

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](#)}}

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}
- 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](#))}

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| 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 {(C01F 7/028 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}

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| 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 |
| | <u>NOTE</u> |
| | 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. La ₄ S ₃ Br ₆ or ternary oxides or hydroxides, e.g. NaCeO ₂ } |
| C01F 17/0018 | . . {Oxygen being the only anion} |
| 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}