

**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 <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 ( control <a href="#">per se</a> <a href="#">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</a> 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 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 [C01F 17/0056](#) )}
- C01F 17/0037
  - .. { Sulfur being the only anion }
- C01F 17/0043
  - . { Oxides or hydroxides ( ternary oxides or hydroxides, e.g. NaCeO<sub>2</sub> [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 }