

**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:**

- |                  |                                                                                                                                                                  |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>C01F 1/00</b> | <b>Methods of preparing compounds of the metals beryllium, magnesium, aluminium, calcium, strontium, barium, radium, thorium, or the rare earths, in general</b> |
| <b>C01F 3/00</b> | <b>Compounds of beryllium</b>                                                                                                                                    |
| C01F 3/005       | . {Fluorides or double fluorides of beryllium with alkali metals or ammonium; Preparation of beryllium compounds therefrom }                                     |
| C01F 3/02        | . Oxides; Hydroxides                                                                                                                                             |
| <b>C01F 5/00</b> | <b>Compounds of magnesium</b>                                                                                                                                    |
| 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 <a href="#">C04B 2/10</a> )                                                 |
| 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 { <a href="#">(C01F 7/028 takes precedence)</a> }
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 <a href="#">C01F 7/14</a> ) }
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 <a href="#">C01F 7/47</a> ) }
C01F 7/066	....	{Treatment of the separated residue }
C01F 7/0666	....	{Process control or regulation ( <a href="#">control per se G05</a> ) }
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 ( <a href="#">C01F 7/0613</a> and <a href="#">C01F 7/066</a> 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 { <a href="#">(C01F 7/028 takes precedence)</a> }
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 CaCO<sub>3</sub>-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. La<sub>4</sub>S<sub>3</sub>Br<sub>6</sub> or ternary oxides or hydroxides, e.g.  
NaCeO<sub>2</sub> }
- 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 <a href="#">C01F 17/0056</a> ) }
C01F 17/0037	. . {Sulfur being the only anion }
C01F 17/0043	. {Oxides or hydroxides (ternary oxides or hydroxides, e.g. NaCeO <sub>2</sub> <a href="#">C01F 17/0018</a> ) }
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 }