# SECTION C — CHEMISTRY; METALLURGY

## C01 INORGANIC CHEMISTRY

**C01F COMPOUNDS OF THE METALS BERYLLIUM, MAGNESIUM, ALUMINIUM, CALCIUM, STRONTIUM, BARIUM, RADIUM, THORIUM, OR OF THE RARE EARTH METALS** (metal hydrides 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; metal amides C01B 21/092; nitrites C01B 21/50; phosphides C01B 25/08; salts of oxyacids of phosphorus C01B 25/16; carbides C01B 32/90; 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; fermentation or enzyme-using processes for the preparation of elements or inorganic compounds except carbon dioxide C12P 3/00; obtaining metal compounds from mixtures, e.g. ores, which are intermediate compounds in a metallurgical process for obtaining a free metal C22B; production of non-metallic elements or inorganic compounds by electrolysis or electrophoresis C25B)

**Note(s) [7, 2006.01]**

1. Attention is drawn to Note (1) after class C01, which defines the last place priority rule applied in this class, i.e. in the range of subclasses C01B-C01G and within these subclasses.
2. Therapeutic activity of compounds is further classified in subclass A61P.

**1/00 Methods of preparing compounds of the metals beryllium, magnesium, aluminium, calcium, strontium, barium, radium, thorium, or the rare earths, in general [1, 2006.01]**

**3/00 Compounds of beryllium [1, 2006.01]**

3/02 • Oxides; Hydroxides **[3, 2006.01]**

**5/00 Compounds of magnesium [1, 2006.01]**

5/02 • Magnesia **[1, 2006.01]**

5/04 • • by oxidation of metallic magnesium **[1, 2006.01]**

5/06 • • by thermal decomposition of magnesium compounds (calcining magnesite or dolomite C04B 2/10) **[1, 2006.01]**

5/08 • • • by calcining magnesium hydroxide **[1, 2006.01]**

5/10 • • • by thermal decomposition of magnesium chloride with water vapour **[1, 2006.01]**

5/12 • • • by thermal decomposition of magnesium sulfate, with or without reduction **[1, 2006.01]**

5/14 • Magnesium hydroxide **[1, 2006.01]**

5/16 • • by treating magnesia, e.g. calcined dolomite, with water or solutions of salts not containing magnesium **[1, 2006.01]**

5/20 • • by precipitation from solutions of magnesium salts with ammonia **[1, 2006.01]**

5/22 • • from magnesium compounds with alkali hydroxides or alkaline earth oxides or hydroxides **[1, 2006.01]**

5/24 • Magnesium carbonates **[1, 2006.01]**

5/26 • Magnesium halides **[1, 2006.01]**

5/28 • • Fluorides **[1, 2006.01]**

5/30 • • Chlorides **[1, 2006.01]**

5/32 • • • Preparation of anhydrous magnesium chloride by chlorinating magnesium compounds **[1, 2006.01]**

5/34 • • • Dehydrating magnesium chloride containing water of crystallisation **[1, 2006.01]**

5/36 • • Bromides **[1, 2006.01]**

5/38 • Magnesium nitrates **[1, 2006.01]**

5/40 • Magnesium sulfates (double sulfates of magnesium with sodium or potassium C01D 5/12, with other alkali metals C01D 15/06, C01D 17/00) **[1, 3, 2006.01]**

5/42 • Magnesium sulfites **[1, 2006.01]**

**7/00 Compounds of aluminium [1, 2006.01, 2022.01]**

7/02 • Aluminium oxide; Aluminium hydroxide; Aluminates **[1, 2006.01, 2022.01]**

7/021 • • After-treatment of oxides or hydroxides **[2022.01]**

7/022 • • • Classification **[2022.01]**

7/023 • • • Grinding, deagglomeration or disintegration **[2022.01]**

7/025 • • • Granulation or agglomeration **[2022.01]**

7/026 • • • Making or stabilising dispersions **[2022.01]**

7/027 • • • Treatment involving fusion or vaporisation **[2022.01]**

7/028 • • Beta-aluminas **[2022.01]**

7/04 • • Preparation of alkali metal aluminates; Aluminium oxide or hydroxide therefrom (C01F 7/028 takes precedence) **[1, 2006.01, 2022.01]**

7/043 • • • Lithium aluminates **[2022.01]**

7/046 • • • Stabilisation of aluminates **[2022.01]**

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) **[1, 2006.01, 2022.01]**

7/0606 • • • • Making-up the alkali hydroxide solution from recycled spent liquor **[2022.01]**

7/0613 • • • • Pretreatment of the minerals, e.g. grinding **[2022.01]**

7/062 • • • • Digestion **[2022.01]**

7/0626 • • • • • Processes making use of tube digestion only **[2022.01]**
7/0633 • • • • • characterised by the use of additives **[2022.01]**
7/064 • • • • • Apparatus for digestion, e.g. digestor vessels or heat exchangers **[2022.01]**
7/0646 • • • • Separation of the insoluble residue, e.g. of red mud **[2022.01]**
7/0653 • • • • • characterised by the flocculant added to the slurry (final clarification of the aluminate solution C01F 7/47) **[2022.01]**
7/066 • • • • Treatment of the separated residue **[2022.01]**
7/0666 • • • • Process control or regulation **[2022.01]**
7/0673 • • • • from phosphate-containing minerals **[2022.01]**
7/068 • • • • from carbonate-containing minerals, e.g. dawsonite **[2022.01]**
7/0686 • • • • from sulfate-containing minerals, e.g. alunite **[2022.01]**
7/0693 • • • • from waste-like raw materials, e.g. fly ash or Bayer calcination dust **[2022.01]**
7/08 • • • by treating aluminous minerals with sodium carbonate, e.g. sinter processes (C01F 7/0613, C01F 7/066 take precedence) **[1, 2006.01, 2022.01]**
7/085 • • • • according to the lime-sinter process **[2022.01]**
7/10 • • • by treating aluminous minerals with alkali sulfates and reducing agents **[1, 2006.01]**
7/12 • • • Alkali metal aluminates from alkaline earth metal aluminates **[1, 2006.01]**
7/14 • • • Aluminium oxide or hydroxide from alkali metal aluminates **[1, 2006.01, 2022.01]**
7/141 • • • • from aqueous aluminate solutions by neutralisation with an acidic agent **[2022.01]**
7/142 • • • • • with carbon dioxide **[2022.01]**
7/144 • • • • from aqueous aluminate solutions by precipitation due to cooling, e.g. as part of the Bayer process **[2022.01]**
7/145 • • • • • characterised by the use of a crystal growth modifying agent other than aluminium hydroxide seed **[2022.01]**
7/147 • • • • • Apparatus for precipitation **[2022.01]**
7/148 • • • • • Separation of the obtained hydroxide, e.g. by filtration or dewatering **[2022.01]**
7/16 • • Preparation of alkaline-earth metal aluminates or magnesium aluminates; Aluminium oxide or hydroxide therefrom (C01F 7/028 takes precedence) **[1, 2006.01, 2022.01]**
7/162 • • • Magnesium aluminates **[2022.01]**
7/164 • • • Calcium aluminates **[2022.01]**
7/166 • • • Strontium aluminates **[2022.01]**
7/168 • • • Barium aluminates **[2022.01]**
7/18 • • • Aluminium oxide or hydroxide from alkaline earth metal aluminates **[1, 2006.01]**
7/20 • • Preparation of aluminium oxide or hydroxide from aluminous ores using acids or salts **[1, 2006.01]**
7/22 • • • with halides or halogen acids **[1, 2006.01]**
7/24 • • • with nitric acid or nitrogen oxides **[1, 2006.01]**
7/26 • • • with sulfuric acids or sulfates **[1, 2006.01]**
7/28 • • • with sulfurous acid **[1, 2006.01]**
7/30 • • Preparation of aluminium oxide or hydroxide by thermal decomposition or by hydrolysis or oxidation of aluminium compounds **[1, 2006.01, 2022.01]**
7/302 • • • Hydrolysis or oxidation of gaseous aluminium compounds in the gaseous phase **[2022.01]**
7/304 • • • • of organic aluminium compounds **[2022.01]**
7/306 • • • Thermal decomposition of hydrated chlorides, e.g. of aluminium trichloride hexahydrate **[2022.01]**
7/308 • • • Thermal decomposition of nitrates **[2022.01]**
7/32 • • • Thermal decomposition of sulfates including complex sulfates, e.g. alums **[1, 2006.01]**
7/34 • • Preparation of aluminium hydroxide by precipitation from solutions containing aluminium salts **[1, 2006.01]**
7/36 • • • from organic aluminium salts **[1, 2006.01]**
7/38 • • Preparation of aluminium oxide by thermal reduction of aluminous minerals **[1, 2006.01]**
7/40 • • • in the presence of aluminium sulfide **[1, 2006.01]**
7/42 • • Preparation of aluminium oxide or hydroxide from metallic aluminium, e.g. by oxidation **[1, 2006.01, 2022.01]**
7/422 • • • by oxidation with a gaseous oxidator at a high temperature **[2022.01]**
7/424 • • • • using a plasma **[2022.01]**
7/426 • • • by applying mechanical energy to solid aluminium at a low temperature **[2022.01]**
7/428 • • • by oxidation in an aqueous solution **[2022.01]**
7/44 • • Dehydration of aluminium oxide or hydroxide, i.e. all conversions of one form into another involving a loss of water **[1, 2006.01, 2022.01]**
7/441 • • • by calcination **[2022.01]**
7/442 • • • • in presence of a calcination additive **[2022.01]**
7/444 • • • • Apparatus therefor **[2022.01]**
7/445 • • • • making use of a fluidised bed **[2022.01]**
7/447 • • • by wet processes **[2022.01]**
7/448 • • • • using superatmospheric pressure, e.g. hydrothermal conversion of gibbsite into boehmite **[2022.01]**
7/46 • • Purification of aluminium oxide, aluminium hydroxide or aluminates (C01F 7/028 takes precedence) **[1, 5, 2006.01]**
7/47 • • • of aluminates, e.g. removal of compounds of Si, Fe, Ga or of organic compounds from Bayer process liquors **[5, 2006.01, 2022.01]**
7/473 • • • • Removal of organic compounds, e.g. sodium oxalate **[2022.01]**
7/476 • • • • • by oxidation **[2022.01]**
7/48 • Halides, with or without other cations besides aluminium **[1, 2006.01]**
7/50 • • Fluorides **[1, 2006.01]**
7/52 • • • Double compounds containing both fluorine and other halide groups **[1, 2006.01]**
7/54 • • • Double compounds containing both aluminium and alkali metals or alkaline earth metals **[1, 2006.01]**
7/56 • • Chlorides (containing fluorine C01F 7/52) **[1, 3, 2006.01, 2022.01]**
7/57 • • • Basic aluminium chlorides, e.g. polyaluminium chlorides **[2022.01]**
7/58 • • • Preparation of anhydrous aluminium chloride **[1, 2006.01]**
7/60 • • • • from oxygen-containing aluminium compounds **[1, 2006.01]**
7/62 • • • Purification **[1, 2006.01]**
7/64 • • Bromides (containing fluorine C01F 7/52) **[1, 3, 2006.01]**

7/66 • Nitrates, with or without other cations besides aluminium **[1, 3, 2006.01]**
7/68 • Aluminium compounds containing sulfur **[1, 3, 2006.01]**
7/70 • • Sulfides **[1, 2006.01]**
7/72 • • Sulfites **[1, 2006.01]**
7/74 • • Sulfates **[1, 2006.01, 2022.01]**
7/741 • • • Preparation from elemental aluminium or elemental aluminium containing materials, e.g. foil or dross **[2022.01]**
7/743 • • • Preparation from silicoaluminious materials, e.g. clays or bauxite **[2022.01]**
7/745 • • • Preparation from alums, e.g. alunite **[2022.01]**
7/746 • • • After-treatment, e.g. dehydration or stabilisation **[2022.01]**
7/748 • • • • Purification **[2022.01]**
7/76 • • • Double salts, i.e. compounds containing, besides aluminium and sulfate ions, only other cations, e.g. alums **[1, 2006.01, 2022.01]**
7/762 • • • • Ammonium or alkali metal aluminium sulfates **[2022.01]**
7/765 • • • • • Ammonium aluminium sulfates **[2022.01]**
7/767 • • • • Alkaline earth metal aluminium sulfates **[2022.01]**
7/77 • Aluminium carbonates **[2022.01]**
7/78 • Compounds containing aluminium and two or more other elements, with the exception of oxygen and hydrogen (aluminates C01F 7/02; compounds containing aluminium, fluorine and alkali or alkaline earth metals C01F 7/54; nitrates containing other cations besides aluminium C01F 7/66; sulfides, sulfites or sulfates containing other cations besides aluminium C01F 7/70-C01F 7/74) **[2022.01]**
7/782 • • containing carbonate ions, e.g. dawsonite **[2022.01]**
7/784 • • Layered double hydroxide, e.g. comprising nitrate, sulfate or carbonate ions as intercalating anions **[2022.01]**
7/785 • • • Hydrotalcite **[2022.01]**
7/786 • • containing, besides aluminium, only anions, e.g. $Al[OH]_xCl_y[SO_4]_z$ (mixed halides C01F 7/48) **[2022.01]**
7/788 • • Ammonium aluminium fluorides, e.g. ammonium hexafluoroaluminate **[2022.01]**

**11/00 Compounds of calcium, strontium, or barium** (C01F 7/00 takes precedence) **[1, 3, 2006.01]**
11/02 • Oxides or hydroxides (production of lime C04B 2/00) **[1, 2006.01]**
11/04 • • by thermal decomposition **[1, 2006.01]**
11/06 • • • of carbonates **[1, 2006.01]**
11/08 • • by reduction of sulfates **[1, 2006.01]**
11/10 • • from sulfides **[1, 2006.01]**
11/12 • • from silicates **[1, 2006.01]**
11/16 • • Purification **[1, 2006.01]**
11/18 • Carbonates **[1, 2006.01]**
11/20 • Halides **[1, 2006.01]**
11/22 • • Fluorides **[1, 2006.01]**
11/24 • • Chlorides **[1, 2006.01]**
11/26 • • • from sulfides **[1, 2006.01]**
11/28 • • • by chlorination of alkaline earth metal compounds **[1, 2006.01]**
11/30 • • • Concentrating; Dehydrating; Preventing the absorption of moisture or caking **[1, 2006.01]**
11/32 • • • Purification **[1, 2006.01]**
11/34 • • Bromides **[1, 2006.01]**
11/36 • Nitrates **[1, 2006.01]**
11/38 • • Preparation with nitric acid or nitrogen oxides **[1, 2006.01]**
11/40 • • Preparation by double decomposition with nitrates **[1, 2006.01]**
11/42 • • Double salts (with magnesium C01F 5/38) **[1, 2006.01]**
11/44 • • Concentrating; Crystallising; Dehydrating; Preventing the absorption of moisture or caking **[1, 2006.01]**
11/46 • Sulfates (dehydration of gypsum C04B 11/02) **[1, 2006.01]**
11/48 • Sulfites **[1, 2006.01]**

**13/00 Compounds of radium [1, 2006.01]**

**15/00 Compounds of thorium [1, 2006.01]**

**17/00 Compounds of rare earth metals [1, 2006.01, 2020.01]**

**Note(s) [2020.01]**

1. In this group, the following expression is used with the meaning indicated:
   - "rare earth metals" means elements from the group of the lanthanides as well as scandium or yttrium, taken alone or in combination.
2. When classifying a compound in groups C01F 17/20-C01F 17/38, then its specific preparation or treatment must also be classified in groups C01F 17/10-C01F 17/17 as long as the compound is characterised by its preparation or treatment, and vice versa.

17/10 • Preparation or treatment, e.g. separation or purification **[2020.01]**
17/13 • • by using ion exchange resins, e.g. chelate resins **[2020.01]**
17/17 • • involving a liquid-liquid extraction **[2020.01]**
17/20 • Compounds containing only rare earth metals as the metal element **[2020.01]**
17/206 • • oxide or hydroxide being the only anion **[2020.01]**
17/212 • • • Scandium oxides or hydroxides **[2020.01]**
17/218 • • • Yttrium oxides or hydroxides **[2020.01]**
17/224 • • • Oxides or hydroxides of lanthanides **[2020.01]**
17/229 • • • • Lanthanum oxides or hydroxides **[2020.01]**
17/235 • • • • Cerium oxides or hydroxides **[2020.01]**
17/241 • • • containing two or more rare earth metals, e.g. $NdPrO_3$ or $LaNdPrO_3$ **[2020.01]**
17/247 • • Carbonates **[2020.01]**
17/253 • • Halides **[2020.01]**
17/259 • • • Oxyhalides **[2020.01]**
17/265 • • • Fluorides **[2020.01]**
17/271 • • • Chlorides **[2020.01]**
17/276 • • Nitrates **[2020.01]**
17/282 • • Sulfates **[2020.01]**
17/288 • • Sulfides **[2020.01]**
17/294 • • • Oxysulfides **[2020.01]**
17/30 • Compounds containing rare earth metals and at least one element other than a rare earth metal, oxygen or hydrogen, e.g. $La_4S_3Br_6$ (C01F 17/247-C01F 17/294 take precedence) **[2020.01]**
17/32 • • oxide or hydroxide being the only anion, e.g. $NaCeO_2$ or $Mg_xCa_yEuO$ **[2020.01]**
17/34 • • • Aluminates, e.g. $YAlO_3$ or $Y_{3-x}Gd_xAl_5O_{12}$ **[2020.01]**

17/36 • • halogen being the only anion, e.g. $NaYF_4$ **[2020.01]**

17/38 • • sulfur being the only anion, e.g. $CaLa_2S_4$ **[2020.01]**