 . . . Anhydrous hydrogen peroxide; Anhydrous solutions or gaseous mixtures containing hydrogen peroxide
- C01B15/022 . . Preparation from organic compounds
- C01B15/023 . . . by the alkyl-anthraquinone process
- C01B15/024 . . . from hydrocarbons
- C01B15/026 . . . from alcohols
- C01B15/027 . . Preparation from water
- C01B15/027B . . . [N: Preparation by reaction of water, carbon monoxide and oxygen] [N9709]
- C01B15/029 . . Preparation from hydrogen and oxygen
- C01B15/029B . . . [N: by electrical discharge]
- C01B15/03 . . Preparation from inorganic peroxy compounds, e.g. from peroxysulfate
- C01B15/032 . . . from metal peroxides
- C01B15/037 . . Stabilisation by additives
- C01B15/04 . Metal peroxides or peroxyhydrates thereof; [N: Metal] superoxides; [N: Metal] ozonides; [N: Peroxyhydrates thereof]
- C01B15/043 . . of alkali metals, alkaline earth metals or magnesium [N: or beryllium or aluminium]
- C01B15/043B . . . [N: of alkali metals]
- C01B15/047 . . of heavy metals
- C01B15/047B . . . [N: of actinides]

- C01B15/055 . Peroxyhydrates ([C01B15/04 takes precedence](#)); Peroxyacids or salts thereof
- C01B15/06 . . containing sulfur
- C01B15/08 . . . Peroxysulfates
- C01B15/08D [N: Stabilisation of the solid compounds, subsequent to the preparation or to the crystallisation, by additives or by coating]
- C01B15/10 . . containing carbon
- C01B15/10B . . . [N: containing only alkali metals as metals]
- C01B15/10D . . . [N: Stabilisation of the solid compounds, subsequent to the preparation or to the crystallisation, by additives or by coating]
- C01B15/12 . . containing boron
- C01B15/12D . . . [N: Stabilisation of the solid compounds, subsequent to the preparation or to the crystallisation, by additives or by coating]
- C01B15/12H . . . [N: Dehydration of solid hydrated peroxyborates to less hydrated or anhydrous products]
- C01B15/14 . . containing silicon
- C01B15/16 . . containing phosphorus

C01B17/00 Sulfur; Compounds thereof

- C01B17/02 . Preparation of sulfur; Purification
- C01B17/02F . . [N: Separation of sulfur from liquids, e.g. by coalescence] [N9412] [C9505]
- C01B17/02G . . [N: Separation of sulfur from gases] [N9412]
- C01B17/02K . . [N: Solidification or cooling of liquid sulfur] [N9505]
- C01B17/02M . . [N: Melting] [N9412]
- C01B17/02N . . [N: Vaporising or superheating] [N9412] [C9505]
- C01B17/02P . . [N: Purification, e.g. degassing] [C9801]
- C01B17/02S . . [N: Converting into particles, e.g. by granulation, milling] [N9412]
- C01B17/02T . . [N: Other after-treatment of sulfur] [N9505]
- C01B17/02T2 . . . [N: of particulate sulfur] [N9505]
- C01B17/02W . . [N: from non-gaseous sulfur compounds other than sulfides or materials containing such sulfides] [N9412]
- C01B17/02W2 . . . [N: by reduction of sulfates] [N9412]
- C01B17/02W2C [N: of calcium sulfates] [N9412]
- C01B17/02Z . . Recovery of sulfur from material containing elemental sulfur, e.g. luxmasses [N: or sulfur containing ores]; Purification [N: of the recovered sulfur] [C9412]
- C01B17/033 . . . using a liquid extractant
- C01B17/04 . . from gaseous sulfur compounds including gaseous sulfides
- C01B17/04B . . . [N: by processes comprising a dry catalytic conversion of hydrogen sulfide-containing gases, e.g. the Claus process]
- C01B17/04B1 [N: Pretreatment of the hydrogen sulfide containing gases]
- C01B17/04B2 [N: characterised by the combustion step]
- C01B17/04B2B [N: Combustion reactors] [C9409]
- C01B17/04B2D [N: Multistage combustion] [C9409]
- C01B17/04B4 [N: characterised by the catalytic conversion]

- C01B17/04B4B [N: Catalytic converters] [C9409]
- C01B17/04B4D [N: Catalyst compositions] [C9409]
- C01B17/04B4S [N: at least one catalyst bed operating below the dew-point of sulfur]
- C01B17/04B4V [N: in a moving bed] [N9501]
- C01B17/04B6 [N: Separation of the obtained sulfur] [N9409]
- C01B17/04B8 [N: Process control; Start-up or cooling-down procedures of the Claus process] [N9409] [C9601]
- C01B17/04B10 [N: the hydrogen sulfide-containing gas being a Claus process tail gas]
- C01B17/04B14 [N: without intermediate formation of sulfur dioxide] [C9509]
- C01B17/04B14D [N: Catalyst compositions] [N9509]
- C01B17/04B14S [N: at least one catalyst bed operating below the dew-point of sulfur] [N9509]
- C01B17/04D [N: by reaction of sulfur dioxide or sulfur trioxide containing gases with reducing agents other than hydrogen sulfide]
- C01B17/04D2 [N: with hydrocarbons or mixtures containing them]
- C01B17/04D4 [N: with carbon or solid carbonaceous materials]
- C01B17/04D6 [N: with carbon monoxide or carbon monoxide containing mixtures]
- C01B17/04D8 [N: with hydrogen or hydrogen-containing mixtures, e.g. synthesis gas]
- C01B17/04G [N: by dissociation of hydrogen sulfide into the elements]
- C01B17/05 by wet processes
- C01B17/06 from non-gaseous sulfides or materials containing such sulfides, e.g. ores
- C01B17/10 Finely divided sulfur, e.g. sublimed sulfur, flowers of sulfur
- C01B17/12 Insoluble sulfur (mu-sulfur)
- C01B17/12R [N: Sulfur isotopes other than 32S] [N9505]
- C01B17/16 Hydrogen sulfides
- C01B17/16D [N: Preparation from elemental sulfur] [C9705]
- C01B17/16D2 [N: from elemental sulfur and hydrogen] [N9705]
- C01B17/16F [N: Preparation by reduction of oxidic sulfur compounds] [N9705]
- C01B17/16H [N: Preparation from sulfides, oxysulfides or polysulfides] [N9705]
- C01B17/16M [N: Separation] [N9705]
- C01B17/16P [N: Purification]
- C01B17/18 Hydrogen polysulfides
- C01B17/20 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)
- C01B17/22 Alkali metal sulfides or polysulfides
- C01B17/24 Preparation by reduction
- C01B17/26 with carbon
- C01B17/28 with reducing gases
- C01B17/30 Preparation from sodium or potassium amalgam with sulfur or sulfides
- C01B17/32 Hydrosulfides of sodium or potassium

- C01B17/34 . . Polysulfides of sodium or potassium
- C01B17/36 . . Purification
- C01B17/38 . . Dehydration
- C01B17/40 . . Making shaped products, e.g. granules

- C01B17/42 . Sulfides or polysulfides of magnesium, calcium, strontium, or barium
- C01B17/43 . . from oxides or hydroxides with sulfur or hydrogen sulfide
- C01B17/44 . . by reduction of sulfates

- C01B17/45 . Compounds containing sulfur and halogen, with or without oxygen
- C01B17/45B . . [N: containing sulfur and halogen only] [N0703]
- C01B17/45B2 . . . [N: containing sulfur and fluorine only] [N0703]
- C01B17/45B2D [N: Sulfur tetrafluoride] [N0703]
- C01B17/45B2F [N: Sulfur hexafluoride] [N0703]
- C01B17/45B4 . . . [N: containing sulfur and chlorine only] [N0703]
- C01B17/45B4B [N: Sulfur dichloride] [N0703]
- C01B17/45B4F [N: Sulfur hexachloride] [N0703]
- C01B17/45D . . [N: Compounds containing sulfur, halogen and oxygen only] [N0703]
- C01B17/45D2 . . . [N: Thionyl fluoride (SOF₂)] [N0703]
- C01B17/45D4 . . . [N: Sulfuryl fluoride (SO₂F₂)] [N0703]
- C01B17/45D8 . . . [N: Thionyl chloride (SOCl₂)] [N0703]
- C01B17/45D10 . . . [N: Sulfuryl chloride (SO₂Cl₂)] [N0703]

- C01B17/46 . Compounds containing sulfur, halogen, hydrogen, and oxygen
- C01B17/46B . . [N: Fluorosulfonic acid (FSO₃H)] [N0703]
- C01B17/46D . . [N: Chlorosulfonic acid (ClSO₃H)] [N0703]

- C01B17/48 . Sulfur dioxide; Sulfurous acid
- C01B17/50 . . Preparation of sulfur dioxide
- C01B17/50B . . . [N: by reduction of sulfur compounds]
- C01B17/50B2 [N: of sulfur trioxide]
- C01B17/50B4 [N: of sulfuric acid]
- C01B17/50B6 [N: of ammonium sulfates (of ammonium sulfates containing sulfuric acid solutions [C01B17/58F](#))]
- C01B17/50B8 [N: of alkali metal sulfates]
- C01B17/50B10 [N: of calcium sulfates]
- C01B17/50B12 [N: of iron sulfates]
- C01B17/50D . . . [N: by oxidation of sulfur compounds]
- C01B17/52 . . . by roasting sulfides ([C22B1/00](#) takes precedence)
- C01B17/54 . . . by burning elemental sulfur
- C01B17/56 . . . Separation; Purification
- C01B17/58 . . . Recovery of sulfur dioxide from acid tar or the like [N: or from any waste sulfuric acid]
- C01B17/58F [N: from ammonium sulfate containing sulfuric acid solutions]

- C01B17/60 . . . Isolation of sulfur dioxide from gases
- C01B17/62 . Methods of preparing sulfites in general (particular individual sulfites, see the relevant groups of subclasses [C01B](#) to [C01G](#), according to the cation)
- C01B17/62B . . [N: metabisulfites or pyrosulfites]
- C01B17/64 . Thiosulfates; Dithionites; Polythionates
- C01B17/66 . . Dithionites [N: or hydrosulfites (S2O4 2-)]
- C01B17/66K . . . [N: Stabilisation by additives subsequent to preparation; Dust prevention by additives]
- C01B17/69 . Sulfur trioxide; Sulfuric acid
- C01B17/70 . . Stabilisation of gamma-form sulfur trioxide
- C01B17/74 . . Preparation
- C01B17/74B . . . [N: from sulfates]
- C01B17/76 . . . by contact processes
- C01B17/76B [N: High pressure processes]
- C01B17/765 Multi-stage SO₃-conversion
- C01B17/765B [N: with intermediate absorption]
- C01B17/77 Fluidised-bed processes
- C01B17/775 Liquid phase contacting processes or wet catalysis processes
- C01B17/78 characterised by the catalyst used
- C01B17/79 containing vanadium
- C01B17/80 Apparatus
- C01B17/80B [N: Converters]
- C01B17/80D [N: Absorbers; Heat exchangers]
- C01B17/82 . . . of sulfuric acid using a nitrogen oxide process
- C01B17/84 Chamber process
- C01B17/86 Tower process
- C01B17/88 . . Concentration of sulfuric acid
- C01B17/90 . . Separation; Purification
- C01B17/90B . . . [N: 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 [C01B17/50B](#), from spent acids [C01B17/58](#))]
- C01B17/90B10 [N: by dialysis] [N9411]
- C01B17/90B12 [N: by liquid-liquid extraction] [N9411]
- C01B17/90B14 [N: by ion-exchange] [N9411]
- C01B17/90D . . . [N: Removal of organic impurities]
- C01B17/90H . . . [N: Removal of mercury]
- C01B17/90K . . . [N: Removal of arsenic]
- C01B17/90M . . . [N: Removal of antimony or bismuth] [N9411] [C9502]
- C01B17/92 . . . Recovery from acid tar or the like, [N: e.g. alkylation acids (obtaining sulfur dioxide as an intermediate in sulfur trioxide recovery therefrom [C01B17/58](#))]
- C01B17/92H [N: by processes involving a liquid-liquid extraction]

- C01B17/94 . . . Recovery from nitration acids
- C01B17/96 . Methods for the preparation of sulfates in general (particular individual sulfates, see the relevant groups of subclasses [C01B](#) to [C01G](#), according to the cation)
- C01B17/96B . . [N: Pyrosulfates]
- C01B17/98 . Other compounds containing sulfur and oxygen (persulfuric acids [C01B15/06](#); persulfates [C01B15/08](#))

- C01B19/00** **Selenium; Tellurium; Compounds thereof** (phosphorus compounds [C01B25/14](#))
- C01B19/00B . [N: Preparation involving a liquid-liquid extraction, an adsorption or an ion-exchange]
- C01B19/00D . [N: Compounds containing, besides selenium or tellurium, more than one other element, with -O- and -OH not being considered as anions]
- C01B19/00H . [N: Oxides; Hydroxides]
- C01B19/00K . [N: Halides]
- C01B19/00P . [N: Tellurides or selenides of metals ([C01B19/00D](#) takes precedence)]
- C01B19/00R . [N: Salts of oxyacids of selenium or tellurium]
- C01B19/02 . Elemental selenium or tellurium
- C01B19/04 . Binary compounds [N: including binary selenium-tellurium compounds ([C01B19/00H](#), [C01B19/00K](#), [C01B19/00P](#) take precedence)]

- C01B21/00** **Nitrogen; Compounds thereof**
- C01B21/02 . Preparation of nitrogen (by decomposition of ammonia [N: [C01B3/04C](#)]) [C0902]
- C01B21/04 . Purification or separation of nitrogen (by liquefying [F25J](#))
- C01B21/04D . . [N: Purification or separation processes] [N9511]
- [N: **Note**
In this group, additional features relating to the purification or separation processes are indexed with codes chosen from [M01B210/00Q](#) to [M01B210/00W90](#)]
- C01B21/04D2 . . . [N: Chemical processing only] [N9511]
- C01B21/04D2B [N: by oxidation] [N9511]
- C01B21/04D2D [N: by reduction] [N9511]
- C01B21/04D2F [N: by complexation] [N9511]
- C01B21/04D4 . . . [N: Physical processing only] [N9511]
- C01B21/04D4B [N: by making use of membranes] [N9511]
- C01B21/04D4B2 [N: characterised by the membrane] [N9511]
- C01B21/04D4D [N: by adsorption in solids] [N9511]
- C01B21/04D4D2 [N: characterised by the adsorbent] [N9511]

| | | |
|----------------|-----------|--|
| C01B21/04D4D2C | | [N: Carbon based materials] [N9511] |
| C01B21/04D4D2F | | [N: Zeolites] [N9511] |
| C01B21/04D4D2K | | [N: Other molecular sieve materials] [N9511] |
| C01B21/04D4D8 | | [N: Temperature swing adsorption] [N9511] |
| C01B21/04D4D12 | | [N: in getters] [N9511] |
| C01B21/04D4F | | [N: by absorption in liquids] [N9511] |
| C01B21/04D6 | | [N: Combined chemical and physical processing] [N9511] |

[N: Note

In this group, processing steps are indexed with codes chosen from [M01B210/00D](#) to [M01B210/00D4F](#)]

| | | |
|-----------|-----------|---|
| C01B21/06 | | Binary compounds of nitrogen with metals, with silicon, or with boron, [N: or with carbon, i.e. nitrides; Compounds of nitrogen with more than one metal, silicon or boron] (azides C01B21/08) [C9501] |
|-----------|-----------|---|

[N: Notes

- Binary compounds, i.e. compounds of nitrogen with only one other element chosen from metals, silicon, boron or carbon, are classified in groups [C01B21/06](#) or [C01B21/06C](#) to [C01B21/076](#). Compounds of nitrogen with more than one element chosen from metals, silicon or boron are classified in [C01B21/06B](#)
- Documents relating to several specific binary compounds are classified in 21/06 only and receive the indexing codes chosen from [M01B21/06B](#) to [M01B21/076](#) to identify the specific compounds

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| | | |
|--------------|-----------|--|
| C01B21/06B | | [N: with two or more other elements chosen from metals, silicon or boron] [C9501] |
| C01B21/06C | | [N: Binary compounds of nitrogen with carbon] [N9501] |
| C01B21/06D | | [N: with alkali metals] [N9409] |
| C01B21/06D2 | | [N: with lithium] [N9409] |
| C01B21/06E | | [N: with alkaline-earth metals, beryllium or magnesium] [N9409] |
| C01B21/06F | | [N: with transition metals other than titanium, zirconium or hafnium] [N9409] |
| C01B21/06F2 | | [N: with vanadium, niobium or tantalum] [N9409] |
| C01B21/06F4 | | [N: with chromium, molybdenum or tungsten] [N9409] |
| C01B21/06F6 | | [N: with iron, cobalt or nickel] [N9409] |
| C01B21/06F8 | | [N: with copper] [N9409] |
| C01B21/06F10 | | [N: with one or more rare earth metals] [N9409] |
| C01B21/06F12 | | [N: with one or more actinides, e.g. UN, PuN] [N9409] |
| C01B21/06K | | [N: with gallium, indium or thallium] [N9409] |
| C01B21/06L | | [N: with germanium, tin or lead] [N9409] |
| C01B21/06R | | [N: with metals not specified in groups C01B21/06D to C01B21/06L , other than aluminium, titanium, zirconium or hafnium] [N9409] |
| C01B21/064 | | with boron [C0309] |
| C01B21/064B | | [N: Preparation by direct nitridation of elemental boron] [N0309] |
| C01B21/064C | | [N: Preparation from boron halides] [N0309] |
| C01B21/064D | | [N: Preparation by carboreductive nitridation] [N0309] |

- C01B21/064F . . . [N: Preparation by pyrolysis of boron and nitrogen containing compounds] [N0309]
- C01B21/064T . . . [N: After-treatment, e.g. grinding, purification (transformation of hexagonal into cubic or wurtzitic boron nitride [C04B35/5831](#))] [N0309]
- C01B21/068 . . with silicon
- C01B21/068B . . . [N: Preparation by direct nitridation of silicon]
- C01B21/068D . . . [N: Preparation by carboreductive nitridation]
- C01B21/068T . . . [N: After-treatment, e.g. grinding, purification]
- C01B21/072 . . with aluminium
- C01B21/072B . . . [N: Preparation by direct nitridation of aluminium] [C0311]
- C01B21/072B8 [N: using a plasma] [N9508]
- C01B21/072D . . . [N: Preparation by carboreductive nitridation]
- C01B21/072T . . . [N: After-treatment, e.g. grinding, purification]
- C01B21/076 . . with titanium or zirconium [N: or hafnium]
- C01B21/076B . . . [N: Preparation by direct nitridation of titanium, zirconium or hafnium] [N0311]
- C01B21/076C . . . [N: Preparation from titanium, zirconium or hafnium halides] [N0311]
- C01B21/076D . . . [N: Preparation by carboreductive nitridation] [N0311]
- C01B21/076F . . . [N: Preparation by pyrolysis of nitrogen containing titanium, zirconium or hafnium compounds] [N0311]
- C01B21/076T . . . [N: After-treatment, e.g. grinding, purification] [N0311]
- C01B21/08 . . Hydrazoic acid; Azides; Halogen azides
- C01B21/082 . . Compounds containing nitrogen and non-metals [N: and optionally metals] ([C01B21/06](#), [C01B21/08](#) take precedence)
- C01B21/082B . . [N: Oxynitrides of metals, boron or silicon] [C9711]
- C01B21/082B2 . . . [N: Silicon oxynitrides]
- C01B21/082B3 . . . [N: Aluminium oxynitrides] [N0401]
- C01B21/082B4 . . . [N: Silicon aluminium oxynitrides, i.e. sialons]
- C01B21/082D . . [N: Carbonitrides or oxycarbonitrides of metals, boron or silicon] [C9711]
- C01B21/083 . . containing one or more halogen atoms
- C01B21/083B . . . [N: Binary compounds of nitrogen with halogens]
- C01B21/083B2 [N: Nitrogen trifluoride][N0410]
- C01B21/083B2P [N: Purification][N0410]
- C01B21/084 . . . containing also one or more oxygen atoms, e.g. nitrosyl halides
- C01B21/084B [N: Halides of nitrogen oxides]
- C01B21/084B1 [N: Nitrosyl fluoride] [N9810]
- C01B21/084B2 [N: Nitrosyl chloride]
- C01B21/084D [N: Nitrosyl perchlorate] [N9810]
- C01B21/086 . . containing one or more sulfur atoms
- C01B21/086B . . . [N: Binary compounds of nitrogen with sulfur]
- C01B21/087 . . containing one or more hydrogen atoms
- C01B21/088 . . . containing also one or more halogen atoms
- C01B21/09 Halogeno-amines, e.g. chloramine

- C01B21/09B [N: Chloramine, i.e. NH₂Cl or dichloramine, i.e. NHC_l2]
- C01B21/09Z containing also one or more metal atoms
- C01B21/09ZB [N: Metal imides or amides (silicon imides or amides [C01B21/087](#))]
- C01B21/09ZB2 [N: of alkali metals]
- C01B21/09Z containing also one or more sulfur atoms
- C01B21/09ZB [N: Imidodisulfonic acid; Nitrilotrisulfonic acid; Salts thereof]
- C01B21/09A Nitrosyl containing acids
- C01B21/096 Amidosulfonic acid; Salts thereof
- C01B21/097 containing phosphorus atoms
- C01B21/097B [N: containing also one or more sulfur atoms]
- C01B21/098 Phosphonitrilic dihalides; Polymers thereof
- C01B21/098A [N: Phosphonitrilic difluorides; Polymers thereof] [N9409]
- C01B21/098B [N: Phosphonitrilic dichlorides; Polymers thereof]
- C01B21/12 Carbamic acid [N: or thiocarbamic acid]; Salts thereof [C1007]
- C01B21/12B [N: Metal carbamates]
- C01B21/14 Hydroxylamine; Salts thereof
- C01B21/14B [N: Preparation]
- C01B21/14B2 [N: by catalytic reduction of nitrogen oxides or nitrates with hydrogen]
- C01B21/14B4 [N: by reduction of nitrogen oxides or nitrites with bisulfite or sulfur dioxide, e.g. by the Raschig process]
- C01B21/14B6 [N: by reaction in the gas phase, e.g. of nitrogen, hydrogen and oxygen]
- C01B21/14B8 [N: of hydroxylamine from its salts]
- C01B21/14B10 [N: of hydroxylamine salts by processes not covered by one or more of groups [C01B21/14B2](#) to [C01B21/14B8](#), e.g. by conversion of one salt into another]
- C01B21/14F [N: Concentration]
- C01B21/14H [N: Separation]
- C01B21/14P [N: Purification]
- C01B21/14S [N: Stabilisation]
- C01B21/16 Hydrazine; Salts thereof

- C01B21/20 Nitrogen oxides; Oxyacids of nitrogen; Salts thereof
- C01B21/20A [N: Preparation of nitrogen oxides using a plasma or an electric discharge] [N0101]
- C01B21/20B [N: Nitric anhydride (N₂O₅) ([C01B21/20A](#) takes precedence)] [C0101]
- C01B21/22 Nitrous oxide (N₂O) [N: ([C01B21/20A](#) takes precedence)] [C0101]
- C01B21/24 Nitric oxide (NO) [N: ([C01B21/20A](#) takes precedence)] [C0101]
- C01B21/26 Preparation by catalytic [N: or non-catalytic] oxidation of ammonia
- C01B21/26B [N: obtaining nitrogen dioxide or tetroxide]
- C01B21/26C [N: characterised by the catalyst]
- C01B21/26D [N: Means for preventing deterioration or loss of catalyst or for recovering lost catalyst]
- C01B21/28 Apparatus
- C01B21/30 Preparation by oxidation of nitrogen [N: ([C01B21/26](#) takes precedence)]
- C01B21/32 Apparatus

- C01B21/34 . . Nitrogen trioxide (N₂O₃) [N: ([C01B21/20A](#) takes precedence)] [C0101]
- C01B21/36 . . Nitrogen dioxide (NO₂, N₂O₄) ([N: [C01B21/20A](#)], [C01B21/26](#), [C01B21/30](#) take precedence) [C0101]
- C01B21/38 . . Nitric acid
- C01B21/40 . . . Preparation by absorption of oxides of nitrogen [N: ([C01B21/26](#) takes precedence)]
- C01B21/42 . . . Preparation from nitrates
- C01B21/44 . . . Concentration [N: ([C01B21/40](#) takes precedence)]
- C01B21/46 . . . Purification; Separation; [N: Stabilisation ([C01B21/40](#) takes precedence)]
- C01B21/48 . . Methods for the preparation of nitrates in general (particular individual nitrates, see the relevant groups of subclasses [C01B](#) to [C01G](#), according to the cation)
- C01B21/50 . . Nitrous acid; Salts thereof

C01B23/00 **Noble gases; Compounds thereof** (liquefying [F25J](#); [N: noble gases obtained by rectification [F25J3/02C30](#)]) [C1111]

- C01B23/00B . [N: Compounds of noble gases]
- C01B23/00D . [N: Purification or separation processes of noble gases] [N9511]
- C01B23/00D2 . . [N: Chemical processing only] [N9511]
- C01B23/00D2B . . . [N: by oxidation] [N9511]
- C01B23/00D2D . . . [N: by reduction] [N9511]
- C01B23/00D2F . . . [N: by complexation] [N9511]
- C01B23/00D4 . . [N: Physical processing only] [N9511]
- C01B23/00D4B . . . [N: by making use of membranes] [N9511]
- C01B23/00D4B2 [N: characterised by the membrane] [N9511]
- C01B23/00D4D . . . [N: by adsorption in solids] [N9511]
- C01B23/00D4D2 [N: characterised by the adsorbent] [N9511]
- C01B23/00D4D2C [N: Carbon based materials] [N9511]
- C01B23/00D4D2F [N: Zeolites] [N9511]
- C01B23/00D4D2K [N: Other molecular sieve materials] [N9511]
- C01B23/00D4D8 [N: Temperature swing adsorption] [N9511]
- C01B23/00D4D12 [N: in getters] [N9511]
- C01B23/00D4F . . . [N: by absorption in liquids] [N9511]
- C01B23/00D6 . . [N: Combined chemical and physical processing] [N9511]

[N: **Note**

In this group, processing steps are indexed with codes chosen from [M01B210/00D](#) to [M01B210/00D4F](#)

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C01B25/00 **Phosphorus; Compounds thereof** ([N: [C01B6/00](#)], [C01B21/00](#), [C01B23/00](#) take precedence; perphosphates [C01B15/16](#)) [C9711]

- C01B25/00B . [N: Phosphorus]
- C01B25/00B2 . . [N: Stabilisation ([C01B25/04](#) takes precedence)]

- C01B25/01 . Treating phosphate ores or other raw phosphate materials to obtain phosphorus or phosphorus compounds
- C01B25/02 . Preparation of phosphorus
- C01B25/023 . . of red phosphorus
- C01B25/027 . . of yellow phosphorus
- C01B25/04 . Purification of phosphorus
- C01B25/043 . . of red phosphorus
- C01B25/047 . . of yellow phosphorus
- C01B25/06 . Hydrogen phosphides
- C01B25/08 . Other phosphides
- C01B25/08B . . [N: of alkali metals, alkaline-earth metals or magnesium]
- C01B25/08D . . [N: of boron, aluminium, gallium or indium]
- C01B25/08D2 . . . [N: of boron]
- C01B25/08D4 . . . [N: of aluminium]
- C01B25/08D6 . . . [N: of gallium or indium]
- C01B25/08F . . [N: containing plural metal]
- C01B25/10 . Halides or oxyhalides of phosphorus
- C01B25/12 . Oxides of phosphorus
- C01B25/14 . Sulfur, selenium, or tellurium compounds of phosphorus [C9508]
- C01B25/16 . Oxyacids of phosphorus; Salts thereof (peroxyacids or salts thereof [C01B15/00](#))
- C01B25/16B . . [N: containing at least one phosphorus atom with an oxidation number less than five, other than those mentioned below; Salts thereof]
- C01B25/163 . . Phosphorous acid; Salts thereof
- C01B25/165 . . Hypophosphorous acid; Salts thereof
- C01B25/168 . . Pyrophosphorous acid; Salts thereof
- C01B25/18 . . Phosphoric acid
- C01B25/18B . . . [N: 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]
- C01B25/20 . . . Preparation from elemental phosphorus or phosphoric anhydride
- C01B25/22 . . . Preparation by reacting phosphate-containing material with an acid, e.g. wet process
- C01B25/22B [N: Arrangements of vessels used in reacting phosphate-containing material in wet process]
- C01B25/22D [N: with an acid or a mixture of acids other than sulfuric acid]
- C01B25/22D2 [N: with hydrochloric acid or hydrogen chloride in aqueous medium]
- C01B25/22D4 [N: with nitric acid or nitrous vapours in aqueous medium]
- C01B25/222 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 [C9508]
- C01B25/223 only one form of calcium sulfate being formed
- C01B25/223B [N: Anhydrite processes]
- C01B25/225 Dihydrate process
- C01B25/226 Hemihydrate process
- C01B25/228 one form of calcium sulfate being formed and then converted to another form [C9508]
- C01B25/228B [N: Dihydrate-anhydrite or hemihydrate-anhydrite process]
- C01B25/229 Hemihydrate-dihydrate process
- C01B25/229B {7 dots} [N: the conversion being performed in one or more vessels different from those used for reaction after separation of phosphoric acid]
- C01B25/231 Dihydrate-hemihydrate process
- C01B25/232 Preparation by reacting phosphate containing material with concentrated sulfuric acid and subsequently lixiviating the obtained mass, e.g. clinker process [C9508]
- C01B25/234 Purification; Stabilisation; Concentration (purification concomitant with preparation [C01B25/22](#); preparation involving solvent-solvent extraction [C01B25/46](#))
- C01B25/234B [N: Concentration concomitant with purification, e.g. elimination of fluorine]
- C01B25/234B2 [N: Concentration]
- C01B25/235 Clarification; Stabilisation to prevent post-precipitation of dissolved impurities
- C01B25/237 Selective elimination of impurities [N: ([C01B25/234B](#) takes precedence)]
- C01B25/237B [N: Anionic impurities, e.g. silica or boron compounds] [C9508]
- C01B25/237B2 [N: Fluoride or fluosilicate anion]
- C01B25/237B4 [N: Sulfate]
- C01B25/238 Cationic impurities, [N: e.g. arsenic compounds] [C9508]
- C01B25/24 Condensed phosphoric acids
- C01B25/26 Phosphates (perphosphates [C01B15/16](#))
- C01B25/26B [N: General methods for obtaining phosphates]
- C01B25/28 Ammonium phosphates
- C01B25/30 Alkali metal phosphates
- C01B25/30B [N: Preparation from liquid orthophosphoric acid or from an acid solution or suspension of orthophosphates (using ion-exchangers [C01B25/30](#))]
- C01B25/30B2 [N: with elimination of impurities]
- C01B25/30D [N: Preparation from phosphorus-containing compounds by alkaline treatment]
- C01B25/30D2 [N: from phosphates]
- C01B25/30F [N: Methods for converting an alkali metal orthophosphate into another one; Purification; Decolorasing; Dehydrating; Drying]
- C01B25/32 Phosphates of magnesium, calcium, strontium, or barium
- C01B25/32A [N: Methods for converting an alkaline earth metal ortho-phosphate into another ortho-phosphate (by reaction, e.g. of phosphate rock with phosphoric acid [C01B25/32B](#))] [N9603]
- C01B25/32B [N: Preparation by neutralisation of orthophosphoric acid]

- C01B25/32D [N: Preparation from a reaction solution obtained by acidifying with an acid other than orthophosphoric acid]
- C01B25/32F [N: Preparation by double decomposition]
- C01B25/32K [N: After-treatment (increasing the phosphate content of ores [C01B25/32](#))]
- C01B25/32M [N: Defluorination during or after the preparation]
- C01B25/34 Magnesium phosphates
- C01B25/36 Aluminium phosphates
- C01B25/37 Phosphates of heavy metals
- C01B25/37B [N: of titanium, vanadium, zirconium, niobium, hafnium or tantalum]
- C01B25/37D [N: of iron]
- C01B25/37F [N: of manganese]
- C01B25/38 Condensed phosphates
- C01B25/38B [N: of alkaline-earth metals or magnesium]
- C01B25/39 of alkali metals
- C01B25/39B [N: Preparation and dehydrating]
- C01B25/40 Polyphosphates
- C01B25/40B [N: of ammonium]
- C01B25/41 of alkali metals
- C01B25/41B [N: Preparation from alkali metal orthophosphates]
- C01B25/41B2 {7 dots} [N: Apparatus]
- C01B25/41B4 {7 dots} [N: Pure alkali metal polyphosphates from impure starting materials]
- C01B25/41D [N: After-treatment]
- C01B25/42 Pyrophosphates
- C01B25/42B [N: of alkali metals]
- C01B25/44 Metaphosphates
- C01B25/445 of alkali metals
- C01B25/45 containing plural metal, or metal and ammonium
- C01B25/45B [N: containing metal and ammonium] [C9711]
- C01B25/45D [N: having molecular-sieve properties]
- [N: **WARNING** [N0806]
Group [C01B25/45D](#) 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 [C01B37/00](#) and [C01B39/00](#).
]
- C01B25/455 containing halogen [N: (completely halogenated alkali metal phosphates [C01D](#), e.g. lithium hexafluorophosphate [C01D15/00B](#))] [C9909]
- C01B25/455B [N: Hypochlorite-phosphate double salts, e.g. 4(Na3PO411H2O). NaOCl or so-called chlorinated trisodium phosphate]
- C01B25/46 . . . Preparation involving solvent-solvent extraction (solvent extraction in general [B01D11/00](#))
- C01B25/46B [N: 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 [C01B25/237](#))]

[N: Notes

1. 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
2. Documents which belong to more than one subgroup of [C01B25/46B2](#) to [C01B25/46B10](#) are classified by a combination, e.g. [C01B25/46B2](#)+B4+B8

]

- [C01B25/46B2](#) [N: the extracting agent being alcohol or a mixture of alcohols]
[C01B25/46B4](#) [N: the extracting agent being a ketone or a mixture of ketones]
[C01B25/46B6](#) [N: the extracting agent being an ether or a mixture of ethers]
[C01B25/46B8](#) [N: the extracting agent being an ester or a mixture of esters]
[C01B25/46B10](#) [N: the extracting agent being a nitrogenous solvent or a mixture of nitrogenous solvents such as amines or amides]
[C01B25/46D](#) . . . [N: the extracting agent being already present during the phosphate-containing material reaction step]
[C01B25/46F](#) . . . [N: the extraction being performed on the reaction slurry itself, i.e. without separating the acid ([C01B25/232](#) takes precedence)]

C01B31/00

Carbon; Compounds thereof ([N: [C01B6/00](#)], [C01B21/00](#), [C01B23/00](#) take precedence; percarbonates [C01B15/10](#); carbon black [C09C1/48](#); gas carbon production [C10B](#)) [[C9602](#)]

- [C01B31/00D](#) . [N: Carbon fluorides, e.g. (CF)_n or (C₂F)_n (preparation of intercalation compounds of graphite with fluorine [C01B31/04C](#))] [[C1201](#)]
[C01B31/02](#) . Preparation of carbon (by using ultra high pressure, e.g. for the formation of diamonds, [B01J3/06](#); by crystal growth [C30B](#)); Purification; [N: After-treatment] [[C9603](#)]
[C01B31/02B](#) . . [N: Nanosized carbon materials (graphene [C01B31/04H](#))] [[C1104](#)]
[C01B31/02B2](#) . . . [N: Fullerenes] [[N1104](#)]
[C01B31/02B4](#) . . . [N: Carbon nanotubes] [[N1104](#)]

[N: Note [[N1104](#)]

In groups [C01B31/02B4](#) to [C01B31/02B6](#) it is desirable to add indexing codes for structural aspects or properties of carbon nanotubes. The indexing codes are chosen from [M01B202/00](#) to [M01B202/36](#)

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- [C01B31/02B4B](#) [N: Preparation] [[N1104](#)]
[C01B31/02B4B2](#) [N: characterized by the catalyst] [[N1104](#)]
[C01B31/02B4B4](#) [N: being a continuous process] [[N1104](#)]
[C01B31/02B4B6](#) [N: in the liquid phase] [[N1104](#)]
[C01B31/02B4D](#) [N: After-treatments] [[N1104](#)]
[C01B31/02B4D2](#) [N: Purification] [[N1104](#)]
[C01B31/02B4D4](#) [N: Sorting] [[N1104](#)]
[C01B31/02B4D6](#) [N: Derivatisation, solubilisation or dispersion in solvents] [[N1104](#)]
[C01B31/02B4D8](#) [N: Cutting] [[N1104](#)]
[C01B31/02B4D10](#) [N: Opening or filling] [[N1104](#)]

- C01B31/02B6 . . . [N: Other structures, e.g. nano-onions, nano-scrolls, nano-horns, nano-cones or nano-walls] [N1104]
- C01B31/04 . . Graphite, including modified graphite e.g. graphitic oxides, intercalated graphite, expanded graphite or graphene [C1104]
 - [N: **Note** [N1104]
 - In groups [C01B31/04](#) to [C01B31/04H4B](#) it is desirable to add indexing codes for structural aspects or properties of graphene. The indexing codes are chosen from [M01B204/00](#) to [M01B204/32](#)
 -]
- C01B31/04B . . . [N: Purification; Recovery or purification of graphite formed in iron making, e.g. kish graphite] [N9603]
- C01B31/04C . . . [N: Intercalation] [N1104]
 - [N: **WARNING** [N1104]
 - Group [C01B31/04C](#) is not complete pending a reclassification. See also group [C01B31/00D](#)
 -]
- C01B31/04D . . . [N: Expanded or exfoliated graphite] [N9603] [C1104]
 - [N: **WARNING** [N1104]
 - Groups [C01B31/04F](#) to [C01B31/04H4B](#) are not complete pending a reclassification. See also groups [C01B31/00B](#) and [C01B31/04](#)
 -]
- C01B31/04F . . . [N: Graphitic oxides, graphitic acids or salts thereof] [N1104]
- C01B31/04H . . . [N: Graphene] [N1104]
 - [N: Preparation] [N1104]
 - [N: by CVD] [N1104]
 - [N: by epitaxial growth] [N1104]
 - [N: by exfoliation] [N1104]
 - [N: starting from graphitic oxide] [N1104]
 - [N: After-treatments] [N1104]
 - [N: Purification] [N1104]
- C01B31/06 . . Diamond
- C01B31/06F . . . [N: After-treatment, e.g. purification, irradiation]
- C01B31/08 . Active carbon
 - [N: from waste materials, e.g. tyres, spent sulfite pulp liquor]
 - [N: from distillation residues of coal or petroleum; from petroleum acid sludge] [C9710]
 - [N: After-treatment, e.g. purification (**granulation** [C01B31/14](#))]
 - [N: Coating; Grafting; Microencapsulation]
 - [N: with "molecular sieve" properties]
 - [N: 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] [C9710]
 - [N: Reactivation or regeneration (**by a physical process** [C01B31/08M](#))] [C9710]
 - [N: Apparatus ([C01B31/08M](#) takes precedence)] [C9710]

- C01B31/08T . . [N: Making shaped products, e.g. fibres, spheres, membranes, foam, or the like (granulation [C01B31/14](#))]
 - C01B31/10 . . Preparation by using gaseous activating agents [N: ([C01B31/08M](#), [C01B31/08R](#) take precedence)] [C9710]
 - C01B31/12 . . Preparation by using non-gaseous activating agents [N: ([C01B31/08M](#), [C01B31/08R](#) take precedence)] [C9710]
 - C01B31/12B . . . [N: Preparation by impregnation with a metallic compound]
 - C01B31/14 . . Granulation (apparatus [B01J2/00](#))
- [N: **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
]
- C01B31/18 . Carbon monoxide (metal carbonyls [C01G](#))
 - C01B31/20 . Carbon dioxide
 - C01B31/22 . . Solidifying
 - C01B31/24 . 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)
 - C01B31/26 . Compounds containing carbon and sulfur, e.g. carbon disulfide, carbon oxysulfide; Thiophosgene
 - C01B31/26B . . [N: Carbon disulfide]
 - C01B31/26B2 . . . [N: Preparation by reacting sulfur or a sulfur compound with a hydrocarbon]
 - C01B31/26D . . [N: Carbon oxysulfide]
 - C01B31/28 . Phosgene
 - C01B31/30 . Carbides (alloys [C22](#))
 - C01B31/30B . . [N: Oxycarbides, sulfocarbides or mixtures of carbides with other bodies, e.g. graphite; Carbides of other non-metals, e.g. silicocarbides, borocarbides] [C9712]
- [N: **Note**
Mixtures of carbides, other than those covered by group [C01B31/30J](#), and belonging to more than one of the groups [C01B31/30D](#) to [C01B31/36](#) are classified in [C01B31/30B](#)
]
- C01B31/30D . . [N: Simple carbides of elements not covered below]
 - C01B31/30F . . [N: Titanium carbides]
 - C01B31/30H . . [N: Carbides of actinides]
 - C01B31/30J . . [N: Carbides of alkali metals, strontium, barium or magnesium; Mixtures thereof with calcium carbide]
 - C01B31/32 . . Calcium carbide
 - C01B31/34 . . Tungsten or molybdenum carbides
 - C01B31/36 . . Carbides of silicon or boron
- C01B33/00 Silicon; Compounds thereof** ([N: [C01B6/00](#), [C01B21/00](#), [C01B23/00](#) take precedence;

persilicates [C01B15/14](#); carbides [C01B31/36](#)) [[C9602](#)]

- C01B33/02 . Silicon (forming single crystals or homogeneous polycrystalline material with defined structure [C30B](#))
- C01B33/021 . . Preparation (chemical coating from the vapour phase [C23C16/00](#))
- C01B33/023 . . . by reduction of silica or [N: free] silica-containing material [[C9510](#)]
- C01B33/025 with carbon or a solid carbonaceous material, i.e. carbo-thermal process
- C01B33/027 . . . by decomposition or reduction of gaseous or vaporised silicon compounds other than silica or silica-containing material
- C01B33/029 by decomposition of monosilane
- C01B33/03 by decomposition of silicon halides or halosilanes or reduction thereof with hydrogen as the only reducing agent
- C01B33/031 by decomposition of silicon tetraiodide
- C01B33/033 by reduction of silicon halides or halosilanes with a metal or a metallic alloy as the only reducing agents
- C01B33/035 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
- C01B33/037 . . Purification (by zone-melting [C30B13/00](#))
- C01B33/039 . . . by conversion of the silicon into a compound, optional purification of the compound, and reconversion into silicon
- C01B33/04 . Hydrides of silicon
- C01B33/04B . . [N: Monosilane]
- C01B33/04D . . [N: Purification]
- C01B33/06 . Metal silicides (alloys [C22](#))
- C01B33/08 . Compounds containing halogen
- C01B33/10 . . Compounds containing silicon, fluorine, and other elements
- C01B33/10B . . . [N: Fluosilicic acid; Salts thereof]
- C01B33/107 . . Halogenated silanes
- C01B33/107B . . . [N: Tetrafluoride]
- C01B33/107D . . . [N: Tetrachloride, trichlorosilane or silicochloroform, dichlorosilane, monochlorosilane or mixtures thereof]
- C01B33/107D2 [N: prepared by reacting chlorine with silicon or a silicon-containing material]
- C01B33/107D2B [N: with the preferential formation of tetrachloride]
- C01B33/107D2B2 [N: from silicon]
- C01B33/107D2D [N: with the preferential formation of trichlorosilane]
- C01B33/107D2D2 [N: from silicon]
- C01B33/107D4 [N: prepared by hydrochlorination of silicon or of a silicon-containing material]
- C01B33/107D4B [N: with the preferential formation of tetrachloride]
- C01B33/107D4B2 [N: from silicon]

- C01B33/107D4D [N: with the preferential formation of trichlorosilane]
- C01B33/107D4D2 [N: from silicon]
- C01B33/107F [N: Tetrabromide; Tetraiodide]
- C01B33/107G [N: Halogenated silanes obtained by disproportionation and molecular rearrangement of halogenated silanes]
- C01B33/107H [N: Purification]
- C01B33/107H2 [N: by adsorption]
- C01B33/107H2B [N: the adsorbing material being formed in situ, e.g. by partial hydrolysis]
- C01B33/107H4 [N: by forming addition compounds or complexes, the reactant being possibly contained in an adsorbent]
- C01B33/113 Silicon oxides; Hydrates thereof [N: (preparing monoxide by reduction of siliceous material [C01B33/18B2](#))]
- C01B33/12 Silica; Hydrates thereof, e.g. lepidoic silicic acid
- C01B33/12B [N: Lepidoic silicic acid]
- C01B33/12D [N: Preparation of adsorbing porous silica not in gel form and not finely divided, i.e. silicon skeletons, by acidic treatment of siliceous materials]
- C01B33/12F [N: Preparation of silica of undetermined type]
- C01B33/12F2 [N: by acidic treatment of aqueous silicate solutions]
- C01B33/14 Colloidal silica, e.g. dispersions, gels, sols
- C01B33/141 Preparation of hydrosols or aqueous dispersions
- C01B33/141B [N: by oxidation of silicon in basic medium]
- C01B33/141D [N: by suspending finely divided silica in water]
- C01B33/141D2 [N: an aqueous dispersion being obtained]
- C01B33/142 by acidic treatment of silicates
- C01B33/143 of aqueous solutions of silicates
- C01B33/143B {7 dots} [N: using ion exchangers]
- C01B33/145 Preparation of hydroorganosols, organosols or dispersions in an organic medium
- C01B33/146 After-treatment of sols ([N: preparation of hydrosols or aqueous dispersions from hydroorganosols, organosols or dispersions in an organic medium [C01B33/141](#)]; preparation of hydroorganosols, organosols or dispersions in an organic medium from hydrosols [N: or aqueous dispersions] [C01B33/145](#))
- C01B33/146B [N: "Build-up" of particles using only one sol and a "heel" consisting or not of the sol]
- C01B33/148 Concentration; Drying; Dehydration; Stabilisation; Purification [N: ([C01B33/146B](#) takes precedence)]
- C01B33/148B [N: Stabilisation, e.g. prevention of gelling; Purification]
- C01B33/149 Coating
- C01B33/151 by progressively adding a sol to a different sol, i.e. "build-up" of particles using a "heel"
- C01B33/152 Preparation of hydrogels
- C01B33/152B [N: from or via fluosilicic acid or salts thereof]
- C01B33/154 by acidic treatment of aqueous silicate solutions
- C01B33/154B [N: using ion exchangers]
- C01B33/154D [N: the first formed hydrosol being converted to a hydrogel by

- introduction into an organic medium immiscible or only partly miscible with water]
- C01B33/155 Preparation of hydroorganogels or organogels
- C01B33/157 After-treatment of gels
- C01B33/158 Purification; Drying; Dehydrating
- C01B33/158B [N: Dehydration into aerogels]
- C01B33/159 Coating or hydrophobisation
- C01B33/16 Preparation of silica xerogels
- C01B33/16B [N: by hydrolysis of organosilicon compounds, e.g. ethyl orthosilicate]
- C01B33/16D [N: by acidification of silicate in the presence of an inert organic phase]
- C01B33/18 Preparation of finely divided silica neither in sol nor in gel form; After-treatment thereof (preparation of aerogels by dehydrating gels [C01B33/158](#); treatment to enhance the pigmenting or filling properties [C09C](#))
- C01B33/18B [N: by a dry process]
- C01B33/18B2 [N: by reduction of a siliceous material, e.g. with a carbonaceous reducing agent and subsequent oxidation of the silicon monoxide formed]
- C01B33/18B4 [N: by oxidation or hydrolysis in the vapour phase of silicon compounds such as halides, trichlorosilane, monosilane]
- C01B33/18B4B [N: by hydrolysis of tetrafluoride]
- C01B33/18B6 [N: of crystalline silica-polymorphs having molecular sieve properties, e.g. silicalites]
- C01B33/18D [N: from or via fluosilicic acid or salts thereof by a wet process]
- C01B33/187 by acidic treatment of silicates
- C01B33/193 of aqueous solutions of silicates
- C01B33/20 Silicates (persilicates [C01B15/14](#); [N: containing aluminium [C01B33/26](#)])
- C01B33/22 Magnesium silicates
- C01B33/24 Alkaline-earth metal silicates
- C01B33/26 Aluminium-containing silicates, [N: i.e. silico-aluminates]
- C01B33/28 [N: IPC4] Base exchange silicates, e.g. zeolites (regeneration [B01J49/00](#))
- C01B33/28B [N: 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)] [C9501]
- [N: **Note**
Documents which belong to more than one subgroup of [C01B33/C01B28B2](#) to [C01B33/C01B28B8](#) will be described by a combination, e.g. [C01B33/C01B28B2B](#) + B4B. The documents which pertain to the structure of a specific molecular sieve are classified in the relevant subgroup
]
- C01B33/28B2 [N: of type A (UNION CARBIDE trade name; corresponds to GRACE's types Z-12 or Z-12L)]
- C01B33/28B2B [N: from aqueous solutions of an alkali metal aluminate and an alkali metal silicate excluding any other source of alumina or silica]
- C01B33/28B2D [N: 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 [C01B33/28B2](#))
- C01B33/28B4 [N: of faujasite type, or type X or Y (UNION CARBIDE trade names; correspond to GRACE`s types Z-14 and Z-14HS, respectively)]
- C01B33/28B4B [N: of type X] [N0003]
- C01B33/28B4D [N: of type Y]
- C01B33/28B6 [N: of mordenite type, e.g. ptilolite or dachiardite]
- C01B33/28B8 [N: of other types characterised by an X-ray spectrum and a definite composition]
- C01B33/28B10 [N: from a reacting mixture containing an amine or an organic cation, e.g. a quaternary onium cation-ammonium, phosphonium, stibonium]
- C01B33/28B12 [N: the aluminium or the silicon in the network being partly replaced]
- C01B33/28B14 [N: containing an element or a compound occluded in the pores of the network, e.g. an oxide already present in the starting reaction mixture]
- C01B33/32 . . . Alkali metal silicates ([N: [C01B33/20B](#)], [C01B33/26](#) take precedence)]
- C01B33/32B . . . [N: 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] [N9608]
- [N: **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 [C01B33/32](#)]
- C01B33/36 . . . having base-exchange properties but not having molecular sieve properties (regeneration thereof [B01J49/00](#))
- C01B33/38 . . . Layered base-exchange silicates, e.g. clays, micas or alkali metal silicates of kenyaite or magadiite type [N: (activation of naturally occurring clays [B01J20/12](#); pillared layered base-exchange silicates [B01J29/04P](#))] [C1103]
- C01B33/40 Clays
- C01B33/40B [N: not containing aluminium]
- C01B33/42 Micas; [N: Interstratified clay-mica products (delaminated mica or vermiculite platelets obtained by a process involving cation-exchange [C04B14/20G2](#))] [C9812]
- C01B33/42B [N: not containing aluminium]
- C01B33/44 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
- C01B33/46 Amorphous silicates, e.g. so-called "amorphous zeolites" (crystalline zeolites [C01B39/00](#))
- C01B35/00** **Boron; Compounds thereof** (monoborane, diborane, metal borohydrides or addition complexes thereof [C01B6/00](#); perborates [C01B15/12](#); binary compounds with nitrogen [C01B21/06](#); [N: compounds of noble gases [C01B23/00B](#)]; phosphides [C01B25/08](#); carbides [C01B31/36](#); alloys containing boron C22) [C9602]
- C01B35/02 . . . Boron; Borides
- C01B35/02B . . . [N: Boron]

- C01B35/02D . . [N: Higher boron hydrides, i.e. containing at least three boron atoms]
- C01B35/04 . . Metal borides

- C01B35/06 . Boron halogen compounds
- C01B35/06B . . [N: Halides]
- C01B35/06D . . [N: Tetrafluoboric acid; Salts thereof]
- C01B35/06D2 . . . [N: Tetrafluoboric acid]
- C01B35/06D4 . . . [N: Alkali metal tetrafluoborates]
- C01B35/06F . . [N: Halogenated hydrides]

- C01B35/08 . Compounds containing boron and nitrogen, phosphorus, oxygen, sulfur, selenium or tellurium

- C01B35/10 . . Compounds containing boron and oxygen ([C01B35/06](#) takes precedence)
- C01B35/10A . . . [N: having molecular-sieve properties]
- C01B35/10B . . . [N: Carbonyl compounds derived from boron hydrides]
- C01B35/10D . . . [N: Oxides]
- C01B35/10D2 [N: Boric anhydride]
- C01B35/10F [N: Oxyacids]
- C01B35/10F2 [N: Orthoboric acid]
- C01B35/10F2B [N: Preparation from boron ores or borates using acids or salts]
- C01B35/10F2B2 [N: by means of ammonia-carbon dioxide]
- C01B35/10F2D [N: Preparation by working up other natural sources, e.g. seawater]
- C01B35/10F2F [N: Purification; Separation; Concentration]
- C01B35/12 . . . Borates [N: ([C01B35/10F2B](#) takes precedence)]
- C01B35/12B [N: of alkali metal]
- C01B35/12B2 [N: Sodium tetraborates; Hydrates thereof, e.g. borax]
- C01B35/12B2B [N: Preparation from boron ores or other borates]
- C01B35/12B2D [N: Preparation by working up natural brines, e.g. seawater]
- C01B35/12B2F [N: Purification; Concentration; Dehydration; Stabilisation; Other after-treatment]

- C01B35/12D [N: of alkaline-earth metals, beryllium, aluminium or magnesium]
- C01B35/12F [N: of heavy metals]
- C01B35/12G [N: containing plural metal or metal and ammonium]
- C01B35/14 . . Compounds containing boron and nitrogen, phosphorus, sulfur, selenium or tellurium [C9710]
- C01B35/14B . . . [N: Phosphates]
- C01B35/14D . . . [N: Compounds containing boron and nitrogen, e.g. borazoles (ammonium tetrafluoborates [C01B35/06D](#); ammonium borates [C01B35/12](#))]

- Guide heading:** **Compounds characterised primarily by their physical or chemical properties, rather than by their chemical constitution**

- C01B37/00** **Compounds having molecular sieve properties but not having base-exchange properties**

[N: Note

Compounds classified in main group [C01B37/00](#) are also classified in other groups of class [C01](#) according to their composition

]

- C01B37/00B . [N: Metallophosphates not containing aluminium, e.g. gallophosphates or silicogallophosphates]
- C01B37/00D . [N: Silicates, i.e. so-called metasilicalites or metallozeosilites]
- C01B37/00F . [N: Borosilicates] [N9605]
- C01B37/02 . Crystalline silica-polymorphs, e.g. silicalites [N: dealuminated aluminosilicate zeolites]
- C01B37/04 . Aluminophosphates (APO compounds)
- C01B37/06 . Aluminophosphates containing other elements, e.g. metals, boron
- C01B37/06B . . [N: the other elements being metals only]
- C01B37/08 . . Silicoaluminophosphates (SAPO compounds), [N: e.g. CoSAPO]

C01B39/00

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, [B01J20/10](#); treatment to modify the catalytic properties, e.g. combination of treatments to make the zeolites appropriate to their use as a catalyst, [B01J29/04](#); treatment to improve the ion-exchange properties [B01J39/14](#); regeneration or reactivation of ion-exchange properties [B01J49/00](#); preparation of stabilised suspensions used in detergents [C11D3/12](#))

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.

[N: Note

Compounds classified in main group [C01B39/00](#) are also classified in other groups of class [C01](#) according to their composition

]

- C01B39/02 . 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
- C01B39/02B . . [N: Preparation of physical mixtures or intergrowth products of zeolites chosen from group [C01B39/04](#) or two or more of groups [C01B39/14](#) to [C01B39/48](#)]

- C01B39/02P . . [N: After-treatment]
- C01B39/04 . . using at least one organic template directing agent, e.g. an ionic quaternary ammonium compound or an aminated compound
- C01B39/06 . . Preparation of isomorphous zeolites characterised by measures to replace the aluminium or silicon atoms in the lattice framework by atoms of other elements, [N: i.e. by direct or secondary synthesis]
- C01B39/06B . . . [N: Galloaluminosilicates; Group IVB- metalloaluminosilicates; Ferroaluminosilicates]
- C01B39/08 . . . the aluminium atoms being wholly replaced
- C01B39/08B [N: Gallosilicates]
- C01B39/08D [N: Group IVB- metasilicates]
- C01B39/08F [N: Ferrosilicates]
- C01B39/10 . . . the replacing atoms being [N: at least] phosphorus atoms
- C01B39/12 . . . the replacing atoms being [N: at least] boron atoms
- C01B39/14 . . Type A [C0902]
- C01B39/14B . . . [N: using at least one organic template directing agent]
- C01B39/16 . . . from aqueous solutions of an alkali metal aluminate and an alkali metal silicate excluding any other source of alumina or silica but seeds [N: (C01B39/14B takes precedence)]
- C01B39/18 . . . 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 [N: (C01B39/14B takes precedence)]
- C01B39/20 . . Faujasite type, e.g. type X or Y [C0902]
- C01B39/20B . . . [N: using at least one organic template directing agent; Hexagonal faujasite; Intergrowth products of cubic and hexagonal faujasite]
- C01B39/22 . . . Type X [N: (C01B39/20B takes precedence)]
- C01B39/24 . . . Type Y [N: (C01B39/20B takes precedence)] [C9807]
- C01B39/26 . . Mordenite type [N: (C01B39/02B, C01B39/02P, C01B39/06 take precedence)] [C9508]
- C01B39/26B . . . [N: using at least one organic template directing agent]
- C01B39/28 . . Phillipsite or harmotome type [N: (C01B39/02B, C01B39/02P, C01B39/06 take precedence)] [C1201]
- C01B39/30 . . Erionite or offretite type, e.g. zeolite T [C0902]
- C01B39/30B . . . [N: using at least one organic template directing agent]
- C01B39/32 . . Type L [C0902]
- C01B39/34 . . Type ZSM-4 [N0902]
- C01B39/36 . . Pentasil type, e.g. types ZSM-5, ZSM-8 or ZSM-11 [C0902]
- C01B39/36B . . . [N: Type ZSM-8; Type ZSM-11; ZSM 5/11 intermediate]
- C01B39/38 . . . Type ZSM-5
- C01B39/40 using at least one organic template directing agent
- C01B39/42 . . Type ZSM-12 [C9508]
- C01B39/44 . . Ferrierite type, e.g. types ZSM-21, ZSM-35 or ZSM-38 [C0902]
- C01B39/44B . . . [N: using at least one organic template directing agent]
- C01B39/46 . . Other types characterised by their X-ray diffraction pattern and their defined composition [N: (C01B39/02B, C01B39/02P, C01B39/06 take precedence)] [C9508]

C01B39/48 . . . using at least one organic template directing agent

C01B39/50 . Zeolites wherein inorganic bases or salts occlude channels in the lattice framework, e.g. sodalite, cancrinite, nosean, hauynite [N: (ultramarine [C09C1/32](#))]

C01B39/52 . . Sodalites

C01B39/54 . Phosphates, e.g. APO or SAPO compounds

[N: **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 [C01B37/00](#)

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