

CPC**COOPERATIVE PATENT CLASSIFICATION****C01F**

COMPOUNDS OF THE METALS BERYLLIUM, MAGNESIUM, ALUMINIUM, CALCIUM, STRONTIUM, BARIUM, RADIUM, THORIUM, OR OF THE RARE-EARTH METALS (metal hydrides { monoborane, diborane or addition complexes thereof } [C01B 6/00](#); salts of oxyacids of halogens [C01B 11/00](#); peroxides, salts of peroxyacids [C01B 15/00](#); sulfides or polysulfides of magnesium, calcium, strontium, or barium [C01B 17/42](#); thiosulfates, dithionites, polythionates [C01B 17/64](#); compounds containing selenium or tellurium [C01B 19/00](#); binary compounds of nitrogen with metals [C01B 21/06](#); azides [C01B 21/08](#); { compounds other than ammonia or cyanogen containing nitrogen and non-metals and optionally metals [C01B 21/082](#); amides or imides of silicon [C01B 21/087](#) }; metal { imides or } amides [C01B 21/092](#), { [C01B 21/0923](#) }; nitrites [C01B 21/50](#); { compounds of noble gases [C01B 23/0005](#) }; phosphides [C01B 25/08](#); salts of oxyacids of phosphorus [C01B 25/16](#); carbides [C01B 31/30](#); compounds containing silicon [C01B 33/00](#); compounds containing boron [C01B 35/00](#); compounds having molecular sieve properties but not having base-exchange properties [C01B 37/00](#); compounds having molecular sieve and base-exchange properties, e.g. crystalline zeolites, [C01B 39/00](#); cyanides [C01C 3/08](#); salts of cyanic acid [C01C 3/14](#); salts of cyanamide [C01C 3/16](#); thiocyanates [C01C 3/20](#); { double sulfates of magnesium with sodium or potassium [C01D 5/12](#); with other alkali metals [C01D 15/00](#), [C01D 17/00](#) })

Guidance heading:

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| C01F 1/00 | Methods of preparing compounds of the metals beryllium, magnesium, aluminium, calcium, strontium, barium, radium, thorium, or the rare earths, in general |
| C01F 3/00 | Compounds of beryllium |
| C01F 3/005 | . {Fluorides or double fluorides of beryllium with alkali metals or ammonium; Preparation of beryllium compounds therefrom } |
| C01F 3/02 | . Oxides; Hydroxides |
| C01F 5/00 | Compounds of magnesium |
| C01F 5/02 | . Magnesia |
| C01F 5/04 | . . by oxidation of metallic magnesium |
| C01F 5/06 | . . by thermal decomposition of magnesium compounds (calcining magnesite or dolomite C04B 2/10) |
| C01F 5/08 | . . . by calcining magnesium hydroxide |
| C01F 5/10 | . . . by thermal decomposition of magnesium chloride with water vapour |
| C01F 5/12 | . . . by thermal decomposition of magnesium sulfate, with or without reduction |
| C01F 5/14 | . Magnesium hydroxide |

- C01F 5/145 .. {Purification }
- C01F 5/16 .. by treating magnesia, e.g. calcined dolomite, with water or solutions of salts not containing magnesium
- C01F 5/20 .. by precipitation from solutions of magnesium salts with ammonia
- C01F 5/22 .. from magnesium compounds with alkali hydroxides or alkaline- earth oxides or hydroxides
- C01F 5/24 . Magnesium carbonates
- C01F 5/26 . Magnesium halides
- C01F 5/28 .. Fluorides
- C01F 5/30 .. Chlorides
- C01F 5/305 ... {Dehydrating ammonium or alkali magnesium chlorides, e.g. carnalite }
- C01F 5/32 ... Preparation of anhydrous magnesium chloride by chlorinating magnesium compounds
- C01F 5/34 ... Dehydrating magnesium chloride containing water of crystallisation
- C01F 5/36 .. Bromides
- C01F 5/38 . Magnesium nitrates
- C01F 5/40 . Magnesium sulfates (double sulfates of magnesium with sodium or potassium [C01D 5/12](#), with other alkali metals {[C01D 15/00](#) }, [C01D 17/00](#))
- C01F 5/42 . Magnesium sulfites
- C01F 7/00 Compounds of aluminium**
- C01F 7/001 . {Aluminium carbonate }
- C01F 7/002 . {Compounds containing, besides aluminium, two or more other elements, with the exception of oxygen and hydrogen (compounds containing aluminium, fluorine and alkali or alkaline earth metals [C01F 7/54](#); compounds containing sulfur and other cations besides aluminium [C01F 7/68](#)) }
- C01F 7/004 .. {containing carbonate ions, e.g. dawsonite }
- C01F 7/005 ... {Hydrotalcite }
- C01F 7/007 .. {containing, besides aluminium, only anions, e.g. $\text{Al}(\text{OH})_x\text{CL}_y(\text{SO}_4)_z$ (mixed halides [C01F 7/48](#)) }
- C01F 7/008 .. {Ammonium aluminium fluorides }
- C01F 7/02 . Aluminium oxide; Aluminium hydroxide; Aluminates
- C01F 7/021 .. {After-treatment of oxides or hydroxides }
- C01F 7/022 ... {Classification }
- C01F 7/023 ... {Grinding, deagglomeration, disintegration }
- C01F 7/025 ... {Granulation, agglomeration }
- C01F 7/026 ... {Making or stabilising dispersions }
- C01F 7/027 ... {Treatment involving fusion or vaporisation }
- C01F 7/028 .. {Beta-aluminas }

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| C01F 7/04 | .. | Preparation of alkali metal aluminates; Aluminium oxide or hydroxide therefrom { (C01F 7/028 takes precedence) } |
| C01F 7/043 | ... | {Lithium aluminate } |
| C01F 7/046 | ... | {Stabilisation of aluminates } |
| C01F 7/06 | ... | by treating aluminous minerals {or waste-like raw materials } with alkali hydroxide, {e.g. leaching of bauxite according to the Bayer process (obtaining aluminium oxide or hydroxide from the resulting aluminate solution C01F 7/14) } |
| C01F 7/0606 | .... | {Make-up of the alkali hydroxide solution from recycled spent liquor } |
| C01F 7/0613 | .... | {Pretreatment of the minerals, e.g. grinding } |
| C01F 7/062 | .... | {Digestion } |
| C01F 7/0626 | ..... | {Processes making use of tube digestion only } |
| C01F 7/0633 | ..... | {characterised by the use of additives } |
| C01F 7/064 | ..... | {Apparatus for digestion, e.g. digester vessels, heat exchangers } |
| C01F 7/0646 | .... | {Separation of the insoluble residue, e.g. red mud } |
| C01F 7/0653 | ..... | {characterised by the flocculant added to the slurry (final clarification of the aluminate solution C01F 7/47) } |
| C01F 7/066 | .... | {Treatment of the separated residue } |
| C01F 7/0666 | .... | {Process control or regulation (control per se G05) } |
| C01F 7/0673 | .... | {from phosphate-containing minerals } |
| C01F 7/068 | .... | {from carbonate-containing minerals, e.g. dawsonite } |
| C01F 7/0686 | .... | {from sulfate-containing minerals, e.g. alunite } |
| C01F 7/0693 | .... | {from waste-like raw materials, e.g. fly ash, Bayer calcination dust } |
| C01F 7/08 | .. | by treating aluminous minerals with sodium carbonate, {e.g. sinter processes (C01F 7/0613 and C01F 7/066 take precedence) } |
| C01F 7/085 | .... | {according to the lime-sinter process } |
| C01F 7/10 | .. | by treating aluminous minerals with alkali sulfates and reducing agents |
| C01F 7/12 | .. | Alkali metal aluminates from alkaline-earth metal aluminates |
| C01F 7/14 | .. | Aluminium oxide or hydroxide from alkali metal aluminates |
| C01F 7/141 | .... | {from aqueous aluminate solutions by neutralisation with an acidic agent } |
| C01F 7/142 | ..... | {with carbon dioxide } |
| C01F 7/144 | .... | {from aqueous aluminate solutions by precipitation due to cooling, e.g. as part of the Bayer process } |
| C01F 7/145 | ..... | {characterised by a crystal growth modifying agent other than aluminium hydroxide seed } |
| C01F 7/147 | ..... | {Apparatus for precipitation } |
| C01F 7/148 | ..... | {Separation of the obtained hydroxide, e.g. filtration, dewatering } |
| C01F 7/16 | .. | Preparation of alkaline-earth metal aluminates {or magnesium aluminate }; Aluminium oxide or hydroxide therefrom { (C01F 7/028 takes precedence) } |
| C01F 7/162 | ... | {Magnesium aluminates } |
| C01F 7/164 | ... | {Calcium aluminates } |
| C01F 7/166 | ... | {Strontium aluminates } |
| C01F 7/168 | ... | {Barium aluminates } |
| C01F 7/18 | .. | Aluminium oxide or hydroxide from alkaline-earth metal aluminates |
| C01F 7/20 | .. | Preparation of aluminium oxide or hydroxide from aluminous ores with acids or salts |

- C01F 7/22 ... with halides { or halogen acids }
- C01F 7/24 ... with nitric acid or nitrogen oxides
- C01F 7/26 ... with sulfuric acids or sulfates
- C01F 7/28 ... with sulfurous acid
- C01F 7/30 .. Preparation of aluminium oxide or hydroxide by thermal decomposition {or by hydrolysis or oxidation } of aluminium compounds
- C01F 7/302 ... {Hydrolysis or oxidation of gaseous aluminium compounds in the gas phase }
- C01F 7/304 {of organic aluminium compounds }
- C01F 7/306 ... {Thermal decomposition of hydrated chlorides, e.g. aluminium trichloride hexahydrate }
- C01F 7/308 ... {Thermal decomposition of nitrates }
- C01F 7/32 ... {Thermal decomposition } of sulfates {including complex sulfates, e.g. alums }
- C01F 7/34 .. Preparation of aluminium hydroxide by precipitation from solutions containing aluminium salts
- C01F 7/36 ... from organic aluminium salts
- C01F 7/38 .. Preparation of aluminium oxide by thermal reduction of aluminous minerals
- C01F 7/40 ... in the presence of aluminium sulfide
- C01F 7/42 .. Preparation of aluminium oxide or hydroxide from metallic aluminium, e.g. by oxidation
- C01F 7/422 ... {by oxidation with a gaseous oxidator at a high temperature }
- C01F 7/424 {using a plasma }
- C01F 7/426 ... {by applying mechanical energy to solid aluminium at a low temperature }
- C01F 7/428 ... {by oxidation in an aqueous solution }
- C01F 7/44 .. Dehydration of aluminium {oxide or } hydroxide, {i.e. all conversions of one form into another involving a loss of water }
- C01F 7/441 ... {by calcination }
- C01F 7/442 {in presence of a calcination additive }
- C01F 7/444 {Apparatus therefor }
- C01F 7/445 {making use of a fluidised bed }
- C01F 7/447 ... {by wet processes }
- C01F 7/448 {using superatmospheric pressure, e.g. hydrothermal conversion of gibbsite into boehmite }
- C01F 7/46 .. Purification of aluminium oxide, aluminium hydroxide or aluminates { (7/02H takes precedence) }
- C01F 7/47 ... of aluminates, {e.g. removal of compounds of Si, Fe, Ga or of organic compounds from Bayer process liquors }
- C01F 7/473 {Removal of organic compounds, e.g. sodium oxalate }
- C01F 7/476 {by oxidation }
- C01F 7/48 . Aluminium halides
- C01F 7/50 .. Fluorides
- C01F 7/52 ... Double compounds containing both fluorine and other acid { halide } groups
- C01F 7/54 ... Double compounds containing both aluminium and alkali metals or alkaline-earth metals
- C01F 7/56 .. Chlorides (containing fluorine [C01F 7/52](#))

- C01F 7/58 . . . Preparation of anhydrous aluminium chloride
- C01F 7/60 from oxygen-containing aluminium compounds
- C01F 7/62 . . . Purification
- C01F 7/64 . . Bromides ([containing fluorine C01F 7/52](#))

- C01F 7/66 . Aluminium nitrates ([containing fluorine {C01F 7/002 }](#))

- C01F 7/68 . Aluminium compounds containing sulfur ([containing fluorine {C01F 7/002 }](#))
- C01F 7/70 . . Sulfides
- C01F 7/72 . . Sulfites
- C01F 7/74 . . Sulfates
- C01F 7/741 . . . {Preparation from elemental aluminium or elemental aluminium containing materials, e.g. foil, dross }
- C01F 7/743 . . . {Preparation from silicoaluminous materials, e.g. clays, bauxite }
- C01F 7/745 . . . {Preparation from alums, e.g. alunite }
- C01F 7/746 . . . {After-treatment, e.g. dehydration, stabilisation }
- C01F 7/748 {Purification }
- C01F 7/76 . . . Double salts, {i.e. compounds containing, besides aluminium and sulfate ions, only other cations }, e.g. alums
- C01F 7/762 {Ammonium or alkali metal aluminium sulfates }
- C01F 7/765 {Ammonium aluminium sulfates }
- C01F 7/767 {Alkaline earth metal aluminium sulfates }

- C01F 11/00** **Compounds of calcium, strontium, or barium ([C01F 7/00](#) takes precedence)**

- C01F 11/005 . {Preparation involving liquid-liquid extraction, absorption or ion-exchange }

- C01F 11/02 . Oxides or hydroxides ([production of lime C04B 2/00](#))
- C01F 11/04 . . by thermal decomposition
- C01F 11/06 . . . of carbonates
- C01F 11/08 . . by reduction of sulfates
- C01F 11/10 . . from sulfides
- C01F 11/12 . . from silicates
- C01F 11/16 . . Purification

- C01F 11/18 . Carbonates
- C01F 11/181 . . {Preparation of calcium carbonate by carbonation of aqueous solutions and characterised by control of the carbonation conditions }
- C01F 11/182 . . {Preparation of calcium carbonate by carbonation of aqueous solutions and characterised by an additive other than CaCO₃-seeds }
- C01F 11/183 . . . {the additive being an organic compound }
- C01F 11/184 . . {Preparation of calcium carbonate by carbonation of solutions based on non-aqueous solvents }
- C01F 11/185 . . {After-treatment, e.g. grinding, purification, conversion of crystal morphology }
- C01F 11/186 . . {Strontium or barium carbonate }

- C01F 11/187 . . . {Strontium carbonate }
- C01F 11/188 . . . {Barium carbonate }

- C01F 11/20 . Halides
- C01F 11/22 . . Fluorides
- C01F 11/24 . . Chlorides
- C01F 11/26 . . . from sulfides
- C01F 11/28 . . . by chlorination of alkaline-earth metal compounds
- C01F 11/30 . . . Concentrating; Dehydrating; Preventing the adsorption of moisture or caking
- C01F 11/32 . . . Purification
- C01F 11/34 . . Bromides

- C01F 11/36 . Nitrates
- C01F 11/38 . . Preparation with nitric acid or nitrogen oxides
- C01F 11/40 . . Preparation by double decomposition with nitrates
- C01F 11/42 . . Double salts (with magnesium [C01F 5/38](#))
- C01F 11/44 . . Concentrating; Crystallising; Dehydrating; Preventing the absorption of moisture or caking

- C01F 11/46 . Sulfates (dehydration of gypsum {for the production of calcium sulfate cements } [C04B 11/02](#))
- C01F 11/462 . . {Sulfates of Sr or Ba }
- C01F 11/464 . . {Sulfates of Ca from gases containing sulfur oxides }
- C01F 11/466 . . {Conversion of one form of calcium sulfate to another }
- C01F 11/468 . . {Purification of calcium sulfates }

- C01F 11/48 . Sulfites

- C01F 13/00 Compounds of radium**

- C01F 15/00 Compounds of thorium**

- C01F 17/00 Compounds of the rare earth metals, i.e. scandium, yttrium, lanthanum, or the group of the lanthanides**

- NOTE**
- In this group "rare earth metals" means one single element or a combination of elements taken from the group as specified above

- C01F 17/0006 . {Preparation involving a liquid-liquid extraction, an adsorption or an ion exchange }
- C01F 17/0012 . {Compounds containing besides rare earth metals two or more other element with the exception of oxygen or hydrogen, e.g. La₄S₃Br₆ or ternary oxides or hydroxides, e.g. NaCeO₂ }
- C01F 17/0018 . . {Oxygen being the only anion }

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| C01F 17/0025 | . . . {Aluminates } |
| C01F 17/0031 | . . {Halogen being the only anion (compounds containing besides rare earth metals only different halogens, e.g. Sc C01F 17/0056) } |
| C01F 17/0037 | . . {Sulfur being the only anion } |
| C01F 17/0043 | . {Oxides or hydroxides (ternary oxides or hydroxides, e.g. NaCeO ₂ C01F 17/0018) } |
| C01F 17/005 | . {Carbonates } |
| C01F 17/0056 | . {Halides } |
| C01F 17/0062 | . . {Fluorides } |
| C01F 17/0068 | . . {Chlorides } |
| C01F 17/0075 | . {Nitrates } |
| C01F 17/0081 | . {Sulfates } |
| C01F 17/0087 | . {Sulfides } |
| C01F 17/0093 | . . {Oxysulfides } |