

**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](#))}
- 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</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}
<b>C01F 11/00</b>	<b>Compounds of calcium, strontium, or barium (C01F 7/00 takes precedence)</b>
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.  $\text{La}_4\text{S}_3\text{Br}_6$  or ternary oxides or hydroxides, e.g.  $\text{NaCeO}_2$ }
- 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.  $\text{NaCeO}_2$  [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}