

CPC**COOPERATIVE PATENT CLASSIFICATION****C04B**

LIME, MAGNESIA; SLAG; CEMENTS; COMPOSITIONS THEREOF, e.g. MORTARS, CONCRETE OR LIKE BUILDING MATERIALS; ARTIFICIAL STONE [{\(roofing granules E04D 7/005\)}](#); **CERAMICS** [\(devitrified glass-ceramics C03C 10/00\)](#); **REFRACTORIES; TREATMENT OF NATURAL STONE**

NOTES

1. In this subclass, the following terms or expressions are used with the meanings indicated:
 - "fillers" includes pigments, aggregates and fibrous reinforcing materials;
 - "active ingredients" includes processing aids or property improvers, e.g. grinding aids used after the burning process or used in the absence of a burning process;
 - "mortars", "concrete" and "artificial stone" are to be considered as a single group of materials, and therefore, in the absence of an indication to the contrary, they include mortar, concrete and other cementitious compositions.
2. In groups [C04B 7/00](#) to [C04B 32/00](#), in the absence of an indication to the contrary, classification is made in the last appropriate place.
3. A composition classified in groups [C04B 26/00](#) or [C04B 28/00](#) is also classified in groups [C04B 14/00](#) to [C04B 24/00](#) if a filler or active ingredient is of interest.
4. In groups [C04B 2/00](#) to [C04B 32/00](#) and [C04B 38/00](#) to [C04B 41/00](#) it is desirable to classify the individual constituents of the mixtures, or other aspects relating to the mixtures or constituents, using Combination Sets with symbols chosen from groups [C04B 2/00](#) to [C04B 41/00](#).
5. In groups [C04B 2/00](#) to [C04B 32/00](#) and [C04B 38/00](#) to [C04B 41/00](#) it is desirable to classify the function of the individual constituents of the mixtures, or other aspects relating to the properties or uses of the mixtures or products obtained, using Combination Sets with symbols chosen from groups [C04B 2103/00](#) to [C04B 2111/00](#).
6. Groups [C04B 20/123](#) and [C04B 20/126](#) are used for indexing purposes only of documents classified in [C04B 20/12](#)

WARNING

The following IPC groups are not used in the CPC system. Subject matter covered by these groups is classified in the following CPC groups:

C04B 5/02	covered by	B01J 2/00 ,
C21B 3/06		
C04B 33/132	to	C04B 33/138 covered by
C04B 33/13		
C04B 35/035	covered by	C04B 35/26
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C04B 35/567 ,	C04B 35/569 ,	C04B 35/576 ,
C04B 35/577	covered by	C04B 35/565 ,

C04B

(continued)

[C04B 35/571](#) to [C04B 35/5755](#),
[C04B 35/806](#)
[C04B 35/582](#) covered by [C04B 35/581](#),
[C04B 35/806](#)
[C04B 35/5833](#), [C04B 35/5835](#) covered by
[C04B 35/583](#), [C04B 35/806](#)
[C04B 35/586](#), [C04B 35/587](#), [C04B 35/594](#),
[C04B 35/596](#) covered by [C04B 35/584](#),
[C04B 35/589](#) to [C04B 35/5935](#),
[C04B 35/806](#)
[C04B 35/599](#) covered by [C04B 35/597](#)
[C04B 35/81](#) covered by [C04B 35/78](#)
[C04B 35/84](#) covered by [C04B 35/628](#),
[C04B 35/78](#)

Lime; Magnesia; Slag**C04B 2/00****Lime, magnesia or dolomite** (hydraulic lime cements [C04B 7/34](#))

- C04B 2/005 . {obtained from an industrial by-product}
- C04B 2/02 . Lime {(obtaining $\text{Ca}(\text{OH})_2$ otherwise than by simple slaking of quick lime [C01F 11/02](#))}
- C04B 2/04 . . Slaking {(simultaneous dehydrating of gypsum and slaking of lime [C04B 11/022](#))}
- C04B 2/045 . . . {After-treatment of slaked lime}
- C04B 2/06 . . . with addition of substances, e.g. hydrophobic agents; {Slaking in the presence of other compounds}
- C04B 2/063 {Slaking of impure quick lime, e.g. contained in fly ash}
- C04B 2/066 {Making use of the hydration reaction, e.g. the reaction heat for dehydrating gypsum; Chemical drying by using unslaked lime}
- C04B 2/08 . . . Devices therefor
- C04B 2/10 . Preheating, burning calcining or cooling (decarbonation during burning of cement raw materials [C04B 7/43](#); {obtaining CaO or MgO otherwise than by thermal decomposition of the corresponding carbonates [C01F 11/02](#), [C01F 5/02](#))
- C04B 2/102 . . {of magnesia, e.g. dead burning}
- C04B 2/104 . . {Ingredients added before or during the burning process}
- C04B 2/106 . . {in fluidised bed furnaces}
- C04B 2/108 . . {Treatment or selection of the fuel therefor}
- C04B 2/12 . . in shaft or vertical furnaces (shaft or vertical furnaces in general [F27B 1/00](#))

C04B 5/00**Treatment of {metallurgical} slag** (manufacture of slag wool [C03B](#); in, or for, the production of metals [C21B](#), [C22B](#)); **Artificial stone from molten {metallurgical} slag** (mechanical aspects [B28B 1/54](#) {other cast stone [C04B 32/005](#)})

- C04B 5/06 . Ingredients, other than water, added to the molten slag {or to the granulating medium or before remelting}; Treatment with gases or gas generating compounds, e.g. to obtain porous slag
- C04B 5/065 . . {Porous slag}

Cements**C04B 7/00****Hydraulic cements** (calcium sulfate cements [C04B 11/00](#))

C04B 7/003

- . {Barium or strontium cements}

C04B 7/006

- . {Cement-clinker used in the unground state in mortar - or concrete compositions}

C04B 7/02

- . Portland cement

C04B 7/04

- . . using raw materials containing gypsum, {i.e. processes of the Mueller-Kuehne type}

C04B 7/06

- . . using alkaline raw materials ([C04B 7/60](#) takes precedence)

C04B 7/12

- . Natural pozzuolanes; Natural pozzuolana cements; {Artificial pozzuolanes or artificial pozzuolana cements other than those obtained from waste or combustion residues, e.g. burned clay; Treating inorganic materials to improve their pozzuolanic characteristics} ([cements containing slag C04B 7/14](#))

C04B 7/13

- . . Mixtures thereof with inorganic cementitious materials, e.g. Portland cements

C04B 7/14

- . Cements containing slag ([slags from waste incineration C04B 7/28](#))

C04B 7/147

- . . Metallurgical slag

C04B 7/153

- . . . Mixtures thereof with other inorganic cementitious materials or other activators

C04B 7/1535

- {with alkali metal containing activators, e.g. sodium hydroxide or waterglass}

C04B 7/17

- with calcium oxide containing activators {([C04B 7/1535](#) takes precedence)}

C04B 7/19

- Portland cements

C04B 7/21

- with calcium sulfate containing activators {([C04B 7/1535](#) takes precedence)}

C04B 7/22

- . Iron ore cements; {Iron rich cements, e.g. Ferrari cements, Kühl cements}

C04B 7/24

- . Cements from oil shales, residues or waste other than slag

C04B 7/243

- . . {Mixtures thereof with activators or composition-correcting additives, e.g. mixtures of fly ash and alkali activators}

C04B 7/246

- . . {from waste building materials, e.g. waste asbestos-cement products, demolition waste}

C04B 7/26

- . . from raw materials containing flue dust, {i.e. fly ash ([C04B 7/243](#) takes precedence)}

C04B 7/28

- . . from combustion residues, {e.g. ashes or slags from waste incineration} ([C04B 7/243](#) , [C04B 7/26](#) take precedence)

C04B 7/30

- . . from oil shale; from oil shale residues; {from lignite processing, e.g. using certain lignite fractions}

C04B 7/32

- . Aluminous cements

C04B 7/323

- . . {Calcium aluminosulfate cements, e.g. cements hydrating into ettringite}

C04B 7/326

- . . {Calcium aluminohalide cements, e.g. based on $11\text{CaO} \cdot 7\text{Al}_2\text{O}_3 \cdot \text{CaX}_2$, where X is Cl or F}

C04B 7/34

- . Hydraulic lime cements; Roman cements; {natural cements}

C04B 7/345

- . Hydraulic cements not provided for in one of the groups [C04B 7/02](#) to [C04B 7/34](#)

C04B 7/3453

- . . {Belite cements, e.g. self-disintegrating cements based on dicalciumsilicate}

C04B 7/3456

- . . {Alinite cements, e.g. "Nudelman"-type cements, bromo-alinite cements, fluoro-alinite cements}

- C04B 7/36 . Manufacture of hydraulic cements in general
- C04B 7/361 . . {Condition or time responsive control in hydraulic cement manufacturing processes (controlling or regulating in general [G05](#); [F27B 7/42](#) takes precedence)}
- C04B 7/362 . . . {for raw materials handling, e.g. during the grinding or mixing step}
- C04B 7/364 . . {Avoiding environmental pollution during cement-manufacturing}
- C04B 7/365 . . . {by extracting part of the material from the process flow and returning it into the process after a separate treatment, e.g. in a separate retention unit under specific conditions}
- C04B 7/367 . . . {Avoiding or minimising carbon dioxide emissions}
- C04B 7/368 . . {Obtaining spherical cement particles}
- C04B 7/38 . . Preparing or treating the raw materials individually or as batches, {e.g. mixing with fuel; ([C04B 7/362](#) takes precedence)}
- C04B 7/40 . . . Dehydrating; Forming, e.g. granulating ([apparatus for granulating B01J 2/00](#))
- C04B 7/42 . . . Active ingredients added before, or during, the burning process ([after the burning process C04B 22/00, C04B 24/00](#))
- C04B 7/421 {Inorganic materials}
- C04B 7/422 {Elements}
- C04B 7/424 {Oxides, Hydroxides}
- C04B 7/425 {Acids or salts thereof}
- C04B 7/427 {Silicates}
- C04B 7/428 {Organic materials}
- C04B 7/43 . . Heat treatment, e.g. precalcining, burning, melting; Cooling {(aspects only relating to the installation [F27B](#))}
- C04B 7/432 . . . {Preheating without addition of fuel}
- C04B 7/434 . . . {Preheating with addition of fuel, e.g. calcining}
- C04B 7/436 . . . {Special arrangements for treating part or all of the cement kiln dust}
- C04B 7/438 . . . {Evacuating at least part of the heat treated material before the final burning or melting step, the evacuated material being used as a cement as such}
- C04B 7/44 . . . Burning; Melting
- C04B 7/4407 {Treatment or selection of the fuel therefor, e.g. use of hazardous waste as secondary fuel ([fuels in general C10L](#)); Use of particular energy sources, e.g. waste hot gases from other processes}
- C04B 7/4415 {Waste hot gases}
- C04B 7/4423 {Waste or refuse used as fuel}
- C04B 7/443 {Tyres, e.g. shredded}
- C04B 7/4438 {the fuel being introduced directly into the rotary kiln}
- C04B 7/4446 {the fuel being treated in a separate gasifying or decomposing chamber, e.g. a separate combustion chamber}
- C04B 7/4453 {using plasmas or radiations}
- C04B 7/4461 {Grate sintering}
- C04B 7/4469 {in shaft or vertical kilns}
- C04B 7/4476 {Selection of the kiln atmosphere}
- C04B 7/4484 {Non-electric melting}

- C04B 7/4492 {Inhibiting the formation of or eliminating incrustations in the cement kiln (removing incrustations from rotary-drum furnaces [F27B 7/2075](#))}
 - C04B 7/45 in fluidised beds, {e.g. spouted beds}
 - C04B 7/46 electric
 - C04B 7/47 Cooling; {Waste heat management}
 - C04B 7/475 {using the waste heat, e.g. of the cooled clinker, in an other way than by simple heat exchange in the cement production line, e.g. for generating steam}
 - C04B 7/48 Clinker treatment ([C04B 7/47](#) takes precedence)
 - C04B 7/51 Hydrating
 - C04B 7/52 Grinding; {After-treatment of ground cement}
 - C04B 7/522 {After-treatment of ground cement ([C04B 7/368](#) takes precedence)}
 - C04B 7/525 {Briquetting}
 - C04B 7/527 {obtaining cements characterised by fineness, e.g. by multi-modal particle size distribution}
 - C04B 7/60 Methods for eliminating alkali metals or compounds thereof, {e.g. from the raw materials or during the burning process; methods for eliminating other harmful components ([avoiding environmental pollution C04B 7/364](#))}
- C04B 9/00 Magnesium cements or similar cements**
- C04B 9/02 Magnesium cements containing chlorides, e.g. Sorel cement
 - C04B 9/04 Magnesium cements containing sulfates, nitrates, phosphates or fluorides
 - C04B 9/06 Cements containing metal compounds other than magnesium compounds, e.g. compounds of zinc or lead
 - C04B 9/11 Mixtures thereof with other inorganic cementitious materials
 - C04B 9/12 with hydraulic cements, e.g. Portland cement
 - C04B 9/20 Manufacture, e.g. preparing the batches ([preheating, burning, calcining or cooling lime stone, magnesite or dolomite C04B 2/10](#))
- C04B 11/00 Calcium sulfate cements**
- C04B 11/002 {Mixtures of different CaSO_4 -modifications, e.g. plaster of Paris and anhydrite, used as cements}
 - C04B 11/005 {Preparing or treating the raw materials}
 - C04B 11/007 {After-treatment of the dehydration products, e.g. aging, stabilisation}
 - C04B 11/02 {Methods and apparatus for} dehydrating gypsum {(for other purposes than cement manufacture [C01F 11/466](#))}
 - C04B 11/022 {Simultaneous dehydrating of gypsum and slaking of lime}
 - C04B 11/024 Ingredients added before, or during, the calcining process, e.g. calcination modifiers
 - C04B 11/028 Devices therefor {characterised by the type of calcining devices used therefor or by the type of hemihydrate obtained}
 - C04B 11/0281 {Kettles; Marmites; Autoclaves}
 - C04B 11/0282 {Autoclaves, e.g. using chariots}
 - C04B 11/0283 {Fluidised beds}

- C04B 11/0285 . . . {Rotary kilns}
- C04B 11/0286 . . . {Suspension heaters for flash calcining, e.g. cyclones}
- C04B 11/0287 . . . {Multi-storey horizontal furnaces}
- C04B 11/0288 . . . {Grates}
- C04B 11/032 . . . for the wet process, e.g. dehydrating in solution or under saturated vapour conditions, {i.e. to obtain alpha-hemihydrate ([C04B 11/0281](#) to [C04B 11/0288](#) take precedence)}
- C04B 11/036 . . . for the dry process, e.g. dehydrating in a fluidised bed or in a rotary kiln, {i.e. to obtain beta-hemihydrate ([C04B 11/0281](#) to [C04B 11/0288](#) take precedence)}
- C04B 11/05 . obtaining anhydrite, {e.g. Keene's cement} ([C04B 11/028](#) takes precedence)
- C04B 11/06 . starting from anhydrite
- C04B 11/26 . {strating from chemical gypsum}; starting from phosphogypsum or from waste, e.g. purification products of smoke ([C04B 11/02](#) takes precedence; chemical purification of smoke, fumes or exhaust gases [B01D 53/00](#) {purification of gypsum [C01F 11/46](#)})
- C04B 11/262 . . {waste gypsum other than phosphogypsum}
- C04B 11/264 . . . {Gypsum from the desulfurisation of flue gases}
- C04B 11/266 . . {Chemical gypsum}
- C04B 11/268 . . {pelletizing of the material before starting the manufacture}
- C04B 11/28 . Mixtures thereof with other inorganic cementitious materials ([C04B 7/04](#), [C04B 7/153](#) take precedence)
- C04B 11/30 . . with hydraulic cements, e.g. Portland cements
- C04B 12/00** **Cements not provided for in groups [C04B 7/00](#) to [C04B 11/00](#)**
- C04B 12/005 . {Geopolymer cements, e.g. reaction products of aluminosilicates with alkali metal hydroxides or silicates}
- C04B 12/02 . Phosphate cements (in, or for, the manufacture of ceramics [C04B 33/00](#), [C04B 35/00](#))
- C04B 12/022 . . {Al-phosphates}
- C04B 12/025 . . {Phosphates of ammonium or of the alkali or alkaline earth metals}
- C04B 12/027 . . {mixtures thereof with other inorganic cementitious materials}
- C04B 12/04 . Alkali metal or ammonium silicate cements {Alkyl silicate cements; Silica sol cements; Soluble silicate cements} (alkali metal silicates per se, their preparation [C01B 33/32](#); ammonium silicates per se, their preparation [C01C 1/00](#))

Use of materials as fillers (ceramics [C04B 33/00](#), [C04B 35/00](#); reinforcing elements for building materials [E04C 5/00](#))

C04B 14/00 **Use of inorganic materials as fillers, e.g. pigments, for mortars, concrete or artificial stone; Treatment of inorganic materials specially adapted to enhance their filling properties in mortars, concrete or artificial stone (expanding or defibrillating materials [C04B 20/00](#))**

NOTE

Fillers with a well-defined shape other than granular are considered to be reinforcing elements and thus are classified in [E04C 5/00](#). However, if they

C04B 14/00

(continued)

are only characterised by their composition, classification is made in [C04B](#) only

- C04B 14/005 . {Inorganic fillers with a shape other than granular or fibrous (carbon nanotubes [C04B 14/026](#))}
- C04B 14/02 . Granular materials, {e.g. micro-balloons}
- C04B 14/022 . . {Carbon}
- C04B 14/024 . . . {Graphite}
- C04B 14/026 . . . {of particular shape, e.g. nanotubes}
- C04B 14/028 {Carbon aerogels}
- C04B 14/04 . . Silica-rich materials; Silicates
- C04B 14/041 . . . {Aluminium silicates other than clay}
- C04B 14/042 . . . {Magnesium silicates, e.g. talc, sepiolite}
- C04B 14/043 . . . {Alkaline-earth metal silicates, e.g. wollastonite}
- C04B 14/044 . . . {Polysilicates, e.g. geopolymers}
- C04B 14/045 . . . {Alkali-metal containing silicates, e.g. petalite (waterglass [C04B 12/04](#))}
- C04B 14/046 . . . {Zircon}
- C04B 14/047 . . . {Zeolites}
- C04B 14/048 . . . {Granite}
- C04B 14/06 . . . Quartz; Sand
- C04B 14/062 {Micro-silica, e.g. colloidal silica (preparing micro-silica slurries or suspensions [C04B 18/148](#))}
- C04B 14/064 {Silica aerogel}
- C04B 14/066 {Precipitated or pyrogenic silica}
- C04B 14/068 {Specific natural sands, e.g. sea -, beach -, dune - or desert sand}
- C04B 14/08 . . . Diatomaceous earth
- C04B 14/10 . . . Clay {(sepiolite [C04B 14/042](#); grog [C04B 18/025](#))}
- C04B 14/102 {Attapulgate clay}
- C04B 14/104 {Bentonite, e.g. montmorillonite}
- C04B 14/106 {Kaolin}
- C04B 14/108 {Shale, slate (colliery shale [C04B 18/125](#))}
- C04B 14/12 Expanded clay
- C04B 14/14 . . . Minerals of volcanic origin {(granite [C04B 14/048](#))}
- C04B 14/16 porous, e.g. pumice
- C04B 14/18 Perlite
- C04B 14/185 {expanded}
- C04B 14/20 . . . Mica; Vermiculite {(Mechanical splitting [B28D](#))}
- C04B 14/202 {Vermiculite}
- C04B 14/204 {expanded}
- C04B 14/206 {Mica or vermiculite modified by cation-exchange; chemically exfoliated vermiculate}

C04B 14/208	. . . . . {delaminated mica or vermiculite platelets}
C04B 14/22	. . . Glass; {Devitrified glass}
C04B 14/24	. . . . porous, e.g. foamed glass
C04B 14/26	. . Carbonates
C04B 14/28	. . . of calcium
C04B 14/285	. . . . {Marble}
C04B 14/30	. . Oxides other than silica {(ferrites C04B 14/363)}
C04B 14/301	. . . {porous or hollow}
C04B 14/302	. . . . {Aerogels}
C04B 14/303	. . . {Alumina}
C04B 14/304	. . . {Magnesia}
C04B 14/305	. . . {Titanium oxide, e.g. titanates}
C04B 14/306	. . . {Zirconium oxide (zircon C04B 14/046)}
C04B 14/307	. . . {Chromium oxide}
C04B 14/308	. . . {Iron oxide}
C04B 14/309	. . . {Copper oxide or solid solutions thereof}
C04B 14/32	. . Carbides; Nitrides; Borides; {Silicides}
C04B 14/321	. . . {Borides}
C04B 14/322	. . . {Carbides}
C04B 14/323	. . . . {Boron carbide}
C04B 14/324	. . . . {Silicon carbide}
C04B 14/325	. . . {Nitrides}
C04B 14/326	. . . . {Aluminium nitride}
C04B 14/327	. . . . {Boron nitride}
C04B 14/328	. . . . {Silicon nitride}
C04B 14/34	. . Metals, {e.g. ferro-silicon}
C04B 14/36	. . Inorganic materials not provided for in groups { C04B 14/022 and} C04B 14/04 to C04B 14/34
C04B 14/361	. . . {Soil, e.g. laterite}
C04B 14/363	. . . {Ferrites}
C04B 14/365	. . . {Gypsum (synthetic gypsum C04B 18/0445 , C04B 18/064)}
C04B 14/366	. . . {Phosphates, e.g. apatite}
C04B 14/368	. . . {Baryte}
C04B 14/38	. Fibrous materials; Whiskers
C04B 14/383	. . {Whiskers}
C04B 14/386	. . {Carbon (carbon nanotubes C04B 14/026)}
C04B 14/40	. . Asbestos
C04B 14/405	. . . {Waste asbestos}
C04B 14/42	. . Glass

C04B 14/44	. . . Treatment for enhancing alkali resistance {(composition of alkali resistant glass fibres C03C 13/00 ; coating of glass fibres C03C 25/10)}
C04B 14/46	. . Rock wool; {Ceramic or silicate fibres (C04B 14/40 , C04B 14/42 take precedence)}
C04B 14/4606	. . . {added as organic or organo-mineral precursors}
C04B 14/4612	. . . {Al-borates}
C04B 14/4618	. . . {Oxides}
C04B 14/4625	. . . . {Alumina}
C04B 14/4631	. . . . {Silica}
C04B 14/4637	. . . {Zirconia or zircon}
C04B 14/4643	. . . {Silicates other than zircon}
C04B 14/465	. . . . {Ca-silicate, e.g. wollastonite}
C04B 14/4656	. . . . {Al-silicates, e.g. clay}
C04B 14/4662	. . . . {Polysilicates, e.g. geopolymers}
C04B 14/4668	. . . . {of volcanic origin}
C04B 14/4675	. . . . {from slags}
C04B 14/4681	. . . {Titanates}
C04B 14/4687	. . . {Non-oxide ceramics (carbon or graphite fibres C04B 14/386)}
C04B 14/4693	. . . . {Silicon carbide}
C04B 14/48	. . Metal

C04B 16/00 Use of organic materials as fillers, e.g. pigments, for mortars, concrete or artificial stone; Treatment of organic materials specially adapted to enhance their filling properties in mortars, concrete or artificial stone

NOTE

Fillers with a well-defined shape other than granular are considered to be reinforcing elements and thus are classified in [E04C 5/00](#). However, if they are only characterised by their composition, classification is made in [C04B](#) only

C04B 16/02	. Cellulosic materials (cellulosic waste materials, e.g. sawdust, rice husks, C04B 18/24)
C04B 16/04	. Macromolecular compounds (C04B 16/02 takes precedence)
C04B 16/06	. . fibrous
C04B 16/0608	. . . {Fibrilles, e.g. fibrillated films}
C04B 16/0616	. . . {from polymers obtained by reactions only involving carbon-to-carbon unsaturated bonds}
C04B 16/0625	. . . . {Polyalkenes, e.g. polyethylene}
C04B 16/0633	. . . . . {Polypropylene}
C04B 16/0641	. . . . {Polyvinylalcohols; Polyvinylacetates}
C04B 16/065	. . . . {Polyacrylates; Polymethacrylates}
C04B 16/0658	. . . . . {Polyacrylonitrile}
C04B 16/0666	. . . . {Polystyrene}

- C04B 16/0675 . . . {from polymers obtained otherwise than by reactions only involving carbon-to-carbon unsaturated bonds}
- C04B 16/0683 {Polyesters, e.g. polylactides}
- C04B 16/0691 {Polyamides; Polyaramides}
- C04B 16/08 . . porous, e.g. expanded polystyrene beads {or micro-balloons}
- C04B 16/082 . . . {other than polystyrene based, e.g. polyurethane foam}
- C04B 16/085 . . . {expanded in situ, i.e. during or after mixing the mortar, concrete or artificial stone ingredients}
- C04B 16/087 . . . {shredded}
- C04B 16/10 . . Treatment for enhancing the mixability with the mortar {(coating [C04B 20/10](#))}
- C04B 16/12 . characterised by the shape (fibrous macromolecular compounds [C04B 16/06](#); porous macromolecular compounds [C04B 16/08](#)), {e.g. perforated strips}

C04B 18/00

Use of agglomerated or waste materials or refuse as fillers for mortars, concrete or artificial stone (use of waste materials for the manufacture of cement [C04B 7/24](#)); **Treatment of agglomerated or waste materials or refuse, specially adapted to enhance their filling properties in mortars, concrete or artificial stone**

NOTE

Fillers with a well defined shape other than granular are considered to be reinforcing elements and thus are classified in [E04C 5/00](#). However, if they are only characterised by their composition, classification is made in [C04B](#) only

- C04B 18/02 . Agglomerated materials, {e.g. artificial aggregates}
- C04B 18/021 . . {agglomerated by a mineral binder, e.g. cement}
- C04B 18/022 . . {agglomerated by an organic binder}
- C04B 18/023 . . {Fired or melted materials ([C04B 20/06](#) takes precedence)}
- C04B 18/025 . . . {Grog}
- C04B 18/026 . . . {Melted materials ([C04B 14/22](#) takes precedence)}
- C04B 18/027 . . {Lightweight materials ([C04B 14/12](#) takes precedence)}
- C04B 18/028 . . {temporarily agglomerated, e.g. agglomerates which fall apart during mixing with the other mortar or concrete ingredients}
- C04B 18/04 . Waste materials; Refuse {([C04B 14/405](#) takes precedence)}
- C04B 18/0409 . . {Waste from the purification of bauxite, e.g. red mud}
- C04B 18/0418 . . {Wet materials, e.g. slurries}
- C04B 18/0427 . . {Dry materials}
- C04B 18/0436 . . {Dredged harbour or river sludge (other slurries or sludges [C04B 18/0418](#))}
- C04B 18/0445 . . {Synthetic gypsum, e.g. phosphogypsum (gypsum from smoke purification [C04B 18/064](#))}
- C04B 18/0454 . . {Bleaching earth}
- C04B 18/0463 . . {Hazardous waste}
- C04B 18/0472 . . . {Waste material contaminated by heavy metals}

C04B 18/0481	. . . {Other specific industrial waste materials not provided for elsewhere in C04B 18/00 }
C04B 18/049	. . . {Wastes from oil or other wells, e.g. drilling mud}
C04B 18/06	. . . Combustion residues, e.g. purification products of smoke, fumes or exhaust gases
C04B 18/061	. . . {Ashes from fluidised bed furnaces}
C04B 18/062	. . . {Purification products of smoke, fume or exhaust-gases}
C04B 18/064	. . . . {Gypsum}
C04B 18/065	. . . . {Residues from coal gasification}
C04B 18/067	. . . . {Slags}
C04B 18/068	. . . . {from burning wood}
C04B 18/08	. . . . Flue dust, {i.e. fly ash}
C04B 18/081	. . . . {from brown coal or lignite}
C04B 18/082	. . . . {Cenospheres}
C04B 18/084	. . . . {obtained from mixtures of pulverised coal and additives, added to influence the composition of the resulting flue dust}
C04B 18/085	. . . . {Pelletizing}
C04B 18/087	. . . . {from liquid fuels, e.g. oil}
C04B 18/088	. . . . {in high volume fly ash compositions}
C04B 18/10	. . . . Burned {or pyrolised} refuse
C04B 18/101	. . . . {Burned rice husks or other burned vegetable material}
C04B 18/103	. . . . {Burned or pyrolised sludges}
C04B 18/105	. . . . {Gaseous combustion products or dusts collected from waste incineration, e.g. sludge resulting from the purification of gaseous combustion products of waste incineration}
C04B 18/106	. . . . . {Fly ash from waste incinerators}
C04B 18/108	. . . . . {involving a melting step}
C04B 18/12	. . . from quarries, mining or the like
C04B 18/125	. . . . {Slate residues, e.g. colliery shale or oil shale or oil shale ash}
C04B 18/14	. . . from metallurgical processes (treatment of slag C04B 5/00 ; for manufacture of cement C04B 7/14)
C04B 18/141	. . . . {Slags}
C04B 18/142	. . . . . {Steelmaking slags, converter slags}
C04B 18/143	. . . . . {L.D. slags, i.e. Linz-Donawitz slags}
C04B 18/144	. . . . . {Slags from the production of specific metals other than iron or of specific alloys, e.g. ferrochrome slags}
C04B 18/145	. . . . . {Phosphorus slags}
C04B 18/146	. . . . . {Silica fume}
C04B 18/147	. . . . . {Conditioning}
C04B 18/148	. . . . . . {Preparing silica fume slurries or suspensions}
C04B 18/149	. . . . . {other than silica fume or slag}
C04B 18/16	. . . from building or ceramic industry ({ separating plants for waste concrete slurry B03B 9/063 })

C04B 18/162	. . . {Cement kiln dust; Lime kiln dust}
C04B 18/165	. . . {Ceramic waste}
C04B 18/167	. . . {Recycled material, i.e. waste material reused in the production of the same material}
C04B 18/18	. . organic (C04B 18/10 takes precedence)
C04B 18/20	. . . from macromolecular compounds {(recycled expanded polystyrene C04B 16/08)}
C04B 18/22	. . . . Rubber {e.g. ground waste tires}
C04B 18/24	. . . Vegetable refuse, e.g. rice husks, maize-ear refuse; Cellulosic materials, e.g. paper, {cork}
C04B 18/241	. . . . {Paper, e.g. waste paper; Paper pulp}
C04B 18/243	. . . . . {Waste from paper processing or recycling paper, e.g. de-inking sludge (burned paper processing waste C04B 18/10)}
C04B 18/245	. . . . {Cork; Bark}
C04B 18/246	. . . . {expanded}
C04B 18/248	. . . . {from specific plants, e.g. hemp fibres}
C04B 18/26	. . . . Wood, e.g. sawdust, wood shavings
C04B 18/265	. . . . . {from specific species, e.g. birch}
C04B 18/28	. . . . Mineralising; Compositions therefor
C04B 18/30	. . Mixed waste; Waste of undefined composition, (C04B 18/10 takes precedence)
C04B 18/305	. . . {Municipal waste}

C04B 20/00 Use of materials as fillers for mortars, concrete or artificial stone according to more than one of groups [C04B 14/00](#) to [C04B 18/00](#) and characterised by shape or grain distribution; Treatment of materials according to more than one of the groups [C04B 14/00](#) to [C04B 18/00](#) specially adapted to enhance their filling properties in mortars, concrete or artificial stone; Expanding or defibrillating materials

NOTE

Fillers with a well-defined shape other than granular are considered to be reinforcing elements and thus are classified in [E04C 5/00](#). However, if they are only characterised by their composition, classification is made in [C04B](#) only

C04B 20/0004	. {Microcomposites or nanocomposites, e.g. composite particles obtained by polymerising monomers onto inorganic materials}
C04B 20/0008	. {Materials specified by a shape not covered by C04B 20/0016 to C04B 20/0056 , e.g. nanotubes}
C04B 20/0012	. . {Irregular shaped fillers}
C04B 20/0016	. {Granular materials, e.g. micro-balloons}
C04B 20/002	. . {Hollow or porous granular materials}
C04B 20/0024	. . . {expanded in situ, i.e. the material is expanded or made hollow after primary shaping of the mortar, concrete or artificial stone mixture (C04B 16/085 takes precedence)}
C04B 20/0028	. . . {crushable}

- C04B 20/0032 . . . {characterised by the gas filling pores, e.g. inert gas or air at reduced pressure}
- C04B 20/0036 . . . {Micro-sized or nano-sized}
- C04B 20/004 . . . {inorganic}
- C04B 20/0044 . . {obtained from irregularly shaped particles}
- C04B 20/0048 . {Fibrous materials}
- C04B 20/0052 . . {Mixtures of fibres of different physical characteristics, e.g. different lengths}
- C04B 20/0056 . . {Hollow or porous fibres}
- C04B 20/006 . . {Microfibres; Nanofibres}
- C04B 20/0064 . . {Ground fibres}
- C04B 20/0068 . . {Composite fibres, e.g. fibres with a core and sheath of different material}
- C04B 20/0072 . . {Continuous fibres}
- C04B 20/0076 . {characterised by the grain distribution}
- C04B 20/008 . . {Micro- or nanosized fillers, e.g. micronised fillers with particle size smaller than that of the hydraulic binder (colloidal silica [C04B 14/062](#) ; silica fume [C04B 18/146](#))}
- C04B 20/0084 . . . {Conditioning, e.g. preparing suspensions thereof ([C04B 18/148](#) takes precedence)}
- C04B 20/0088 . . {Fillers with mono- or narrow grain size distribution}
- C04B 20/0092 . . . {Fillers with fine grain sizes only}
- C04B 20/0096 . . {Fillers with bimodal grain size distribution}
- C04B 20/02 . Treatment
- C04B 20/023 . . {Chemical treatment}
- C04B 20/026 . . {Comminuting, e.g. by grinding or breaking; Defibrillating fibres other than asbestos}
- C04B 20/04 . . Heat treatment
- C04B 20/06 . . . Expanding clay, perlite, vermiculite or like granular materials
- C04B 20/061 {in rotary kilns}
- C04B 20/063 {by grate sintering}
- C04B 20/065 {in fluidised beds}
- C04B 20/066 {in shaft or vertical furnaces}
- C04B 20/068 {Selection of ingredients added before or during the thermal treatment, e.g. expansion promoting agents or particle-coating materials}
- C04B 20/08 . . Defibrillating asbestos {(defibrillating other fibres [C04B 20/026](#))}
- C04B 20/10 . Coating or impregnating {(roofing granules [E04D 7/005](#))}
- C04B 20/1003 . . {Non-compositional aspects of the coating or impregnation}
- C04B 20/1007 . . . {Porous or lightweight coatings}
- C04B 20/1011 . . . {Temporary coatings}
- C04B 20/1014 . . . {Coating or impregnating materials characterised by the shape, e.g. fibrous materials}
- C04B 20/1018 . . {with organic materials (pigments or dyes [C04B 20/1096](#))}
- C04B 20/1022 . . . {Non-macromolecular compounds}
- C04B 20/1025 {Fats; Fatty oils; Ester type waxes; Higher fatty acids; Derivatives thereof}

C04B 20/1029	. . . {Macromolecular compounds}
C04B 20/1033	. . . . {obtained by reactions only involving carbon-to-carbon unsaturated bonds}
C04B 20/1037	. . . . {obtained otherwise than by reactions only involving carbon-to-carbon unsaturated bonds}
C04B 20/104	. . . . {Natural resins, e.g. tall oil}
C04B 20/1044	. . . . {Bituminous materials}
C04B 20/1048	. . . . {Polysaccharides, e.g. cellulose, or derivatives thereof}
C04B 20/1051	. . {Organo-metallic compounds; Organo-silicon compounds, e.g. bentone}
C04B 20/1055	. . {with inorganic materials}
C04B 20/1059	. . . {Pigments or precursors thereof}
C04B 20/1062	. . . {Metals}
C04B 20/1066	. . . {Oxides, Hydroxides}
C04B 20/107	. . . {Acids or salts thereof}
C04B 20/1074	. . . {Silicates, e.g. glass}
C04B 20/1077	. . . {Cements, e.g. waterglass}
C04B 20/1081	. . . . {Mineral polymers, e.g. geopolymers}
C04B 20/1085	. . . . {Waterglass}
C04B 20/1088	. . . {Water}
C04B 20/1092	. . {with pigments or dyes (C04B 20/1059 takes precedence)}
C04B 20/1096	. . . {organic}
C04B 20/12	. . Multiple coating or impregnating
C04B 20/123	. . . {Multiple coatings, for one of the coatings of which at least one alternative is described}
C04B 20/126	. . . {Multiple coatings, comprising a coating layer of the same material as a previous coating layer}

Use of materials as active ingredients

NOTE

Active ingredients which react with cement compounds for forming new or modified mineralogical phases and are added before the hardening process, as well as cements added as additives to other cements, are classified in groups [C04B 7/00](#) to [C04B 12/00](#), e.g. in group [C04B 7/42](#).

C04B 22/00	Use of inorganic materials as active ingredients for mortars, concrete or artificial stone, e.g. accelerators {, shrinkage compensating agents}
C04B 22/0006	. {Waste inorganic materials}
C04B 22/0013	. {Boron compounds}
C04B 22/002	. {Water}
C04B 22/0026	. . {Salt water, e.g. seawater}
C04B 22/0033	. . . {other than sea water, e.g. from mining activities}
C04B 22/004	. . {containing dissolved additives or active agents, i.e. aqueous solutions used as gauging water (C04B 22/0026 takes precedence)}

- C04B 22/0046 . . {Waste slurries or solutions used as gauging water}
- C04B 22/0053 . . {added in a particular physical form, e.g. atomised or in the gas phase}
- C04B 22/006 . . {released by a chemical reaction, e.g. polymer condensation}
- C04B 22/0066 . {Compounds chosen for their high crystalwater content}
- C04B 22/0073 . . {added in the non-hydrated or only partially-hydrated form}
- C04B 22/008 . {Cement and like inorganic materials added as expanding or shrinkage compensating ingredients in mortar or concrete compositions, the expansion being the result of a recrystallisation (mixtures of cements [C04B 7/00](#), [C04B 28/00](#))}
- C04B 22/0086 . {Seeding materials}
- C04B 22/0093 . {Aluminates}
- C04B 22/02 . Elements
- C04B 22/04 . . Metals, e.g. aluminium used as blowing agent
- C04B 22/06 . Oxides, Hydroxides ([C04B 22/0013](#) takes precedence)
- C04B 22/062 . . {of the alkali or alkaline-earth metals}
- C04B 22/064 . . . {of the alkaline-earth metals}
- C04B 22/066 . . {Magnesia; Magnesium hydroxide}
- C04B 22/068 . . {Peroxides, e.g. hydrogen peroxide}
- C04B 22/08 . Acids or salts thereof {([C04B 22/0013](#) takes precedence)}
- C04B 22/082 . . {Acids}
- C04B 22/085 . . {containing nitrogen in the anion, e.g. nitrites}
- C04B 22/087 . . {containing chromium in the anion, e.g. chromates}
- C04B 22/10 . . containing carbon in the anion
- C04B 22/103 . . . {Acids}
- C04B 22/106 . . . {Bicarbonates}
- C04B 22/12 . . containing halogen in the anion
- C04B 22/122 . . . {Acids}
- C04B 22/124 . . . {Chlorides of ammonium or of the alkali or alkaline earth metals, e.g. calcium chloride}
- C04B 22/126 . . . {Fluorine compounds, e.g. silico-fluorine compounds}
- C04B 22/128 . . . {Bromine compounds}
- C04B 22/14 . . containing sulfur in the anion, e.g. sulfides
- C04B 22/141 . . . {Acids}
- C04B 22/142 . . . {Sulfates}
- C04B 22/143 {Calcium-sulfate}
- C04B 22/144 {Phosphogypsum}
- C04B 22/145 {Gypsum from the desulfuration of flue gases}
- C04B 22/146 {other waste Ca-sulfate}
- C04B 22/147 {Alkali-metal sulfates; Ammonium sulfate}
- C04B 22/148 {Aluminium-sulfate}
- C04B 22/149 {Iron-sulfates}
- C04B 22/16 . . containing phosphorus in the anion, e.g. phosphates

C04B 22/165 . . . {Acids}

C04B 24/00 Use of organic materials as active ingredients for mortars, concrete or artificial stone, e.g. plasticisers

NOTE

Groups [C04B 24/003](#) to [C04B 24/006](#) take precedence over groups [C04B 24/008](#) to [C04B 24/226](#)

- C04B 24/001 . {Waste organic materials}
- C04B 24/003 . {Phosphorus-containing compounds}
- C04B 24/005 . {Halogen-containing compounds}
- C04B 24/006 . {Boron-containing compounds}
- C04B 24/008 . {Aldehydes, ketones}
- C04B 24/02 . Alcohols; Phenols; Ethers
- C04B 24/023 . . {Ethers}
- C04B 24/026 . . {Fatty alcohols}
- C04B 24/04 . Carboxylic acids; Salts, anhydrides or esters thereof
- C04B 24/045 . . {Esters, e.g. lactones}
- C04B 24/06 . . containing hydroxy groups
- C04B 24/08 . Fats; Fatty oils; Ester type waxes; Higher fatty acids, i.e. having at least seven carbon atoms in an unbroken chain bound to a carboxyl group; Oxidised oils or fats
- C04B 24/085 . . {Higher fatty acids}
- C04B 24/10 . Carbohydrates or derivatives thereof
- C04B 24/12 . Nitrogen containing compounds {organic derivatives of hydrazine ([hydrazine C04B 22/00](#))}
- C04B 24/121 . . {Amines, polyamines}
- C04B 24/122 . . {Hydroxy amines}
- C04B 24/123 . . {Amino-carboxylic acids}
- C04B 24/124 . . {Amides}
- C04B 24/125 . . {Compounds containing one or more carbon-to-nitrogen double or triple bonds, e.g. imines}
- C04B 24/126 . . {Urea}
- C04B 24/127 . . {Nitro-compounds}
- C04B 24/128 . . {Heterocyclic nitrogen compounds}
- C04B 24/129 . . {Compounds containing one or more nitrogen-to-nitrogen double bonds, e.g. azo-compounds}
- C04B 24/14 . . Peptides; Proteins; Derivatives thereof
- C04B 24/16 . Sulfur-containing compounds
- C04B 24/161 . . {Macromolecular compounds comprising sulfonate or sulfate groups}
- C04B 24/163 . . . {obtained by reactions only involving carbon-to-carbon unsaturated bonds}
- C04B 24/165 {containing polyether side chains}

- C04B 24/166 . . . {obtained otherwise than by reactions only involving carbon-to-carbon unsaturated bonds}
- C04B 24/168 . . . {Polysaccharide derivatives, e.g. starch sulfate}
- C04B 24/18 . . Lignin sulfonic acid or derivatives thereof, e.g. sulfite lye
- C04B 24/20 . . Sulfonated aromatic compounds
- C04B 24/22 . . . Condensation {or polymerisation} products thereof

NOTE

In this group the following term is used with the meaning indicated:

- "aldehydes" also covers other organic compounds reacting as aldehydes, e.g. glyoxylic acid

- C04B 24/223 {Sulfonated melamine-formaldehyde condensation products}
- C04B 24/226 {Sulfonated naphthalene-formaldehyde condensation products}
- C04B 24/24 . . Macromolecular compounds (C04B 24/14 takes precedence; macromolecular compounds comprising sulfonate or sulfate groups C04B 24/16)
- C04B 24/243 . . {Phosphorus-containing polymers}
- C04B 24/246 . . . {containing polyether side chains}
- C04B 24/26 . . obtained by reactions only involving carbon-to-carbon unsaturated bonds {(C04B 24/243 takes precedence)}
- C04B 24/2605 . . . {containing polyether side chains}
- C04B 24/2611 . . . {Polyalkenes}
- C04B 24/2617 . . . {Coumarone polymers}
- C04B 24/2623 . . . {Polyvinylalcohols; Polyvinylacetates}
- C04B 24/2629 {containing polyether side chains}
- C04B 24/2635 . . . {Polyvinylacetals}
- C04B 24/2641 . . . {Polyacrylates; Polymethacrylates}
- C04B 24/2647 {containing polyether side chains}
- C04B 24/2652 . . . {Nitrogen containing polymers, e.g. polyacrylamides, polyacrylonitriles}
- C04B 24/2658 {containing polyether side chains}
- C04B 24/2664 . . . {of ethylenically unsaturated dicarboxylic acid polymers, e.g. maleic anhydride copolymers}
- C04B 24/267 {containing polyether side chains}
- C04B 24/2676 . . . {Polystyrenes}
- C04B 24/2682 . . . {Halogen containing polymers, e.g. PVC}
- C04B 24/2688 . . . {Copolymers containing at least three different monomers}
- C04B 24/2694 {containing polyether side chains}
- C04B 24/28 . . obtained otherwise than by reactions only involving carbon-to-carbon unsaturated bonds {(C04B 24/243 takes precedence)}
- C04B 24/281 . . . {Polyepoxides}
- C04B 24/282 . . . {Polyurethanes; Polyisocyanates}
- C04B 24/283 . . . {Polyesters}

- C04B 24/285 {Polylactides}
- C04B 24/286 {Polycarbonates}
- C04B 24/287 {Polyamides}
- C04B 24/288 {Halogen containing polymers}
- C04B 24/30 Condensation polymers of aldehydes or ketones

NOTE

In this group the following term is used with the meaning indicated:

- "aldehydes" also covers other organic compounds reacting as aldehydes, e.g. glyoxylic acid

- C04B 24/302 {Phenol-formaldehyde condensation polymers}
- C04B 24/305 {Melamine-formaldehyde condensation polymers}
- C04B 24/307 {Urea-formaldehyde condensation polymers}
- C04B 24/32 Polyethers, e.g. alkylphenol polyglycolether
- C04B 24/34 Natural resins, e.g. rosin {(C04B 24/243 takes precedence)}
- C04B 24/36 Bituminous materials, e.g. tar, pitch {(C04B 24/243 takes precedence)}
- C04B 24/38 Polysaccharides or derivatives thereof {(C04B 24/243 takes precedence)}
- C04B 24/383 {Cellulose or derivatives thereof}
- C04B 24/386 {containing polyether side chains}
- C04B 24/40 Compounds containing silicon, titanium or zirconium {or other organo-metallic compounds; Organo-clays; Organo-inorganic complexes}
- C04B 24/405 {Organo-inorganic complexes}
- C04B 24/42 Organo-silicon compounds
- C04B 24/425 {Organo-modified inorganic compounds, e.g. organo-clays}

Compositions of mortars, concrete or artificial stone (artificial stone from molten slag C04B 5/00)

- C04B 26/00** **Compositions of mortars, concrete or artificial stone, containing only organic binders {, e.g. polymer or resin concrete (mechanical aspects of moulding polymer or resin concrete B29C 67/242)}**
- C04B 26/003 . . {Oil-based binders, e.g. containing linseed oil}
- C04B 26/006 . . {Waste materials as binder}
- C04B 26/02 . . . Macromolecular compounds
- C04B 26/023 . . . {Organic ionomer cements}
- C04B 26/026 . . . {Proteins or derivatives thereof}
- C04B 26/04 . . . obtained by reactions only involving carbon-to-carbon unsaturated bonds
- C04B 26/045 {Polyalkenes}
- C04B 26/06 Acrylates
- C04B 26/08 containing halogen
- C04B 26/10 . . . obtained otherwise than by reactions only involving carbon-to-carbon unsaturated bonds

- C04B 26/105 . . . {Furfuryl alcohol polymers, e.g. furan-polymers}
- C04B 26/12 . . . Condensation polymers of aldehydes or ketones

NOTE

In this group the following term is used with the meaning indicated:

- "aldehydes" also covers other organic compounds reacting as aldehydes, e.g. glyoxylic acid

- C04B 26/122 {Phenol-formaldehyde condensation polymers}
- C04B 26/125 {Melamine-formaldehyde condensation polymers}
- C04B 26/127 {Urea formaldehyde condensation polymers}
- C04B 26/14 . . . Polyepoxides
- C04B 26/16 . . . Polyurethanes
- C04B 26/18 . . . Polyesters; Polycarbonates
- C04B 26/20 . . . Polyamides
- C04B 26/22 . . Natural resins, e.g. rosin
- C04B 26/24 . . . Cellulosic waste liquor, e.g. sulfite lye
- C04B 26/26 . . Bituminous materials, e.g. tar, pitch {(C08L 95/00 takes precedence)}
- C04B 26/28 . . Polysaccharides or derivatives thereof
- C04B 26/285 . . . {Cellulose or derivatives thereof, e.g. starch (C04B 26/24 takes precedence)}
- C04B 26/30 . Compounds having one or more carbon-to-metal or carbon-to-silicon linkages; {Other silicon-containing organic compounds; Boron-organic compounds}
- C04B 26/32 . . containing silicon

C04B 28/00 **Compositions of mortars, concrete or artificial stone, containing inorganic binders or the reaction product of an inorganic and an organic binder, e.g. polycarboxylate cements**

NOTE

While using Combination Sets in this main group, the presence of an organic binder is indicated with symbols chosen from group C04B 24/00, and the presence of a supplementary inorganic binder with symbols chosen from groups C04B 7/00 to C04B 12/00

- C04B 28/001 . {containing unburned clay (polymer binder - clay mixtures used in well cementing C09K 8/44)}
- C04B 28/003 . {containing hybrid binders other than those of the polycarboxylate type}
- C04B 28/005 . {containing gelatinous or gel forming binders, e.g. gelatinous Al(OH)₃, sol-gel binders}
- C04B 28/006 . {containing mineral polymers, e.g. geopolymers of the Davidovits type}
- C04B 28/008 . . {Mineral polymers other than those of the Davidovits type, e.g. from a reaction mixture containing waterglass}
- C04B 28/02 . containing hydraulic cements other than calcium sulfates

- C04B 28/021 . . {Ash cements, e.g. fly ash cements (fly ash as filler [C04B 18/08](#)); Cements based on incineration residues, e.g. alkali-activated slags from waste incineration (alkali-activated combustion residues as such [C04B 7/243](#); mixtures of the lime-pozzuolane type [C04B 28/18](#)); Kiln dust cements}
- C04B 28/023 . . {Barium cements}
- C04B 28/025 . . {Belite cements}
- C04B 28/026 . . {Oil shale cements}
- C04B 28/028 . . {Alinite cements, i.e. "Nudelman"-type cements}
- C04B 28/04 . . Portland cements
- C04B 28/06 . . Aluminous cements (monolithic refractories or refractory mortars [C04B 35/66](#))
- C04B 28/065 . . . {Calcium aluminosulfate cements, e.g. cements hydrating into ettringite}
- C04B 28/08 . . Slag cements
- C04B 28/082 . . . {Steelmaking slags; Converter slags}
- C04B 28/085 . . . {Slags from the production of specific alloys, e.g. ferrochrome slags}
- C04B 28/087 . . . {Phosphorus slags}
- C04B 28/10 . . Lime cements or magnesium oxide cements
- C04B 28/105 . . . {Magnesium oxide or magnesium carbonate cements}
- C04B 28/12 . . . Hydraulic lime
- C04B 28/14 . . containing calcium sulfate cements {(gypsum-paper plates [E04C](#))}
- C04B 28/141 . . {containing dihydrated gypsum before the final hardening step, e.g. forming a dihydrated gypsum product followed by a de- and rehydration step}
- C04B 28/142 . . {containing synthetic or waste calcium sulfate cements}
- C04B 28/143 . . . {the synthetic calcium sulfate being phosphogypsum}
- C04B 28/144 . . . {the synthetic calcium sulfate being a flue gas desulfurization product}
- C04B 28/145 . . {Calcium sulfate hemi-hydrate with a specific crystal form}
- C04B 28/146 . . . {alpha-hemihydrate}
- C04B 28/147 . . . {beta-hemihydrate}
- C04B 28/148 . . {containing calcium sulfate formed in situ, e.g. by the reaction of iron sulfate with lime}
- C04B 28/16 . . containing anhydrite, {e.g. Keene's cement}
- C04B 28/165 . . . {containing synthetic anhydrite}
- C04B 28/18 . . containing mixtures of the silica-lime type
- C04B 28/182 . . {based on calcium silicate forming mixtures not containing lime or lime producing ingredients, e.g. waterglass based mixtures heated with a calcium salt}
- C04B 28/184 . . {based on an oxide other than lime}
- C04B 28/186 . . {containing formed Ca-silicates before the final hardening step}
- C04B 28/188 . . . {the Ca-silicates being present in the starting mixture}
- C04B 28/20 . . Sand-lime

WARNING

Group [C04B 28/20](#) is not complete, see also [C04B 28/18](#)

C04B 28/22 . . Lime and pozzuolanas

WARNING

Group [C04B 28/22](#) and subgroup are not complete, see also [C04B 28/18](#)

C04B 28/225 . . . {artificial pozzuolanas}

C04B 28/24 . containing alkyl, ammonium or metal silicates; containing silica sols {(reaction mixtures resulting in mineral polymers [C04B 28/006](#); polymeric reaction products of alkali metal silicates with isocyanates [C08G 18/3895](#))}

C04B 28/26 . . Silicates of the alkali metals

C04B 28/28 . containing organic polyacids, e.g. polycarboxylate cements, {i.e. ionomeric systems}

C04B 28/30 . containing magnesium cements {or similar cements} (magnesium oxide cements [C04B 28/10](#))

C04B 28/32 . . Magnesium oxychloride cements, e.g. Sorel cement

C04B 28/34 . containing cold phosphate binders

NOTE

While using Combination Sets in this main group, the presence of a reactive or reacted oxide is indicated with symbols chosen from [C04B 14/06](#) and [C04B 14/30](#) (and subgroups), except for boron oxide ([C04B 22/0013](#)) and oxides of the alkali or alkaline-earth metals, with the exception of magnesium ([C04B 22/062](#) and [C04B 22/064](#)), e.g. a composition containing a mixture of phosphoric acid, AlCr phosphate and magnesium oxide will be classified in [C04B 28/346](#) and will be indexed with codes [C04B 14/303](#), [C04B 14/304](#) and [C04B 14/307](#). "Phosphates" includes monobasic and dibasic phosphates

C04B 28/342 . . {the phosphate binder being present in the starting composition as a mixture of free acid and one or more reactive oxides}

C04B 28/344 . . {the phosphate binder being present in the starting composition solely as one or more phosphates}

C04B 28/346 . . {the phosphate binder being present in the starting composition as a mixture of free acid and one or more phosphates}

C04B 28/348 . . . {the starting mixture also containing one or more reactive oxides}

C04B 28/36 . containing sulfur, sulfides or selenium

C04B 28/365 . . {containing sulfides or selenium}

C04B 30/00 **Compositions for artificial stone, not containing binders**

C04B 30/02 . containing fibrous materials

C04B 32/00 **Artificial stone not provided for in other groups of this subclass**

C04B 32/005 . {Artificial stone obtained by melting at least part of the composition, e.g. metal ([C04B 28/36](#) and [C03C](#) take precedence; cast stone from molten slag [C04B 5/00](#); artificial stone obtained by melting the polymeric ingredient of the composition [C04B 26/00](#))}

- C04B 32/02 . with reinforcements {(contains no documents; reinforcing elements [E04C 5/00](#))}

NOTE

This group is only used for indexing purposes

Ceramics

- C04B 33/00** **Clay-wares** (monolithic refractories or refractory mortars [C04B 35/66](#); porous products [C04B 38/00](#))

NOTE

In groups [C04B 33/00](#) to [C04B 33/36](#), from 01-10-2008 onwards, the indexing codes of groups [C04B 2235/00](#) to [C04B 2235/9646](#) are used (with the exception of [C04B 2235/349](#), [C04B 2235/6027](#), [C04B 2235/604](#) and [C04B 2235/9661](#)) to identify aspects relating to ceramic starting mixtures and sintered ceramic products

- C04B 33/02 . Preparing or treating the raw materials individually or as batches
- C04B 33/025 . . {Mixtures of materials with different sizes}
- C04B 33/04 . . clay; kaolin
- C04B 33/06 . . . Rendering lime harmless
- C04B 33/08 Preventing efflorescence
- C04B 33/10 . . Eliminating iron or lime
- C04B 33/13 . . Compounding ingredients ([C04B 33/36](#), [C04B 35/71](#) take precedence; {pigments for ceramics [C09C 1/0009](#)})
- C04B 33/1305 . . . {Organic additives}
- C04B 33/131 . . . {Inorganic additives}
- C04B 33/1315 . . . {Non-ceramic binders}
- C04B 33/132 . . . Waste materials; Refuse; {Residues} ([C04B 33/16](#) takes precedence; {waste glass [C04B 33/13](#)})
- C04B 33/1321 {Waste slurries, e.g. harbour sludge, industrial muds (slurries of specific well-defined waste streams, e.g. phosphate muds, other than red mud, [C04B 33/132](#))}
- C04B 33/1322 {Red mud}
- C04B 33/1324 {Recycled material, e.g. tile dust, stone waste, spent refractory material}
- C04B 33/1325 {Hazardous waste other than combustion residues (dredging sludge [C04B 33/1321](#))}
- C04B 33/1327 {containing heavy metals}
- C04B 33/1328 {without additional clay}
- C04B 33/135 Combustion residues, e.g. fly ash, incineration waste {(silica fume [C04B 33/132](#))}
- C04B 33/1352 {Fuel ashes, e.g. fly ash}
- C04B 33/1355 {Incineration residues}
- C04B 33/1357 {Sewage sludge ash or slag}

- C04B 33/138 from metallurgical processes, e.g. slag, furnace dust, galvanic waste
- C04B 33/14 . . . Colouring matters
- C04B 33/16 . . . Lean materials, e.g. grog, quartz
- C04B 33/18 . . . for liquefying the batches
- C04B 33/20 . . for dry-pressing ([C04B 33/13 takes precedence](#))
- C04B 33/22 . Grog products
- C04B 33/24 . Manufacture of porcelain or white ware
- C04B 33/26 . . of porcelain for electrical insulation
- C04B 33/28 . Slip casting ([mechanical features B28B 1/26](#))
- C04B 33/30 . Drying methods
- C04B 33/32 . Burning methods
- C04B 33/323 . . {involving melting, fusion or softening}
- C04B 33/326 . . {under pressure}
- C04B 33/34 . . combined with glazing
- C04B 33/36 . Reinforced clay-wares

C04B 35/00

Shaped ceramic products characterised by their composition {(porous ceramic products [C04B 38/00](#); ceramic articles characterised by particular shape, see the relevant classes, e.g. linings for casting ladles, tundishes, cups or the like [B22D 41/02](#); ceramic substrates for microelectronic semi-conductors [H01L 23/15](#))}; **Ceramics compositions** (containing free metal bonded to carbides, diamond, oxides, borides, nitrides, silicides, e.g. cermets, or other metal compounds, e.g. oxynitrides or sulfides other than as macroscopic reinforcing agents [C22C](#); {shaping of ceramics [B28B](#)}); **Processing powders of inorganic compounds preparatory to the manufacturing of ceramic products** {(Chemical preparation of powders of inorganic compounds [C01](#); infiltration of sintered ceramic preforms with molten metal [C04B 41/51](#))}

NOTES

1. In this group, in the absence of an indication to the contrary, compositions are classified according to the constituent present in the highest proportion by weight.
2. In this group, magnesium is considered as an alkaline earth metal.
3. In this group, a composite is considered as a sintered material containing more than one phase, where the secondary phases are not resulting from sintering aids
4. In this group, fine ceramics are considered as products having a polycrystalline, fine-grained microstructure, e.g. of dimensions below 100 micrometers.
5. The production of ceramic powder is classified in this group in so far as it relates to the preparation of powder with specific characteristics.

C04B 35/00
(continued)

6. In groups [C04B 35/00](#) to [C04B 35/83](#), from 01-01-2005 onwards, the indexing codes of groups [C04B 2235/00](#) to [C04B 2235/9692](#) are used to identify aspects relating to ceramic starting mixtures and sintered ceramic products

WARNING

Attention is drawn to WARNINGS 3 and 4 after subclass title

- | | |
|--------------|---|
| C04B 35/01 | . based on oxide ceramics |
| C04B 35/013 | . . {containing carbon (C04B 35/103 takes precedence)} |
| C04B 35/016 | . . {based on manganites} |
| C04B 35/03 | . . based on magnesium oxide, calcium oxide or oxide mixtures derived from dolomite |
| C04B 35/04 | . . . based on magnesium oxide |
| C04B 35/043 | Refractories from grain sized mixtures |
| C04B 35/0435 | {containing refractory metal compounds other than chromium oxide or chrome ore} |
| C04B 35/047 | containing chromium oxide or chrome ore |
| C04B 35/0473 | {obtained from fused grains} |
| C04B 35/0476 | {obtained from prereacted sintered grains ("simultaneous sinter")} |
| C04B 35/05 | Refractories by fusion casting |
| C04B 35/051 | {containing chromium oxide or chrome ore} |
| C04B 35/053 | Fine ceramics |
| C04B 35/057 | . . . based on calcium oxide |
| C04B 35/06 | . . . based on oxide mixtures derived from dolomite |
| C04B 35/08 | . . based on beryllium oxide |
| C04B 35/10 | . . based on aluminium oxide |
| C04B 35/101 | . . . Refractories from grain sized mixtures |
| C04B 35/1015 | {containing refractory metal compounds other than those covered by C04B 35/103 to C04B 35/106 } |
| C04B 35/103 | containing non-oxide refractory materials, e.g. carbon (C04B 35/106 takes precedence) |
| C04B 35/105 | containing chromium oxide or chrome ore |
| C04B 35/106 | containing zirconium oxide or zircon (ZrSiO_4) |
| C04B 35/107 | . . . Refractories by fusion casting |
| C04B 35/109 | containing zirconium oxide or zircon (ZrSiO_4) |
| C04B 35/111 | . . . Fine ceramics |
| C04B 35/1115 | {Minute sintered entities, e.g. sintered abrasive grains or shaped particles such as platelets (abrasives C09K 3/14)} |
| C04B 35/113 | based on beta-aluminium oxide |
| C04B 35/115 | Translucent or transparent products |
| C04B 35/117 | Composites |
| C04B 35/119 | with zirconium oxide |
| C04B 35/12 | . . based on chromium oxide (C04B 35/047 and C04B 35/105 take precedence) |

- C04B 35/14 . . . based on silica
- C04B 35/16 . . . based on silicates other than clay {(zircon [C04B 35/48](#))}
- C04B 35/18 rich in aluminium oxide
- C04B 35/185 Mullite { $3\text{Al}_2\text{O}_3\text{-}2\text{SiO}_2$ }
- C04B 35/19 Alkali metal aluminosilicates, e.g. spodumene
- C04B 35/195 Alkaline earth aluminosilicates, e.g. cordierite {or anorthite}
- C04B 35/20 rich in magnesium oxide, {e.g. forsterite ([C04B 35/195](#) takes precedence)}
- C04B 35/22 rich in calcium oxide, {e.g. wollastonite ([C04B 35/195](#) takes precedence)}
- C04B 35/26 . . . based on ferrites
- C04B 35/2608 {Compositions containing one or more ferrites of the group comprising manganese, zinc, nickel, copper or cobalt and one or more ferrites of the group comprising rare earth metals, alkali metals, alkaline earth metals or lead}
- C04B 35/2616 {containing lithium}
- C04B 35/2625 {containing magnesium}
- C04B 35/2633 {containing barium, strontium or calcium}
- C04B 35/2641 {Compositions containing one or more ferrites of the group comprising rare earth metals and one or more ferrites of the group comprising alkali metals, alkaline earth metals or lead}
- C04B 35/265 {Compositions containing one or more ferrites of the group comprising manganese or zinc and one or more ferrites of the group comprising nickel, copper or cobalt}
- C04B 35/2658 {Other ferrites containing manganese or zinc, e.g. Mn-Zn ferrites}
- C04B 35/2666 {Other ferrites containing nickel, copper or cobalt}
- C04B 35/2675 {Other ferrites containing rare earth metals, e.g. rare earth ferrite garnets}
- C04B 35/2683 {Other ferrites containing alkaline earth metals or lead}
- C04B 35/2691 {Other ferrites containing alkaline metals}
- C04B 35/42 . . . based on chromites ([C04B 35/047](#) and [C04B 35/105](#) take precedence)
- C04B 35/44 . . . based on aluminates
- C04B 35/443 Magnesium aluminate spinel
- C04B 35/447 . . . based on phosphates, {e.g. hydroxyapatite}
- C04B 35/45 . . . based on copper oxide or solid solutions thereof with other oxides

NOTE

In groups [C04B 35/4504](#) to [C04B 35/4525](#) an invention is classified in the last appropriate place

- C04B 35/4504 {containing rare earth oxides}
- C04B 35/4508 {Type 1-2-3}
- C04B 35/4512 {containing thallium oxide}
- C04B 35/4517 {also containing lead oxide}
- C04B 35/4521 {containing bismuth oxide}
- C04B 35/4525 {also containing lead oxide}

- C04B 35/453 . . . based on zinc, tin, or bismuth oxides or solid solutions thereof with other oxides, e.g. zincates, stannates or bismuthates
- C04B 35/457 based on tin oxides or stannates
- C04B 35/46 . . . based on titanium oxide or titanates (containing also zirconium or hafnium oxides, zirconates or hafnates [C04B 35/49](#))
- C04B 35/462 based on titanates
- C04B 35/465 based on alkaline earth metal titanates
- C04B 35/468 based on barium titanates
- C04B 35/4682 {based on BaTiO_3 perovskite phase}
- C04B 35/4684 {containing lead compounds ([C04B 35/472](#) takes precedence)}
- C04B 35/4686 {based on phases other than BaTiO_3 perovskite phase}
- C04B 35/4688 {containing lead compounds ([C04B 35/472](#) takes precedence)}
- C04B 35/47 based on strontium titanates
- C04B 35/472 based on lead titanates
- C04B 35/475 based on bismuth titanates
- C04B 35/478 based on aluminium titanates
- C04B 35/48 . . . based on zirconium or hafnium oxides, zirconates, {zircon} or hafnates
- C04B 35/481 {containing silicon, e.g. zircon}
- C04B 35/482 Refractories from grain sized mixtures
- C04B 35/484 Refractories by fusion casting
- C04B 35/486 Fine ceramics
- C04B 35/488 Composites
- C04B 35/4885 {with aluminium oxide}
- C04B 35/49 containing also titanium oxides or titanates
- C04B 35/491 based on lead zirconates and lead titanates, {e.g. PZT}
- C04B 35/493 containing also other lead compounds
- C04B 35/495 . . . based on vanadium, niobium, tantalum, molybdenum or tungsten oxides or solid solutions thereof with other oxides, e.g. vanadates, niobates, tantalates, molybdates or tungstates
- C04B 35/497 based on solid solutions with lead oxides
- C04B 35/499 containing also titanates
- C04B 35/50 . . . based on rare-earth compounds {(non-oxide rare earth compounds [C04B 35/5156](#))}
- C04B 35/505 based on yttrium oxide
- C04B 35/51 . . . based on compounds of actinides ({non-oxide actinide compounds [C04B 35/5158](#)}; nuclear fuel materials [G21C 3/62](#))
- C04B 35/515 . . . based on non-oxide ceramics
- C04B 35/5152 . . . {based on halogenides other than fluorides}
- C04B 35/5154 . . . {based on phosphides}
- C04B 35/5156 . . . {based on rare earth compounds}
- C04B 35/5158 . . . {based on actinide compounds}
- C04B 35/52 . . . based on carbon, e.g. graphite

C04B 35/521	. . . {obtained by impregnation of carbon products with a carbonisable material}
C04B 35/522	. . . {Graphite (C04B 35/536 takes precedence)}
C04B 35/524	. . . obtained from polymer precursors, e.g. glass-like carbon material
C04B 35/528	. . . obtained from carbonaceous particles with or without other non-organic components
C04B 35/532	. . . . containing a carbonisable binder
C04B 35/536	. . . based on expanded graphite {or complexed graphite}
C04B 35/547	. . . based on sulfides or selenides {or tellurides}
C04B 35/553	. . . based on fluorides
C04B 35/56	. . . based on carbides {or oxycarbides (containing free metal binder C22C 29/00)}
C04B 35/5603	. . . {with a well-defined oxygen content, e.g. oxycarbides}
C04B 35/5607	. . . {based on refractory metal carbides}
C04B 35/5611	. . . . {based on titanium carbides}
C04B 35/5615	. . . . . {based on titanium silicon carbides}
C04B 35/5618	. . . . . {based on titanium aluminium carbides}
C04B 35/5622	. . . . . {based on zirconium or hafnium carbides}
C04B 35/5626	. . . . . {based on tungsten carbides}
C04B 35/563	. . . based on boron carbide
C04B 35/565	. . . based on silicon carbide
C04B 35/571	. . . . obtained from {Si-containing} polymer precursors {or organosilicon monomers}
C04B 35/573	. . . . obtained by reaction sintering {or recrystallisation}
C04B 35/575	. . . . obtained by pressure sintering
C04B 35/5755	. . . . . {obtained by gas pressure sintering}
C04B 35/58	. . . based on borides, nitrides, [i.e. nitrides, oxynitrides, carbonitrides or oxycarbonitrides] or silicides {(containing free binder metal C22C 29/00)}
C04B 35/58007	. . . {based on refractory metal nitrides}
C04B 35/58014	. . . . {based on titanium nitrides, e.g. TiAlON}
C04B 35/58021	. . . . . {based on titanium carbonitrides}
C04B 35/58028	. . . . . {based on zirconium or hafnium nitrides}
C04B 35/58035	. . . . . {based on zirconium or hafnium carbonitrides}
C04B 35/58042	. . . {based on iron group metals nitrides}
C04B 35/5805	. . . {based on borides}
C04B 35/58057	. . . . {based on magnesium boride, e.g. MgB ₂ }
C04B 35/58064	. . . . {based on refractory borides}
C04B 35/58071	. . . . . {based on titanium borides}
C04B 35/58078	. . . . . {based on zirconium or hafnium borides}
C04B 35/58085	. . . {based on silicides}
C04B 35/58092	. . . . {based on refractory metal silicides}
C04B 35/581	. . . based on aluminium nitride
C04B 35/583	. . . based on boron nitride

- C04B 35/5831 based on cubic boron nitrides {or Wurtzitic boron nitrides, including crystal structure transformation of powder}
- C04B 35/584 based on silicon nitride
- C04B 35/587 Fine ceramics
- C04B 35/589 obtained from {Si-containing} polymer precursors {or organosilicon monomers}
- C04B 35/591 obtained by reaction sintering
- C04B 35/593 obtained by pressure sintering
- C04B 35/5935 {obtained by gas pressure sintering}
- C04B 35/597 based on silicon oxynitride, {e.g. SIALONS}
- C04B 35/622 . Forming processes; Processing powders of inorganic compounds preparatory to the manufacturing of ceramic products

NOTE

In groups [C04B 35/622](#) and subgroups indexing codes are given for aspects relating to the preparation, properties or mechanical treatment or to heat treatments of green bodies. The codes are chosen from [C04B 2235/60](#) to [C04B 2235/668](#)

- C04B 35/62204 . . {using waste materials or refuse (clay-wares containing waste materials [C04B 33/132](#))}
- C04B 35/62209 . . . {using woody material, remaining in the ceramic products (to obtain porous material by burning out [C04B 38/06](#))}
- C04B 35/62213 . . . {using rice material, e.g. bran or hulls or husks}
- C04B 35/62218 . . {obtaining ceramic films, e.g. by using temporary supports}
- C04B 35/62222 . . {obtaining ceramic coatings (coating of mortars, concrete, artificial or natural stone or ceramics [C04B 41/45](#); laminated ceramic products [B32B 18/00](#); coating metallic materials [C23](#); coating of glass [C03C 17/00](#), applying ceramic coatings on silicon for semi-conductor purposes [H01L](#))}
- C04B 35/62227 . . {obtaining fibres}
- C04B 35/62231 . . . {based on oxide ceramics}
- C04B 35/62236 {Fibres based on aluminium oxide}
- C04B 35/6224 {Fibres based on silica}
- C04B 35/62245 {rich in aluminium oxide}
- C04B 35/6225 {Fibres based on zirconium oxide, e.g. zirconates such as PZT}
- C04B 35/62254 {Fibres based on copper oxide}
- C04B 35/62259 {Fibres based on titanium oxide}
- C04B 35/62263 {Fibres based on magnesium oxide}
- C04B 35/62268 {Fibres based on metal phosphorus oxides, e.g. phosphates}
- C04B 35/62272 . . . {based on non-oxide ceramics (carbon nanotubes [C01B 31/0206](#); carbon fibers [D01F 9/12](#))}
- C04B 35/62277 {Fibres based on carbides}
- C04B 35/62281 {based on silicon carbide ([C04B 35/571](#) takes precedence)}
- C04B 35/62286 {Fibres based on nitrides}

- C04B 35/6229 {based on boron nitride}
- C04B 35/62295 {based on silicon nitride ([C04B 35/589](#) takes precedence)}
- C04B 35/624 . . Sol-gel processing
- C04B 35/626 . . Preparing or treating the powders individually or as batches {(pigments for ceramics [C09C 1/0009](#)); preparing or treating macroscopic reinforcing agents for ceramic products, e.g. fibres; mechanical aspects section B}

WARNING

Groups [C04B 35/62605](#) to [C04B 35/62695](#) are not complete, see also other subgroups of [C04B 35/00](#), e.g. [C04B 35/626](#)

- C04B 35/62605 . . . {Treating the starting powders individually or as mixtures}
- C04B 35/6261 {Milling}
- C04B 35/62615 {High energy or reactive ball milling}
- C04B 35/6262 {of calcined, sintered clinker or ceramics}
- C04B 35/62625 {Wet mixtures}
- C04B 35/6263 {characterised by their solids loadings, i.e. the percentage of solids}
- C04B 35/62635 {Mixing details}
- C04B 35/6264 {Mixing media, e.g. organic solvents}
- C04B 35/62645 {Thermal treatment of powders or mixtures thereof other than sintering}
- C04B 35/6265 {involving reduction or oxidation}
- C04B 35/62655 {Drying, e.g. freeze-drying, spray-drying, microwave or supercritical drying}
- C04B 35/6266 {Humidity controlled drying}
- C04B 35/62665 {Flame, plasma or melting treatment}
- C04B 35/6267 {Pyrolysis, carbonisation or auto-combustion reactions}
- C04B 35/62675 {characterised by the treatment temperature}
- C04B 35/6268 {characterised by the applied pressure or type of atmosphere, e.g. in vacuum, hydrogen or a specific oxygen pressure}
- C04B 35/62685 {characterised by the order of addition of constituents or additives}
- C04B 35/6269 {Curing of mixtures}
- C04B 35/62695 {Granulation or pelletising (devices for shaping artificial aggregates from ceramic mixtures [B28B 1/004](#))}
- C04B 35/628 . . . Coating the powders {or the macroscopic reinforcing agents}
- C04B 35/62802 {Powder coating materials}
- C04B 35/62805 {Oxide ceramics}
- C04B 35/62807 {Silica or silicates}
- C04B 35/6281 {Alkaline earth metal oxides}
- C04B 35/62813 {Alumina or aluminates}
- C04B 35/62815 {Rare earth metal oxides}
- C04B 35/62818 {Refractory metal oxides}
- C04B 35/62821 {Titanium oxide}

C04B 35/62823	. . . . .	{Zirconium or hafnium oxide}
C04B 35/62826	. . . . .	{Iron group metal oxides}
C04B 35/62828	. . . . .	{Non-oxide ceramics}
C04B 35/62831	. . . . .	{Carbides}
C04B 35/62834	. . . . .	{Silicon carbide}
C04B 35/62836	. . . . .	{Nitrides}
C04B 35/62839	. . . . .	{Carbon}
C04B 35/62842	. . . . .	{Metals}
C04B 35/62844	. . . . .	{Coating fibres}
C04B 35/62847	. . . . .	{with oxide ceramics}
C04B 35/62849	. . . . .	{Silica or silicates}
C04B 35/62852	. . . . .	{Alumina or aluminates}
C04B 35/62855	. . . . .	{Refractory metal oxides}
C04B 35/62857	. . . . .	{with non-oxide ceramics}
C04B 35/6286	. . . . .	{Carbides}
C04B 35/62863	. . . . .	{Silicon carbide}
C04B 35/62865	. . . . .	{Nitrides}
C04B 35/62868	. . . . .	{Boron nitride}
C04B 35/62871	. . . . .	{Silicon nitride}
C04B 35/62873	. . . . .	{Carbon}
C04B 35/62876	. . . . .	{with metals}
C04B 35/62878	. . . . .	{with boron or silicon}
C04B 35/62881	. . . . .	{with metal salts, e.g. phosphates}
C04B 35/62884	. . . . .	{by gas phase techniques}
C04B 35/62886	. . . . .	{by wet chemical techniques}
C04B 35/62889	. . . . .	{with a discontinuous coating layer}
C04B 35/62892	. . . . .	{with a coating layer consisting of particles}
C04B 35/62894	. . . . .	{with more than one coating layer}
C04B 35/62897	. . . . .	{Coatings characterised by their thickness}
C04B 35/63	. . . . .	using additives specially adapted for forming the products, {e.g.. binder binders}
C04B 35/6303	. . . . .	{Inorganic additives}
C04B 35/6306	. . . . .	{Binders based on phosphoric acids or phosphates}
C04B 35/6309	. . . . .	{Aluminium phosphates}
C04B 35/6313	. . . . .	{Alkali metal or alkaline earth metal phosphates}
C04B 35/6316	. . . . .	{Binders based on silicon compounds}
C04B 35/632	. . . . .	Organic additives
C04B 35/6325	. . . . .	{based on organo-metallic compounds}
C04B 35/634	. . . . .	Polymers (C04B 35/636 takes precedence)
C04B 35/63404	. . . . .	{obtained by reactions only involving carbon-to-carbon unsaturated bonds}

C04B 35/63408	. . . . .	{Polyalkenes}
C04B 35/63412	. . . . .	{Coumarone polymers}
C04B 35/63416	. . . . .	{Polyvinylalcohols [PVA]; Polyvinylacetates}
C04B 35/6342	. . . . .	{Polyvinylacetals, e.g. polyvinylbutyral [PVB]}
C04B 35/63424	. . . . .	{Polyacrylates; Polymethacrylates}
C04B 35/63428	. . . . .	{of ethylenically unsaturated dicarboxylic acid anhydride polymers, e.g. maleic anhydride copolymers}
C04B 35/63432	. . . . .	{Polystyrenes}
C04B 35/63436	. . . . .	{Halogen-containing polymers, e.g. PVC}
C04B 35/6344	. . . . .	{Copolymers containing at least three different monomers}
C04B 35/63444	. . . . .	{Nitrogen-containing polymers, e.g. polyacrylamides, polyacrylonitriles, polyvinylpyrrolidone [PVP], polyethylenimine [PEI]}
C04B 35/63448	. . . . .	{obtained otherwise than by reactions only involving carbon-to-carbon unsaturated bonds}
C04B 35/63452	. . . . .	{Polyepoxides}
C04B 35/63456	. . . . .	{Polyurethanes; Polyisocyanates}
C04B 35/6346	. . . . .	{Polyesters}
C04B 35/63464	. . . . .	{Polycarbonates}
C04B 35/63468	. . . . .	{Polyamides}
C04B 35/63472	. . . . .	{Condensation polymers of aldehydes or ketones}

NOTE

In this group the following term is used with the meaning indicated:

- "aldehydes" also covers other organic compounds reacting as aldehydes, e.g. glyoxylic acid

C04B 35/63476	. . . . .	{Phenol-formaldehyde condensation polymers}
C04B 35/6348	. . . . .	{Melamine-formaldehyde condensation polymers}
C04B 35/63484	. . . . .	{Urea-formaldehyde condensation polymers}
C04B 35/63488	. . . . .	{Polyethers, e.g. alkylphenol polyglycolether, polyethylene glycol [PEG], polyethylene oxide [PEO]}
C04B 35/63492	. . . . .	{Natural resins, e.g. rosin}
C04B 35/63496	. . . . .	{Bituminous materials, e.g. tar, pitch}
C04B 35/636	. . . . .	Polysaccharides or derivatives thereof
C04B 35/6365	. . . . .	{Cellulose or derivatives thereof}
C04B 35/638	. . . . .	Removal thereof
C04B 35/64	. . . . .	Burning or sintering processes (C04B 33/32 takes precedence; {powder metallurgy B22F })
C04B 35/645	. . . . .	Pressure sintering
C04B 35/6455	. . . . .	{Hot isostatic pressing}

- C04B 35/65 . . . Reaction sintering of free metal- or free silicon-containing compositions {(C04B 35/573, C04B 35/591 take precedence)}
- C04B 35/651 {Thermite type sintering, e.g. combustion sintering}
- C04B 35/652 {Directional oxidation or solidification, e.g. Lanxide process}
- C04B 35/653 . . Processes involving a melting step
- C04B 35/657 . . . for manufacturing refractories (C04B 35/05, C04B 35/107, C04B 35/484 take precedence)
- C04B 35/66 . Monolithic refractories or refractory mortars, including those whether or not containing clay {(making or repairing of linings F27D 1/16)}
- C04B 35/71 . Ceramic products containing macroscopic reinforcing agents (C04B 35/66 takes precedence; {infiltration of a porous ceramic matrix with a material forming a non-ceramic phase C04B 41/00, reaction infiltration with Si in order to form SiC C04B 35/573, in order to form Si₃N₄ C04B 35/591})

NOTE

In groups C04B 35/71 to C04B 35/83 the composition of the ceramic products is also classified in groups C04B 35/01 to C04B 35/597

- C04B 35/74 . . containing shaped metallic materials
- C04B 35/76 . . . Fibres, filaments, whiskers, platelets, or the like
- C04B 35/78 . . containing non-metallic materials
- C04B 35/80 . . . Fibres, filaments, whiskers, platelets, or the like {(carbon reinforced with carbon fibres see C04B 35/83)}
- C04B 35/803 {The matrix of the ceramic products consisting of oxides only}
- C04B 35/806 {The matrix of the ceramic products consisting of non-oxides only}
- C04B 35/82 Asbestos; Glass; Fused silica
- C04B 35/83 Carbon fibres in a carbon matrix

NOTE

The products covered by this group are usually referred to as "carbon-carbon composites".

C04B 37/00 **Joining burned ceramic articles with other burned ceramic articles or other articles by heating** (laminated products B32B, E04C; {soldering and welding materials B23K 35/24})

NOTE

In groups C04B 37/00 to C04B 37/04, from 01-10-2008 onwards, features relating to interlayers, additional compositional information or further processing are indexed with codes chosen from C04B 2237/00 to C04B 2237/88

WARNING

Groups C04B 37/005, C04B 37/006, C04B 37/025 and C04B 37/026 are no longer used for classification as from September 1, 2008. Aspects relating to

C04B 37/00

(continued)

interlayers are from that date indexed by codes chosen from [C04B 2237/02](#) to [C04B 2237/16](#)

- C04B 37/001** . {directly with other burned ceramic articles}
- C04B 37/003** . {by means of an interlayer consisting of a combination of materials selected from glass, or ceramic material with metals, metal oxides or metal salts}
- C04B 37/005** . . {consisting of glass or ceramic material}
- C04B 37/006** . . {consisting of metals or metal salts}
- C04B 37/008** . {by means of an interlayer consisting of an organic adhesive, e.g. phenol resin or pitch}
- C04B 37/02** . with metallic articles
- C04B 37/021** . . {in a direct manner, e.g. direct copper bonding [DCB]}
- C04B 37/023** . . {characterised by the interlayer used ([C04B 37/028](#) takes precedence)}
- C04B 37/025** . . . {consisting of glass or ceramic material}
- C04B 37/026** . . . {consisting of metals or metal salts}
- C04B 37/028** . . {by means of an interlayer consisting of an organic adhesive, e.g. phenol resin or pitch}
- C04B 37/04** . with articles made from glass

WARNING

Groups [C04B 37/042](#), [C04B 37/045](#) and [C04B 37/047](#) are not complete, see also [C04B 37/04](#)

- C04B 37/042** . . {in a direct manner}
- C04B 37/045** . . {characterised by the interlayer used ([C04B 37/047](#) takes precedence)}
- C04B 37/047** . . {by means of an interlayer consisting of an organic adhesive, e.g. phenol resin or pitch}

C04B 38/00

Porous mortars, concrete, artificial stone or ceramic ware; Preparation thereof (treating slag with gases or gas generating material [C04B 5/06](#); {expanded graphite [C04B 35/536](#)})

NOTE

Porous materials based on fibres, i.e. materials where the porosity is due to the spaces between the fibres, are not classified in this maingroup, but in one or more of the other relevant maingroups of this subclass, e.g. in [C04B 30/02](#)

- C04B 38/0003** . {containing continuous channels, e.g. of the "dead-end" type or obtained by pushing bars in the green ceramic product ([B28B](#) takes precedence)}
- C04B 38/0006** . {Honeycomb structures (from one or more corrugated sheets by winding or stacking [C04B 38/0083](#))}
- C04B 38/0009** . . {characterised by features relating to the cell walls, e.g. wall thickness or distribution of pores in the walls}
- C04B 38/0012** . . {characterised by the material used for sealing or plugging (some of) the channels of the honeycombs}
- C04B 38/0016** . . {assembled from subunits}

- C04B 38/0019 . . . {characterised by the material used for joining separate subunits}

NOTE

{ When classifying in group [C04B 38/0019](#), classification is also made in [C04B 28/00](#) or [C04B 37/00](#) to give detailed information about the composition of the joining material }

- C04B 38/0022 . {obtained by a chemical conversion or reaction other than those relating to the setting or hardening of cement-like material or to the formation of a sol or a gel, e.g. by carbonising or pyrolysing preformed cellular materials based on polymers, organo-metallic or organo-silicon precursors}

- C04B 38/0025 . . {starting from inorganic materials only, e.g. metal foam; Lanxide type products}

- C04B 38/0029 . . {Porous deposits from the gas phase, e.g. on a temporary support}

- C04B 38/0032 . . {one of the precursor materials being a monolithic element having approximately the same dimensions as the final article, e.g. a paper sheet which after carbonisation will react with silicon to form a porous silicon carbide porous body}

- C04B 38/0035 . . {by evaporation induced self-assembly}

- C04B 38/0038 . {by superficial sintering or bonding of particulate matter}

- C04B 38/0041 . . {the particulate matter having preselected particle sizes}

- C04B 38/0045 . {by a process involving the formation of a sol or a gel, e.g. sol-gel or precipitation processes}

- C04B 38/0048 . . {Precipitation processes}

- C04B 38/0051 . {characterised by the pore size, pore shape or kind of porosity}

- C04B 38/0054 . . {the pores being micro-sized or nano-sized}

- C04B 38/0058 . . {open porosity}

- C04B 38/0061 . . {closed porosity}

- C04B 38/0064 . . {Multimodal pore size distribution}

- C04B 38/0067 . {characterised by the density of the end product}

NOTE

This group is mainly used for classification using Combination Sets in [C04B 38/00](#)

- C04B 38/007 . {characterised by the pore distribution, e.g. inhomogeneous distribution of pores}

NOTE

This group is mainly used for classification using Combination Sets in [C04B 38/00](#)

- C04B 38/0074 . . {expressed as porosity percentage}

- C04B 38/0077 . . {Materials with a non-porous skin}

- C04B 38/008 . {Bodies obtained by assembling separate elements having such a configuration that the final product is porous or by spirally winding one or more corrugated sheets}

- C04B 38/0083 . . {from one or more corrugated sheets or sheets bearing protrusions by winding or stacking}

- C04B 38/0087 . {by generating pores in the ceramic material while in the molten state}
- C04B 38/009 . {Porous or hollow ceramic granular materials, e.g. micro-balloons ([C04B 18/027](#), [C04B 20/002](#) take precedence)}
- C04B 38/0093 . {Other features}
- C04B 38/0096 . . {Pores with coated inner walls}
- C04B 38/02 . by adding chemical blowing agents
- C04B 38/025 . . {generated by microorganisms}
- C04B 38/04 . by dissolving-out added substances
- C04B 38/045 . . {the dissolved-out substance being a monolithic element having approximately the same dimensions as the final article, e.g. a prepreg obtained by bonding together dissolvable particles ([C04B 38/0022](#) takes precedence)}
- C04B 38/06 . by burning-out added substances {by burning natural expanding materials or by sublimating or melting out added substances}

NOTE

Documents in which the characteristic feature is the choice of meltable or sublimable material or the physical aspects of the porous body obtained are classified accordingly, and symbols [C04B 38/0605](#) or [C04B 38/061](#) are allocated in Combination Sets.

- C04B 38/0605 . . {by sublimating}
- C04B 38/061 . . {by melting out}
- C04B 38/0615 . . {the burned-out substance being a monolithic element having approximately the same dimensions as the final article, e.g. a porous polyurethane sheet or a prepreg obtained by bonding together resin particles ([C04B 38/0022](#) takes precedence)}
- C04B 38/062 . . . {the burned-out substance being formed in situ, e.g. by polymerisation of a prepolymer composition containing ceramic powder}
- C04B 38/0625 {involving a foaming step of the burnable material}
- C04B 38/063 . . {Preparing or treating the raw materials individually or as batches}
- C04B 38/0635 . . . {Compounding ingredients ([C04B 38/0615](#) takes precedence)}
- C04B 38/064 {Natural expanding materials, e.g. clay}
- C04B 38/0645 {Burnable, meltable, sublimable materials}
- C04B 38/065 {characterised by physical aspects, e.g. shape, size or porosity}

NOTE

Documents having this group as classification symbol or as part of a Combination Set can also get symbol [C04B 38/0051](#) in the Combination Set, if the importance of the size of the pores obtained is emphasized.

- C04B 38/0655 {Porous materials ([C04B 38/0625](#) takes precedence)}
- C04B 38/066 {characterised by distribution, e.g. for obtaining inhomogeneous distribution of pores}

NOTE

C04B 38/066

(continued)

Documents having this group as classification symbol or as part of a Combination Set can also get symbol [C04B 38/007](#) in the Combination Set, if the importance of the distribution of the pores is emphasized.

- C04B 38/0665 {Waste material; Refuse other than vegetable refuse}
- C04B 38/067 {Macromolecular compounds ([C04B 38/062](#) takes precedence; polysaccharides [C04B 38/0645](#))}
- C04B 38/0675 {Vegetable refuse; Cellulosic materials, e.g. wood chips, cork, peat, paper}
- C04B 38/068 {Carbonaceous materials, e.g. coal, carbon, graphite, hydrocarbons}
- C04B 38/0685 {Minerals containing carbon, e.g. oil shale}
- C04B 38/069 {Other materials, e.g. catalysts ([C04B 33/13](#), [C04B 35/00](#) take precedence)}
- C04B 38/0695 . . {Physical aspects of the porous material obtained}
- C04B 38/08 . by adding porous substances
- C04B 38/085 . . {of micro or nano size}
- C04B 38/10 . by using foaming agents ([C04B 38/02](#) takes precedence) {or by using mechanical means, e.g. adding preformed foam}
- C04B 38/103 . . {the foaming being obtained by the introduction of a gas other than untreated air, e.g. nitrogen}
- C04B 38/106 . . {by adding preformed foams}

C04B 40/00

Processes, in general, for influencing or modifying the properties of mortars, concrete or artificial stone compositions, e.g. their setting or hardening ability (active ingredients [C04B 22/00](#) to [C04B 24/00](#); hardening of a well-defined composition [C04B 26/00](#) to [C04B 28/00](#); making porous, cellular or lightening [C04B 38/00](#); mechanical aspects [B28](#), e.g. conditioning the materials prior to shaping [B28B 17/02](#))

- C04B 40/0003 . {making use of electric or wave energy or particle radiation}
- C04B 40/0007 . . {Electric, magnetic or electromagnetic fields}
- C04B 40/001 . . {Electromagnetic waves}
- C04B 40/0014 . . . {Microwaves}
- C04B 40/0017 . . . {Irradiation, i.e. gamma -, X -, UV rays}
- C04B 40/0021 . . {Sonic or ultrasonic waves, e.g. to initiate sonochemical reactions}
- C04B 40/0025 . {obtaining colloidal mortar}
- C04B 40/0028 . {Aspects relating to the mixing step of the mortar preparation}
- C04B 40/0032 . . {Controlling the process of mixing, e.g. adding ingredients in a quantity depending on a measured or desired value ([B28C 7/00](#) takes precedence)}
- C04B 40/0035 . . {Processes characterised by the absence of a mechanical mixing step, e.g. "no-mix" processes}
- C04B 40/0039 . . {Premixtures of ingredients}
- C04B 40/0042 . . . {Powdery mixtures}
- C04B 40/0046 . . . {characterised by their processing, e.g. sequence of mixing the ingredients when preparing the premixtures}
- C04B 40/005 . . {High shear mixing; Obtaining macro-defect free materials}

- C04B 40/0053 . . . {Obtaining macro-defect free materials otherwise than by high shear mixing}
- C04B 40/0057 . . {Energetic mixing ([C04B 40/005](#) takes precedence)}
- C04B 40/006 . . {involving the elimination of excess water from the mixture}
- C04B 40/0064 . . . {Processes of the Magnini or Hatscheck type}
- C04B 40/0067 . {making use of vibrations}
- C04B 40/0071 . {making use of a rise in pressure}
- C04B 40/0075 . {making use of a decrease in temperature}
- C04B 40/0078 . . {by freezing}
- C04B 40/0082 . {making use of a rise in temperature, e.g. caused by an exothermic reaction}
- C04B 40/0085 . . {involving melting of at least part of the composition}
- C04B 40/0089 . {making use of vacuum or reduced pressure}
- C04B 40/0092 . {Temporary binders, mortars or concrete, i.e. materials intended to be destroyed or removed after hardening, e.g. by acid dissolution}
- C04B 40/0096 . {Provisions for indicating condition of the compositions or the final products, e.g. degree of homogeneous mixing, degree of wear}
- C04B 40/02 . Selection of the hardening environment

NOTE

In this group the following term is used with the meaning indicated:

- "hardening" covers also setting, pre-curing and curing

- C04B 40/0204 . . {making use of electric or wave energy or particle radiation}
- C04B 40/0209 . . . {Electric, magnetic or electromagnetic fields}
- C04B 40/0213 . . . {Electromagnetic waves}
- C04B 40/0218 {Microwaves}
- C04B 40/0222 {Irradiation, i.e. gamma -, X -, UV rays}
- C04B 40/0227 . . . {Sonic or ultrasonic waves}
- C04B 40/0231 . . {Carbon dioxide hardening}
- C04B 40/0236 . . . {Carbon dioxide post-treatment of already hardened material}
- C04B 40/024 . . {Steam hardening, e.g. in an autoclave}
- C04B 40/0245 . . . {including a pre-curing step not involving a steam or autoclave treatment}
- C04B 40/025 . . {Adiabatic curing or hardening}
- C04B 40/0254 . . {Hardening in an enclosed space, e.g. in a flexible container}
- C04B 40/0259 . . {Hardening promoted by a rise in pressure ([C04B 40/024](#) takes precedence)}
- C04B 40/0263 . . {Hardening promoted by a rise in temperature ([C04B 40/024](#) takes precedence)}
- C04B 40/0268 . . . {Heating up to sintering temperatures ([C04B 41/0072](#) takes precedence)}
- C04B 40/0272 . . {Hardening under vacuum or reduced pressure}
- C04B 40/0277 . . {Hardening promoted by using additional water, e.g. by spraying water on the green concrete element ([steam hardening C04B 40/024](#))}
- C04B 40/0281 . . . {Hardening in an atmosphere of increased relative humidity}
- C04B 40/0286 . . . {Hardening under water}

- C04B 40/029 . . . {using an aqueous solution or dispersion}
- C04B 40/0295 . . {Inhomogeneous curing or hardening, e.g. accelerated curing of surface regions of a concrete article; Influencing the setting or hardening process or generate physical or mechanical effects, e.g. to create cracks}
- C04B 40/04 . Preventing evaporation of the mixing water ([permanent coverings C04B 41/00](#))
- C04B 40/06 . Inhibiting the setting, e.g. mortars of the deferred action type containing water in breakable containers; {Inhibiting the action of active ingredients}

NOTE

Compositions with prolonged pot-life are not classified here.

They are classified as other compositions and the symbol [C04B 2111/00086](#) is allocated in Combination Set.

- C04B 40/0608 . . {Dry ready-made mixtures, e.g. mortars at which only water or a water solution has to be added before use}
- C04B 40/0616 . . . {preformed, e.g. bandages}
- C04B 40/0625 . . {Wet ready-made mixtures, e.g. mortars in water- or airtight packages, or mortars containing an accelerator in a breakable emulsion}
- C04B 40/0633 . . {Chemical separation of ingredients, e.g. slowly soluble activator}
- C04B 40/0641 . . {Mechanical separation of ingredients, e.g. accelerator in breakable microcapsules}
- C04B 40/065 . . . {Two or more component mortars}
- C04B 40/0658 . . {Retarder inhibited mortars activated by the addition of accelerators or retarder-neutralising agents}
- C04B 40/0666 . . {Chemical plugs based on hydraulic hardening materials}
- C04B 40/0675 . . {Mortars activated by rain, percolating or sucked-up water; Self-healing mortars or concrete}
- C04B 40/0683 . . {inhibiting by freezing or cooling}
- C04B 40/0691 . . {Thermally activated mortars, e.g. by melting ingredients}

NOTE

In group [C04B 41/00](#), the following terms or expressions are used with the meanings indicated:

- "mortars", "concrete" and "artificial stone" cover materials after primary shaping

C04B 41/00

After-treatment of mortars, concrete, artificial stone or ceramics; Treatment of natural stone (conditioning of the materials prior to shaping [C04B 40/00](#); applying liquids or other fluent materials to surfaces, in general [B05](#); grinding or polishing [B24](#); apparatus or processes for treating or working shaped articles of clay or other ceramic compositions, slag or mixtures containing cementitious material [B28B 11/00](#); working stone or stone-like materials [B28D](#); glazes, other than cold glazes, [C03C 8/00](#); etching, surface-brightening or pickling compositions [C09K 13/00](#))

NOTES

1. In this group, multiple classification is made according to the following rules:

C04B 41/00

(continued)

- when the substrate to be treated is of the artificial stone type, e.g. concrete, classification is made in the range [C04B 41/00](#) to [C04B 41/5392](#) as well as in the range [C04B 41/60](#) to [C04B 41/72](#)
 - when the substrate to be treated is of the ceramic type, classification is made in the range [C04B 41/00](#) to [C04B 41/5392](#) as well as in the range [C04B 41/80](#) to [C04B 41/91](#)
 - when the substrate to be treated is a-specific, classification is made only in the range [C04B 41/00](#) to [C04B 41/5392](#)
2. In groups [C04B 41/0018](#) to [C04B 41/53](#), in the absence of an indication to the contrary, classification is made in the last appropriate place.
 3. Treating, e.g. coating or impregnating, a material with the same material or with a substance which ultimately is transformed into the same material is not considered after-treatment for this group but is classified as preparation of the material, e.g. a carbon body impregnated with a carbonisable substance is classified in [C04B 35/52](#).
 4. In groups [C04B 41/00](#) to [C04B 41/53](#), it is desirable to add the indexing codes relating to the nature of the substrate being treated. The indexing codes, which are chosen from groups [C04B 26/00](#) to [C04B 38/00](#) should be unlinked.
 5. In groups [C04B 41/00](#) to [C04B 41/53](#), it is desirable to add the indexing codes relating to aspects of the coating composition or to the method of application. The indexing codes, which are chosen from groups [C04B 41/00](#) to [C04B 41/5392](#) should be unlinked.
 6. Attention is drawn to internal Note (2) following the title of subclass [C04B](#).

C04B 41/0009

- {Demolition agents based on cementitious or like materials}

NOTE

Products classified in group [C04B 41/0009](#) should also be classified according to their composition, e.g. in [C04B 28/00](#)

C04B 41/0018

- {Coating or impregnating "in situ", e.g. impregnating of artificial stone by subsequent melting of a compound added to the artificial stone composition}

C04B 41/0027

- {Ion-implantation, ion-irradiation or ion-injection}

C04B 41/0036

- {Laser treatment (working by laser beam [B23K 26/00](#))}

C04B 41/0045

- {Irradiation; Radiation, e.g. with UV or IR ([C04B 41/0036](#) takes precedence)}

C04B 41/0054

- {Plasma-treatment, e.g. with gas-discharge plasma}

C04B 41/0063

- {Cooling, e.g. freezing}

NOTE

In this group the term "cooling" is used in the sense of an additional cooling treatment, different from the traditional cooling step in the fabrication of materials involving a heating step, such as sintering of ceramics

C04B 41/0072

- {Heat treatment}

C04B 41/0081

- {characterised by the subsequent cooling step}

- C04B 41/009 . {characterised by the material treated}
- C04B 41/45 . Coating or impregnating (paints [C09D](#)), {e.g. injection in masonry, partial coating of green or fired ceramics, organic coating compositions for adhering together two concrete elements ([ion-implantation C04B 41/0027](#))}

NOTES

1. In group [C04B 41/45](#) and sub-groups, as a general rule, classification is made according to the end products, rather than according to the starting materials, in the coating or impregnating compositions.
2. In groups [C04B 41/45](#) to [C04B 41/528](#) the following term is used with the meaning indicated:
 - "coating" covers material applied to the substrates as powdery material or applied from the gas or liquid phase, e.g. as a slurry; it only covers the use of preformed sheet-like elements in so far as the thickness of these sheets is small compared with the thickness of the substrate and so far as the resulting product is not exclusively one of the type classifiable in [B32B](#)

- C04B 41/4501 . . {with preformed sheet-like elements}
- C04B 41/4503 . . . {having an adhesive layer}
- C04B 41/4505 . . {characterised by the method of application}
- C04B 41/4507 . . . {using keying elements, e.g. particulate material, to facilitate the adherence of coating layers}
- C04B 41/4509 {The keying element being generated from indentations made in the substrate}
- C04B 41/4511 . . . {using temporarily supports, e.g. decalcomania transfers or mould surfaces}
- C04B 41/4513 {the temporary support- and coating material being mixed together, e.g. tile glazing paper sheets}
- C04B 41/4515 . . . {application under vacuum or reduced pressure}
- C04B 41/4517 . . . {application under inert, e.g. non-oxidising, atmosphere}
- C04B 41/4519 . . . {application under an other specific atmosphere}
- C04B 41/4521 . . . {application under increased pressure}
- C04B 41/4523 . . . {applied from the molten state ([vitreous materials C04B 41/5022](#)); Thermal spraying, e.g. plasma spraying}

NOTE

Coating or impregnating with a specific material in the molten state is classified according to the specific material and get symbol [C04B 41/4523](#) in Combination Sets

- C04B 41/4525 {using a molten bath as vehicle, e.g. molten borax}
- C04B 41/4527 {Plasma spraying ([deposition from the gas phase using plasma C04B 41/4533](#))}
- C04B 41/4529 . . . {applied from the gas phase}

NOTE

C04B 41/4529

(continued)

Coating or impregnating with a specific material from the gas phase is classified according to the specific material and symbol [C04B 41/4529](#) is allocated in Combination Sets

C04B 41/4531

. . . . {by C.V.D.}

C04B 41/4533

. . . . {plasma assisted}

C04B 41/4535

. . . {applied as a solution, emulsion, dispersion or suspension}

NOTE

Coating or impregnation with a solution or a suspension of a specific material is classified according to the specific material and symbol [C04B 41/4535](#) is allocated in Combination Sets

C04B 41/4537

. . . . {by the sol-gel process}

C04B 41/4539

. . . . {as a emulsion, dispersion or suspension}

C04B 41/4541

. . . . {Electroless plating}

C04B 41/4543

. . . . {by spraying, e.g. by atomising}

C04B 41/4545

. . . {applied as a powdery material}

NOTE

Coating or impregnation with a specific powdery material is classified according to the specific material and symbols [C04B 41/4545](#) to [C04B 41/4549](#) are allocated in Combination Sets

C04B 41/4547

. . . . {characterised by the grain distribution}

C04B 41/4549

. {Nanometer-sized particles}

C04B 41/455

. . . {the coating or impregnating process including a chemical conversion or reaction}

C04B 41/4552

. . . . {the end product being obtained by a multistep reaction or conversion}

C04B 41/4554

. . . . {the coating or impregnating material being an organic or organo-metallic precursor of an inorganic material}

C04B 41/4556

. . . . {coating or impregnating with a product reacting with the substrate, e.g. generating a metal coating by surface reduction of a ceramic substrate}

C04B 41/4558

. . . . {Coating or impregnating involving the chemical conversion of an already applied layer, e.g. obtaining an oxide layer by oxidising an applied metal layer}

C04B 41/456

. {the conversion only taking place under certain conditions, e.g. avoiding damage of underlaying layers or parts of the substrate}

C04B 41/4562

. . . {Photographic methods, e.g. making use of photo-sensitive materials}

C04B 41/4564

. . . {Electrolytic or electrophoretic processes, e.g. electrochemical re-alkalisation of reinforced concrete ([desalination C04B 41/53](#))}

C04B 41/4566

. . . . {Electrochemical re-alkalisation ([electrochemical desalination C04B 41/5369](#); [cathodic protection C23F 13/02](#))}

C04B 41/4568

. . . {Electrostatic processes}

C04B 41/457

. . {Non-superficial impregnation or infiltration of the substrate}

C04B 41/4572

. . {Partial coating or impregnation of the surface of the substrate}

C04B 41/4574	. . . {Coating different parts of the substrate with different materials}
C04B 41/4576	. . . {Inlaid coatings, i.e. resulting in a plane surface}
C04B 41/4578	. . {Coating or impregnating of green ceramics or unset concrete}
C04B 41/458	. . . {involving a mixing step with the top layer of the substrate}
C04B 41/4582	. . {Porous coatings, e.g. coating containing porous fillers}
C04B 41/4584	. . {Coating or impregnating of particulate or fibrous ceramic material (C04B 20/10 , C04B 35/628 take precedence)}
C04B 41/4586	. . {Non-chemical aspects relating to the substrate being coated or impregnated}
C04B 41/4588	. . . {Superficial melting of the substrate before or during the coating or impregnating step}
C04B 41/459	. . {Temporary coatings or impregnations (C04B 40/04 takes precedence)}
C04B 41/4592	. . . {for masking purposes}
C04B 41/4594	. . . . {in metallisation processes}
C04B 41/4596	. . {with fibrous materials or whiskers}
C04B 41/4598	. . {with waste materials}
C04B 41/46	. . with organic materials
C04B 41/463	. . . {Organic solvents}
C04B 41/466	. . . {Halogenated compounds, e.g. perfluor-compounds}
C04B 41/47	. . . Oils, fats or waxes {natural resins}
C04B 41/472	. . . . {Oils, e.g. linseed oil}
C04B 41/474	. . . . {Natural resins, e.g. rosin}
C04B 41/476	. . . . . {Cellulosic waste liquor, e.g. sulfite lye}
C04B 41/478	. . . . {Bitumen, asphalt, e.g. paraffin}
C04B 41/48	. . . Macromolecular compounds
C04B 41/4803	. . . . {Polysaccharides, e.g. cellulose, or derivatives thereof}
C04B 41/4807	. . . . {Proteins or derivatives thereof}
C04B 41/4811	. . . . {Condensation polymers of aldehydes or ketones}

NOTE

In this group the following term is used with the meaning indicated:

- "aldehydes" also covers other organic compounds reacting as aldehydes, e.g. glyoxylic acid

C04B 41/4815	. . . . . {Melamine-formaldehyde condensation products}
C04B 41/4819	. . . . . {Urea-formaldehyde condensation products}
C04B 41/4823	. . . . . {Phenol-formaldehyde condensation products}
C04B 41/4826	. . . . . {Polyesters}
C04B 41/483	. . . . . {Polyacrylates}
C04B 41/4834	. . . . . {Polyacrylamides}
C04B 41/4838	. . . . . {Halogenated polymers}
C04B 41/4842	. . . . . {Fluorine-containing polymers}

C04B 41/4846	. . . . .	{Perfluoro-compounds}
C04B 41/4849	. . . . .	{Sulfur-containing polymers}
C04B 41/4853	. . . . .	{Epoxides}
C04B 41/4857	. . . . .	{Other macromolecular compounds obtained by reactions only involving carbon-to-carbon unsaturated bonds}
C04B 41/4861	. . . . .	{Polyalkenes}
C04B 41/4865	. . . . .	{Coumarone polymers}
C04B 41/4869	. . . . .	{Polyvinylalcohols, polyvinylacetates}
C04B 41/4873	. . . . .	{Polyvinylacetals}
C04B 41/4876	. . . . .	{Polystyrene}
C04B 41/488	. . . . .	{Other macromolecular compounds obtained otherwise than by reactions only involving unsaturated carbon-to-carbon bonds}
C04B 41/4884	. . . . .	{Polyurethanes; Polyisocyanates}
C04B 41/4888	. . . . .	{Polycarbonates}
C04B 41/4892	. . . . .	{Polyamides}
C04B 41/4896	. . . . .	{Polyethers}
C04B 41/49	. . .	Compounds having one or more carbon-to-metal or carbon-to-silicon linkages {Organo-clay compounds; Organo-silicates, i.e. ortho- or polysilicic acid esters (to obtain SiO ₂ C04B 41/5089 , C04B 41/5035); Organo-phosphorus compounds; Organo-inorganic complexes}

NOTE

As distinct from the general practice in [C04B 41/00](#), classification in [C04B 41/49](#) and sub-groups is done according to the nature of the starting products, not according to the nature of the end products

C04B 41/4905	. . . . .	{containing silicon}
C04B 41/4911	. . . . .	{Organo-clay compounds}
C04B 41/4916	. . . . .	{applied to the substrate as a solventless liquid}
C04B 41/4922	. . . . .	{applied to the substrate as monomers, i.e. as organosilanes R _n SiX _{4-n} , e.g. alkyltrialkoxysilane, dialkyldialkoxysilane}
C04B 41/4927	. . . . .	{Alkali metal or ammonium salts}
C04B 41/4933	. . . . .	{containing halogens, i.e. organohalogen silanes}
C04B 41/4938	. . . . .	{containing silicon bound to hydroxy groups, e.g. trimethyl silanol}
C04B 41/4944	. . . . .	{containing atoms other than carbon, hydrogen, oxygen, silicon, alkali metals or halogens, e.g. N-silyldisilazane: Image }
C04B 41/495	. . . . .	{applied to the substrate as oligomers or polymers}
C04B 41/4955	. . . . .	{Polyorganosilanes, i.e. polymers with a Si-Si-Si- chain}
C04B 41/4961	. . . . .	{Polyorganosiloxanes, i.e. polymers with a Si-O-Si-O-chain; "silicones"}
C04B 41/4966	. . . . .	{containing silicon bound to hydroxy groups, i.e. OH-blocked polysiloxanes}

C04B 41/4972	. . . . . {Alkali metal or ammonium salts}
C04B 41/4977	. . . . . {characterised by the number of silicon atoms}
C04B 41/4983	. . . . . {Polycarbosilanes, i.e. polymers with a -Si-C-Si-chain; Polysilazanes, i.e. polymers with a -Si-N-Si-chain; Polysilathianes, i.e. polymers with a -Si-S-Si-chain}
C04B 41/4988	. . . . . {Organosilicium-organic copolymers, e.g. olefins with terminal silane groups}
C04B 41/4994	. . . . . {Organo-phosphorus compounds}
C04B 41/50	. . with inorganic materials
C04B 41/5001	. . . {with carbon or carbonisable materials}
C04B 41/5002	. . . . {Diamond}
C04B 41/5003	. . . . {Fullerenes or derivatives thereof}
C04B 41/5005	. . . . {Carbon fluorides; Halogen containing carbon or graphite intercalation products}
C04B 41/5006	. . . {Boron compounds}
C04B 41/5007	. . . {with salts or salty compositions, e.g. for salt glazing (C04B 41/5006 takes precedence)}
C04B 41/5009	. . . . {containing nitrogen in the anion, e.g. nitrites}
C04B 41/501	. . . . {containing carbon in the anion, e.g. carbonates}
C04B 41/5011	. . . . {containing halogen in the anion}
C04B 41/5012	. . . . . {chlorides}
C04B 41/5014	. . . . {containing sulfur in the anion, e.g. sulfides}
C04B 41/5015	. . . . {containing phosphorus in the anion, e.g. phosphates}
C04B 41/5016	. . . {Acids}
C04B 41/5018	. . . {with fluorine compounds}
C04B 41/5019	. . . . {applied from the gas phase, e.g. ocratation}
C04B 41/502	. . . {Water}
C04B 41/5022	. . . {with vitreous materials (composition of vitreous glazes and enamels C03C ; ceramic pigments C09C 1/0009)}

NOTE

Glazing of concrete, natural or artificial stone or ceramics is only classified in [C04B 41/5022](#) when non-compositional aspects are important, e.g. aspects relating to the method of application or the choice of the substrate

C04B 41/5023	. . . . {Glass-ceramics (compositions of glass-ceramics C03C 10/00)}
C04B 41/5024	. . . {Silicates (C04B 41/5022 takes precedence; silico-fluorides C04B 41/5018)}
C04B 41/5025	. . . {with ceramic materials (copper oxide or solid solutions thereof C04B 41/5074)}

NOTE

In this subgroup, the materials considered as ceramic materials are those covered by groups [C04B 33/00](#) to [C04B 35/83](#)

C04B 41/5027	. . . .	{Oxide ceramics in general; Specific oxide ceramics not covered by C04B 41/5029 to C04B 41/5051 }
C04B 41/5028	. . . . .	{Manganates}
C04B 41/5029	. . . . .	{Magnesia}
C04B 41/5031	. . . . .	{Alumina}
C04B 41/5032	. . . . .	{Aluminates (aluminate spinels C04B 41/5046)}
C04B 41/5033	. . . . .	{Chromium oxide}
C04B 41/5035	. . . . .	{Silica}
C04B 41/5036	. . . . .	{Ferrites}
C04B 41/5037	. . . . .	{Clay, Kaolin}
C04B 41/5038	. . . . .	{Porcelain}
C04B 41/504	. . . . .	{Engobes}
C04B 41/5041	. . . . .	{Titanium oxide or titanates}
C04B 41/5042	. . . . .	{Zirconium oxides or zirconates; Hafnium oxides or hafnates}
C04B 41/5044	. . . . .	{Hafnates}
C04B 41/5045	. . . . .	{Rare-earth oxides}
C04B 41/5046	. . . . .	{Spinels, e.g. magnesium aluminate spinels}
C04B 41/5048	. . . . .	{Phosphates}
C04B 41/5049	. . . . .	{Zinc or bismuth oxides}
C04B 41/505	. . . . .	{Tin oxide}
C04B 41/5051	. . . . .	{Niobium oxides or niobates}
C04B 41/5053	. . . .	{non-oxide ceramics (carbon or carbonisable materials C04B 41/5001)}
C04B 41/5054	. . . . .	{Sulfides or selenides}
C04B 41/5055	. . . . .	{Fluorides}
C04B 41/5057	. . . . .	{Carbides}
C04B 41/5058	. . . . .	{Boron carbide}
C04B 41/5059	. . . . .	{Silicon carbide}
C04B 41/5061	. . . . .	{Titanium carbide}
C04B 41/5062	. . . . .	{Borides, Nitrides or Silicides}
C04B 41/5063	. . . . .	{Aluminium nitride}
C04B 41/5064	. . . . .	{Boron nitride}
C04B 41/5066	. . . . .	{Silicon nitride}
C04B 41/5067	. . . . .	{Silicon oxynitrides, e.g. SIALON}
C04B 41/5068	. . . . .	{Titanium nitride}
C04B 41/507	. . . . .	{Borides}
C04B 41/5071	. . . . .	{Silicides}
C04B 41/5072	. . . .	{with oxides or hydroxides not covered by C04B 41/5025 (C04B 40/0236 takes precedence; boron oxide C04B 41/5006)}
C04B 41/5074	. . . . .	{Copper oxide or solid solutions thereof (CuO-Cu eutectic C04B 41/5127)}
C04B 41/5075	. . . . .	{Copper oxide}

C04B 41/5076	. . .	{with masses bonded by inorganic cements (sulfur compositions C04B 41/5097)}
C04B 41/5077	. . . .	{Geopolymer cements}
C04B 41/5079	. . . .	{Portland cements}
C04B 41/508	. . . .	{Aluminous cements}
C04B 41/5081	. . . . .	{Calcium alumino sulfate cements}
C04B 41/5083	. . . .	{Slag cements}
C04B 41/5084	. . . .	{Lime, hydraulic lime or magnesium oxide cements}
C04B 41/5085	. . . .	{Calcium sulfate cements}
C04B 41/5087	. . . . .	{Anhydrite}
C04B 41/5088	. . . .	{Cementitious compositions of the silica-lime type}
C04B 41/5089	. . . .	{Silica sols, alkyl, ammonium or alkali metal silicate cements}
C04B 41/509	. . . .	{Magnesium cements, e.g. Sorel cement}
C04B 41/5092	. . . .	{Phosphate cements}
C04B 41/5093	. . .	{with elements other than metals or carbon (treatment with fluorine gas C04B 41/5019)}
C04B 41/5094	. . . .	{Boron}
C04B 41/5096	. . . .	{Silicon (C04B 35/573 takes precedence)}
C04B 41/5097	. . . .	{Sulfur}
C04B 41/5098	. . .	{Cermets}
C04B 41/51	. . .	Metallising, {e.g. infiltration of sintered ceramic preforms with molten metal (covering materials with metals in general C23C ; ceramic compositions containing free metal bonded to carbides, diamond, oxides, borides, nitrides, silicides, e.g. cermets, or other metal compounds, e.g. oxynitrides or sulfides, other than as macroscopic reinforcing agents C22C ; infiltration of preforms containing free metal, e.g. cermets C22C)}
C04B 41/5105	. . . .	{with a composition mainly composed of one or more of the noble metals or copper}
C04B 41/5111	. . . .	{Ag, Au, Pd, Pt or Cu}
C04B 41/5116	. . . .	{Ag or Au}
C04B 41/5122	. . . .	{Pd or Pt}
C04B 41/5127	. . . .	{Cu, e.g. Cu-CuO eutectic}
C04B 41/5133	. . . .	{with a composition mainly composed of one or more of the refractory metals}
C04B 41/5138	. . . .	{with a composition mainly composed of Mn and Mo, e.g. for the Moly-manganese method}
C04B 41/5144	. . . .	{with a composition mainly composed of one or more of the metals of the iron group}
C04B 41/515	. . . .	{Other specific metals}
C04B 41/5155	. . . . .	{Aluminium}
C04B 41/5161	. . . . .	{Tin}
C04B 41/5166	. . . . .	{Lead}
C04B 41/5172	. . . . .	{Cadmium}

- C04B 41/5177 {characterised by the non-metallic part of the metallising composition}
- C04B 41/5183 {inorganic}
- C04B 41/5188 {organic}
- C04B 41/5194 {Metallisation of multilayered ceramics, e.g. for the fabrication of multilayer ceramic capacitors}
- C04B 41/52 . . Multiple coating or impregnating {multiple coating or impregnating with the same composition or with compositions only differing in the concentration of the constituents, is classified as single coating or impregnation}

NOTES

1. Multiple coating or impregnation with the same composition or with compositions only differing in the concentration of the constituents, is classified as single coating or impregnation and symbol [C04B 41/52](#) is allocated in Combination Sets
2. Groups [C04B 41/522](#) and [C04B 41/524](#) are used for Combination Sets only of documents classified in [C04B 41/52](#)

- C04B 41/522 . . . {Multiple coatings, for one of the coatings of which at least one alternative is described}
- C04B 41/524 . . . {Multiple coatings, comprising a coating layer of the same material as a previous coating layer}
- C04B 41/526 . . . {Multiple coating or impregnation with materials having the same composition but different characteristics}
- C04B 41/528 . . . {Applying layers containing opposite charged particles or materials in the successive layers}
- C04B 41/53 . . involving the removal of at least part of the materials of the treated article, {e.g. etching, drying of hardened concrete ([C04B 41/0036](#) to [C04B 41/0054](#) take precedence)}
- C04B 41/5307 . . {Removal of physically bonded water, e.g. drying of hardened concrete ([E04B 1/7007](#) takes precedence)}
- C04B 41/5315 . . {Cleaning compositions, e.g. for removing hardened cement from ceramic tiles}
- C04B 41/5323 . . {to make grain visible, e.g. for obtaining exposed aggregate concrete}
- C04B 41/533 . . . {Seeding methods, i.e. the exposed aggregates, at least partially, not making part of the starting mixture}
- C04B 41/5338 . . {Etching (for obtaining decorative effects [B44C 1/22](#); etching of specific electronic compounds, see the relevant places, e.g. etching of semiconductor bodies [H01L 21/306](#))}
- C04B 41/5346 . . . {Dry etching}
- C04B 41/5353 . . . {Wet etching, e.g. with etchants dissolved in organic solvents}
- C04B 41/5361 . . . {Etching with molten material}
- C04B 41/5369 . . {Desalination, e.g. of reinforced concrete}
- C04B 41/5376 . . . {Electrochemical desalination (electrochemical re-alkalisation [C04B 41/4566](#); drying by electro-osmosis [E04B 1/7007](#))}
- C04B 41/5384 . . {by electrochemical methods (electrochemical desalination [C04B 41/5376](#))}
- C04B 41/5392 . . {by burning ([C04B 38/06](#) takes precedence)}

C04B 41/60	. of only artificial stone
C04B 41/61	. . Coating or impregnation
C04B 41/62	. . . with organic materials
C04B 41/63	. . . . Macromolecular compounds
C04B 41/64	. . . . Compounds having one or more carbon-to-metal or carbon-to-silicon linkages
C04B 41/65	. . . with inorganic materials
C04B 41/66	. . . . Fluorides, e.g. fluorination
C04B 41/67	. . . . Phosphates
C04B 41/68	. . . . Silicic acid; Silicates
C04B 41/69	. . . . Metals
C04B 41/70	. . . for obtaining at least two superposed coatings having different compositions
C04B 41/71	. . . . at least one coating being an organic material
C04B 41/72	. . involving the removal of part of the materials of the treated articles, e.g. etching
C04B 41/80	. of only ceramics
C04B 41/81	. . Coating or impregnation
C04B 41/82	. . . with organic materials
C04B 41/83	. . . . Macromolecular compounds
C04B 41/84	. . . . Compounds having one or more carbon-to-metal or carbon-to-silicon linkages
C04B 41/85	. . . with inorganic materials
C04B 41/86	. . . . Glazes; Cold glazes
C04B 41/87	. . . . Ceramics
C04B 41/88	. . . . Metals
C04B 41/89	. . . for obtaining at least two superposed coatings having different compositions
C04B 41/90	. . . . at least one coating being a metal
C04B 41/91	. . involving the removal of part of the materials of the treated articles, e.g. etching

C04B 2103/00	Function or property of ingredients for mortars, concrete or artificial stone
C04B 2103/0001	. {Living organisms, e.g. micro-organisms, or enzymes}
C04B 2103/0002	. . {Seeds}
C04B 2103/0003	. {Unintentionally added compounds, such as impurities in raw materials, e.g. alkali sulfates in construction grade cement}
C04B 2103/0004	. {Compounds chosen for the nature of their cations}
C04B 2103/0005	. . {Organic ammonium compounds}
C04B 2103/0006	. . {Alkali metal or inorganic ammonium compounds}
C04B 2103/0007	. . . {K}
C04B 2103/0008	. . . {Li}
C04B 2103/0009	. . . {Inorganic ammonium compounds}
C04B 2103/001	. . {Alkaline earth metal or Mg-compounds}
C04B 2103/0011	. . . {Ba}

C04B 2103/0012	. . . {Mg}
C04B 2103/0013	. . {Iron group metal compounds}
C04B 2103/0014	. . . {Fe}
C04B 2103/0015	. . {Noble metal or copper compounds}
C04B 2103/0016	. . . {Cu}
C04B 2103/0017	. . {Refractory metal compounds}
C04B 2103/0018	. . . {Cr}
C04B 2103/0019	. . . {Ti}
C04B 2103/002	. . {Compounds of elements having a valency of 2}
C04B 2103/0021	. . {Compounds of elements having a valency of 3}
C04B 2103/0022	. . {Compounds of elements having a valency of 4}
C04B 2103/0023	. . {Compounds of elements having a valency of 5}
C04B 2103/0024	. . {Compounds of elements having a valency of 6}
C04B 2103/0025	. . {Compounds of the transition metals}
C04B 2103/0026	. {Compounds of unusual isotopes, e.g. heavy water}
C04B 2103/0027	. {Standardised cement types}
C04B 2103/0028	. . {according to API}
C04B 2103/0029	. . . {Type A}
C04B 2103/003	. . . {Type B}
C04B 2103/0031	. . . {Type C}
C04B 2103/0032	. . . {Type D}
C04B 2103/0033	. . . {Type E}
C04B 2103/0034	. . . {Type F}
C04B 2103/0035	. . . {Type G}
C04B 2103/0036	. . . {Type H}
C04B 2103/0037	. . . {Type J}
C04B 2103/0038	. . . {Type K}
C04B 2103/0039	. . {according to ASTM}
C04B 2103/004	. . {according to DIN}
C04B 2103/0041	. {Non-polymeric ingredients chosen for their physico-chemical characteristics}
C04B 2103/0042	. . {Amorphous materials}
C04B 2103/0043	. . {Compounds chosen for their specific Moh's hardness}
C04B 2103/0044	. . {Compounds chosen for their abrasion resistance, e.g. determined according to the L.A. test}
C04B 2103/0045	. {Polymers chosen for their physico-chemical characteristics}
C04B 2103/0046	. . {added as monomers or as oligomers}
C04B 2103/0047	. . . {as a mixture of monomers and prepolymers or oligomers}
C04B 2103/0048	. . . {as oligomers}
C04B 2103/0049	. . {Water-swellaable polymers}
C04B 2103/005	. . . {Alkali-swellaable polymers}

C04B 2103/0051	. . {Water-absorbing polymers, hydrophilic polymers}
C04B 2103/0052	. . {Hydrophobic polymers}
C04B 2103/0053	. . {Water-soluble polymers}
C04B 2103/0054	. . {Water dispersible polymers}
C04B 2103/0055	. . {Water-insoluble polymers}
C04B 2103/0056	. . {Thermohardening polymers}
C04B 2103/0057	. . {added as redispersable powders}
C04B 2103/0058	. . {Core-shell polymers}
C04B 2103/0059	. . {Graft (co-)polymers}
C04B 2103/006	. . . {Comb polymers}
C04B 2103/0061	. . {Block (co-)polymers}
C04B 2103/0062	. . {Cross-linked polymers}
C04B 2103/0063	. . {obtained by an unusual polymerisation process, e.g. by changing the molar ratio of the different monomers during the polymerisation process (C04B 2103/0058 to C04B 2103/0061 take precedence)}
C04B 2103/0064	. . {Polymers unstable in the presence of hydraulic binders, e.g. polymers flocculating in concrete mixtures}
C04B 2103/0065	. . {Polymers characterised by their glass transition temperature (T _g)}
C04B 2103/0066	. . {Film forming polymers}
C04B 2103/0067	. {the ingredients being formed in situ by chemical reactions or conversion of one or more of the compounds of the composition}
C04B 2103/0068	. {Ingredients with a function or property not provided for elsewhere in C04B 2103/00 }
C04B 2103/0069	. . {the ingredients being characterised by their physical state}
C04B 2103/007	. . . {Supercritical fluids}
C04B 2103/0071	. . {Phase-change materials, e.g. latent heat storage materials used in concrete compositions}
C04B 2103/0072	. . {Biodegradable materials}
C04B 2103/0073	. . {Self-degrading materials, e.g. materials undergoing a hydrolytic degradation in the course of time}
C04B 2103/0074	. . {Anti-static agents}
C04B 2103/0075	. . {Anti-dusting agents}
C04B 2103/0076	. . {Deodorizing agents}
C04B 2103/0077	. . {Packaging material remaining in the mixture after the mixing step, e.g. soluble bags containing active ingredients}
C04B 2103/0078	. . {Sorbent materials}
C04B 2103/0079	. . {Rheology influencing agents}
C04B 2103/008	. . {Flocking or deflocking agents}
C04B 2103/0081	. . . {Deflocking agents}
C04B 2103/0082	. . {Segregation-preventing agents; Sedimentation-preventing agents}
C04B 2103/0083	. . . {Bleeding-preventing agents}
C04B 2103/0084	. . {Polyelectrolytes}
C04B 2103/0085	. . {Thixotropic agents}

- C04B 2103/0086 . . {Chelating or complexing agents}
- C04B 2103/0087 . . {Ion-exchanging agents}
- C04B 2103/0088 . . {Compounds chosen for their latent hydraulic characteristics, e.g. pozzuolanes}

NOTE

Code [C04B 2103/0088](#) is only used when the chemical nature of the latent hydraulic material is not specified, when no specific group in subclass [C04B](#) exists for defining the material or when it is chosen from an important number of alternatives.

- C04B 2103/0089 . . {Agents for reducing heat of hydration}
- C04B 2103/009 . . {Anhydrous vehicles for hydraulic cement compositions}
- C04B 2103/0091 . . {Organic co-binders for mineral binder compositions}
- C04B 2103/0092 . . . {for improving green strength}
- C04B 2103/0093 . . {Organic cosolvents}
- C04B 2103/0094 . . {Agents for altering or buffering the pH; Ingredients characterised by their pH}
- C04B 2103/0095 . . {Oxidising agents}
- C04B 2103/0096 . . {Reducing agents}
- C04B 2103/0097 . . {Anion- and far-infrared-emitting materials}
- C04B 2103/0098 . . {Radioactive materials}
- C04B 2103/0099 . {Aspecific ingredients, i.e. high number of alternative specific compounds mentioned for the same function or property}
- C04B 2103/10 . Accelerators; Activators
- C04B 2103/105 . . {for reactions involving organo-silicon compounds}
- C04B 2103/12 . . Set accelerators
- C04B 2103/14 . . Hardening accelerators
- C04B 2103/20 . Retarders
- C04B 2103/22 . . Set retarders
- C04B 2103/24 . . Hardening retarders
- C04B 2103/30 . Water reducers, plasticisers, air-entrainers, flow improvers
- C04B 2103/302 . . {Water reducers}
- C04B 2103/304 . . {Air-entrainers}
- C04B 2103/306 . . {Fluidisers with reduced air-entraining effect}
- C04B 2103/308 . . {Slump-loss preventing agents}
- C04B 2103/32 . . Superplasticisers
- C04B 2103/34 . . {Flow improvers}
- C04B 2103/40 . Surface-active agents, dispersants
- C04B 2103/402 . . {anionic}
- C04B 2103/404 . . {cationic}
- C04B 2103/406 . . {non-ionic}
- C04B 2103/408 . . {Dispersants}
- C04B 2103/42 . Pore formers

- C04B 2103/44 . Thickening, gelling or viscosity increasing agents
- C04B 2103/445 . . {Gelling agents}
- C04B 2103/46 . Water-loss or fluid-loss reducers, hygroscopic or hydrophilic agents, water retention agents
- C04B 2103/465 . . {Water-sorbing agents, hygroscopic or hydrophilic agents}
- C04B 2103/48 . Foam stabilisers
- C04B 2103/50 . Defoamers, air detrainers
- C04B 2103/52 . Grinding aids; Additives added during grinding
- C04B 2103/54 . Pigments; Dyes
- C04B 2103/56 . Opacifiers
- C04B 2103/58 . . {Shrinkage reducing agents}
- C04B 2103/60 . Agents for protection against chemical, physical or biological attack
- C04B 2103/601 . . {Agents for increasing frost resistance}
- C04B 2103/603 . . {Agents for controlling alkali-aggregate reactions}
- C04B 2103/605 . . {UV-stabilising agents}
- C04B 2103/606 . . {Agents for neutralising $\text{Ca}(\text{OH})_2$ liberated during cement hardening}
- C04B 2103/608 . . {Anti-oxidants}
- C04B 2103/61 . . Corrosion inhibitors
- C04B 2103/63 . . Flame-proofing agents
- C04B 2103/65 . . Waterproofers or -repellents
- C04B 2103/67 . . Biocides
- C04B 2103/69 . . . Fungicides

C04B 2111/00 Mortars, concrete or artificial stone or mixtures to prepare them, characterised by specific function, property or use

- C04B 2111/00008 . {Obtaining or using nano-technology related materials}
- C04B 2111/00017 . {Aspects relating to the protection of the environment}
- C04B 2111/00025 . {Aspects relating to the protection of the health, e.g. materials containing special additives to afford skin protection (avoiding chromium eczema by using chromium VI-free or very low chromium VI-content materials [C04B 2111/1081](#))}
- C04B 2111/00034 . {Physico-chemical characteristics of the mixtures}
- C04B 2111/00043 . . {Anhydrous mixtures}

NOTE

Code [C04B 2111/00043](#) is only used in combination with groups [C04B 26/00](#) to [C04B 26/32](#).

- C04B 2111/00051 . . {Mortar or concrete mixtures with an unusual low cement content, e.g. for foundations}
- C04B 2111/0006 . . . {for obtaining materials with the consistency of soil}
- C04B 2111/00068 . . {Mortar or concrete mixtures with an unusual water/cement ratio}
- C04B 2111/00077 . . {Partially hardened mortar or concrete mixtures}
- C04B 2111/00086 . . {Mixtures with prolonged pot-life}

C04B 2111/00094	. .	{Sag-resistant materials}
C04B 2111/00103	. .	{Self-compacting mixtures}
C04B 2111/00112	. .	{Mixtures characterised by specific pH values}
C04B 2111/0012	. .	{Thixotropic mixtures}
C04B 2111/00129	. .	{Extrudable mixtures}
C04B 2111/00137	. .	{Injection moldable mixtures}
C04B 2111/00146	. .	{Sprayable or pumpable mixtures}
C04B 2111/00155	. . .	{Sprayable, i.e. concrete-like, materials able to be shaped by spraying instead of by casting, e.g. gunite}
C04B 2111/00163	. . . .	{by the dry process}
C04B 2111/00172	. . . .	{by the wet process}
C04B 2111/00181	. .	{Mixtures specially adapted for three-dimensional printing (3DP), stereo-lithography or prototyping}
C04B 2111/00189	. .	{Compositions or ingredients of the compositions characterised by analysis-spectra, e.g. NMR}
C04B 2111/00198	. .	{Characterisation or quantities of the compositions or their ingredients expressed as mathematical formulae or equations}
C04B 2111/00206	. .	{Compositions defined by their elemental analysis}
C04B 2111/00215	. .	{Mortar or concrete mixtures defined by their oxide composition}
C04B 2111/00224	. .	{Green materials, e.g. porous green ceramic preforms}
C04B 2111/00232	. .	{Temporary foams}
C04B 2111/00241	. .	{Physical properties of the materials not provided for elsewhere in C04B 2111/00 }
C04B 2111/0025	. .	{Compositions or ingredients of the compositions characterised by the crystal structure}
C04B 2111/00258	. .	{Electromagnetic wave absorbing or shielding materials}
C04B 2111/00267	. .	{Materials permeable to vapours or gases}
C04B 2111/00275	. .	{Materials impermeable to vapours or gases}
C04B 2111/00284	. .	{Materials permeable to liquids}
C04B 2111/00293	. .	{Materials impermeable to liquids}
C04B 2111/00301	. .	{Non-porous materials, e.g. macro-defect free [MDF] products}
C04B 2111/0031	. .	{Heavy materials, e.g. concrete used as ballast material}
C04B 2111/00318	. .	{Materials characterised by relatively small dimensions, e.g. small thickness}
C04B 2111/00327	. . .	{for obtaining micro-structures}
C04B 2111/00336	. .	{Materials with a smooth surface, e.g. obtained by using glass-surfaced moulds}
C04B 2111/00344	. .	{Materials with friction-reduced moving parts, e.g. ceramics lubricated by impregnation with carbon}
C04B 2111/00353	. . .	{Sliding parts}
C04B 2111/00362	. .	{Friction materials, e.g. used as brake linings, anti-skid materials}
C04B 2111/0037	. .	{Materials containing oriented fillers or elements}
C04B 2111/00379	. . .	{the oriented elements being fibres}
C04B 2111/00387	. .	{Anisotropic materials}
C04B 2111/00396	. . .	{only the surface part being anisotropic}

- C04B 2111/00405 . . {Materials with a gradually increasing or decreasing concentration of ingredients or property from one layer to another}
- C04B 2111/00413 . . {Materials having an inhomogeneous concentration of ingredients or irregular properties in different layers}
- C04B 2111/00422 . . {Magnetic properties}
- C04B 2111/00431 . {Refractory materials}
- C04B 2111/00439 . {Physico-chemical properties of the materials not provided for elsewhere in [C04B 2111/00](#)}
- C04B 2111/00448 . . {Low heat cements}
- C04B 2111/00456 . . {Odorless cements}
- C04B 2111/00465 . . {Heat conducting materials}
- C04B 2111/00474 . {Uses not provided for elsewhere in [C04B 2111/00](#)}
- C04B 2111/00482 . . {Coating or impregnation materials}
- C04B 2111/00491 . . . {Primers}
- C04B 2111/005 . . . {for frescos}
- C04B 2111/00508 . . . {Cement paints}
- C04B 2111/00517 . . . {for masonry}
- C04B 2111/00525 . . . {for metallic surfaces}
- C04B 2111/00534 . . . {for plastic surfaces, e.g. polyurethane foams}
- C04B 2111/00543 . . . {for wet surfaces}
- C04B 2111/00551 . . . {Refractory coatings, e.g. for tamping}
- C04B 2111/0056 . . . {for ship decks}
- C04B 2111/00568 . . . {Multiple coating with same or similar material}
- C04B 2111/00577 . . . {applied by spraying (mixtures shapable by spraying [C04B 2111/00155](#))}
- C04B 2111/00586 . . {Roofing materials}
- C04B 2111/00594 . . . {Concrete roof tiles}
- C04B 2111/00603 . . {Ceiling materials}
- C04B 2111/00612 . . {as one or more layers of a layered structure}
- C04B 2111/0062 . . . {Gypsum-paper board like materials}
- C04B 2111/00629 {the covering sheets being made of material other than paper}
- C04B 2111/00637 . . {as glue or binder for uniting building or structural materials}
- C04B 2111/00646 . . . {Masonry mortars}
- C04B 2111/00655 . . {Profiles}
- C04B 2111/00663 . . {as filling material for cavities or the like}
- C04B 2111/00672 . . . {Pointing or jointing materials}
- C04B 2111/00681 {of the drying type}
- C04B 2111/00689 {of the setting type}
- C04B 2111/00698 . . . {for cavity walls}
- C04B 2111/00706 . . . {around pipelines or the like}
- C04B 2111/00715 . . {for fixing bolts or the like}
- C04B 2111/00724 . . {in mining operations, e.g. for backfilling; in making tunnels or galleries}

C04B 2111/00732	. .	{for soil stabilisation}
C04B 2111/00741	. . .	{Preventing erosion}
C04B 2111/0075	. .	{for road construction}
C04B 2111/00758	. .	{for agri-, sylvi- or piscicultural or cattle-breeding applications}
C04B 2111/00767	. .	{for waste stabilisation purposes}
C04B 2111/00775	. . .	{the composition being used as waste barriers or the like, e.g. compositions used for waste disposal purposes only, but not containing the waste itself}
C04B 2111/00784	. . .	{for disposal only}
C04B 2111/00793	. .	{as filters or diaphragms}
C04B 2111/00801	. . .	{Membranes; Diaphragms}
C04B 2111/0081	. .	{as catalysts or catalyst carriers}
C04B 2111/00818	. . .	{Enzyme carriers}
C04B 2111/00827	. . .	{Photocatalysts; (Materials containing photocatalysts to avoid staining by air pollutants C04B 2111/2061)}
C04B 2111/00836	. .	{for medical or dental applications}
C04B 2111/00844	. .	{for electronic applications}
C04B 2111/00853	. .	{in electrochemical cells or batteries, e.g. fuel cells}
C04B 2111/00862	. .	{for nuclear applications, e.g. ray-absorbing concrete}
C04B 2111/0087	. .	{for metallurgical applications}
C04B 2111/00879	. . .	{Non-ferrous metallurgy}
C04B 2111/00887	. . .	{Ferrous metallurgy}
C04B 2111/00896	. .	{as prepregs}
C04B 2111/00905	. .	{as preforms}
C04B 2111/00913	. . .	{as ceramic preforms for the fabrication of metal matrix comp, e.g. cermets}
C04B 2111/00922	. . . .	{Preforms as such}
C04B 2111/00931	. . . .	{Coated or infiltrated preforms, e.g. with molten metal}
C04B 2111/00939	. .	{for the fabrication of moulds or cores}
C04B 2111/00948	. .	{for the fabrication of containers}
C04B 2111/00956	. .	{for making sculptures or artistic casts}
C04B 2111/00965	. .	{for household applications, e.g. use of materials as cooking ware}
C04B 2111/00974	. .	{for pyrotechnic applications, e.g. blasting}
C04B 2111/00982	. .	{as construction elements for space vehicles or aeroplanes}
C04B 2111/00991	. .	{for testing}
C04B 2111/10	. .	Compositions or ingredients thereof characterised by the absence or the very low content of a specific material
C04B 2111/1006	. .	{Absence of well-defined organic compounds}
C04B 2111/1012	. . .	{Organic solvents}
C04B 2111/1018	. .	{Gypsum free or very low gypsum content cement compositions}
C04B 2111/1025	. .	{Alkali-free or very low alkali-content materials}
C04B 2111/1031	. .	{Lime-free or very low lime-content materials}

C04B 2111/1037	. . {Cement free compositions, e.g. hydraulically hardening mixtures based on waste materials, not containing cement as such}
C04B 2111/1043	. . . {Calciumaluminate-free refractories}
C04B 2111/105	. . {Alumina-free or very low alumina-content materials}
C04B 2111/1056	. . {Silica-free or very low silica-content materials}
C04B 2111/1062	. . {Halogen free or very low halogen-content materials}
C04B 2111/1068	. . . {Halogens other than chlorine}
C04B 2111/1075	. . {Chromium-free or very low chromium-content materials}
C04B 2111/1081	. . . {Chromium VI, e.g. for avoiding chromium eczema (materials containing special additives for affording skin protection C04B 2111/00025)}
C04B 2111/1087	. . {Carbon free or very low carbon content fly ashes; Fly ashes treated to reduce their carbon content or the effect thereof}
C04B 2111/1093	. . . {Reducing the effect of the carbon content, without removing the carbon}
C04B 2111/12	. . Absence of mineral fibres, e.g. asbestos
C04B 2111/125	. . . {Mineral fibres other than asbestos}
C04B 2111/20	. Resistance against chemical, physical or biological attack
C04B 2111/2007	. . {Avoiding unauthorised or unwanted use or treatment}
C04B 2111/2015	. . {Sulfate resistance}
C04B 2111/2023	. . {Resistance against alkali-aggregate reaction}
C04B 2111/203	. . {Oil-proof or grease-repellant materials}
C04B 2111/2038	. . {Resistance against physical degradation}
C04B 2111/2046	. . . {Shock-absorbing materials}
C04B 2111/2053	. . . {Earthquake- or hurricane-resistant materials}
C04B 2111/2061	. . . {Materials containing photocatalysts, e.g. TiO ₂ , for avoiding staining by air pollutants or the like}
C04B 2111/2069	. . . {Self cleaning materials, e.g. using lotus effect (using photocatalysts C04B 2111/2061)}
C04B 2111/2076	. . . {Discolouring resistant materials (self cleaning materials C04B 2111/2069)}
C04B 2111/2084	. . {Thermal shock resistance}
C04B 2111/2092	. . {Resistance against biological degradation}
C04B 2111/21	. . Efflorescence resistance
C04B 2111/22	. . Carbonation resistance
C04B 2111/23	. . Acid resistance, e.g. against acid air or rain
C04B 2111/24	. . Sea water resistance
C04B 2111/25	. . Graffiti resistance; Graffiti removing
C04B 2111/26	. . Corrosion of reinforcement resistance
C04B 2111/265	. . . {Cathodic protection of reinforced concrete structures}
C04B 2111/27	. . Water resistance, e.g. waterproof or water-repellant materials
C04B 2111/275	. . . {Making materials water insoluble}
C04B 2111/28	. . Fire resistance, i.e. materials resistant to accidental fires or high temperatures
C04B 2111/285	. . . {Intumescent materials}

- C04B 2111/29 . . {Frost-thaw resistance}
- C04B 2111/30 . Nailable or sawable materials
- C04B 2111/32 . Expansion-inhibited materials
- C04B 2111/325 . . {the expansion being inhibited in one direction only}
- C04B 2111/34 . Non-shrinking or non-cracking materials
- C04B 2111/343 . . {Crack resistant materials}
- C04B 2111/346 . . {Materials exhibiting reduced plastic shrinkage cracking}
- C04B 2111/40 . Porous or lightweight materials
- C04B 2111/42 . . Floating materials
- C04B 2111/50 . Flexible or elastic materials

NOTE

- "flexibility" means ability to bend without breaking;
- "elasticity" means property to resist and recover from deformation produced by a force.

- C04B 2111/503 . . {Elastic materials}
- C04B 2111/506 . . {Bendable material}
- C04B 2111/52 . Sound-insulating materials
- C04B 2111/54 . Substitutes for natural stone, artistic materials or the like
- C04B 2111/542 . . {Artificial natural stone}
- C04B 2111/545 . . . {Artificial marble}
- C04B 2111/547 . . {Imitating ancient compositions, e.g. mediaeval mortars; Compositions specially designed for restauration of ancient buildings or building elements}
- C04B 2111/56 . Compositions suited for fabrication of pipes, e.g. by centrifugal casting, or for coating concrete pipes
- C04B 2111/60 . Flooring materials
- C04B 2111/62 . . Self-levelling compositions
- C04B 2111/70 . Grouts, e.g. injection mixtures for cables for prestressed concrete
- C04B 2111/72 . Repairing or restoring existing buildings or building materials
- C04B 2111/723 . . {Repairing reinforced concrete}
- C04B 2111/726 . . {by chemical conversion of unwanted deposits, e.g. for the restauration of marble monuments}
- C04B 2111/74 . Underwater applications
- C04B 2111/76 . Use at unusual temperatures, e.g. sub-zero
- C04B 2111/763 . . {High temperatures}
- C04B 2111/766 . . {Low temperatures, but above zero}
- C04B 2111/80 . Optical properties, e.g. transparency or reflexivity
- C04B 2111/802 . . {White cement}
- C04B 2111/805 . . {Transparent material}
- C04B 2111/807 . . {Luminescent or fluorescent materials}
- C04B 2111/82 . . Coloured materials

- C04B 2111/90 . Electrical properties
- C04B 2111/905 . . {Anti-static materials}
- C04B 2111/92 . . Electrically insulating materials
- C04B 2111/94 . . Electrically conducting materials

C04B 2201/00 Mortars, concrete or artificial stone characterised by specific physical values

NOTE

Indexing codes [C04B 2201/05](#) to [C04B 2201/30](#) are only to be used when the specific physical values are claimed or when they deviate considerably from the average usual values.

- C04B 2201/05 . Materials having an early high strength, e.g. allowing fast demoulding or formless casting
- C04B 2201/10 . for the viscosity
- C04B 2201/20 . for the density
- C04B 2201/30 . for heat transfer properties such as thermal insulation values, e.g. R-values
- C04B 2201/32 . . for the thermal conductivity, e.g. K-factors
- C04B 2201/40 . for gas flow through the material
- C04B 2201/50 . for the mechanical strength
- C04B 2201/52 . . High compression strength concretes, i.e. with a compression strength higher than about 55 N/mm², e.g. reactive powder concrete [RPC]

C04B 2235/00 Aspects relating to ceramic starting mixtures or sintered ceramic products

NOTE

In this group, magnesium is considered as an alkaline earth metal.

- C04B 2235/02 . Composition of constituents of the starting material or of secondary phases of the final product

NOTE

Indexing codes [C04B 2235/02](#) to [C04B 2235/5481](#) are to be used only if the aspect is not trivial or not standard, e.g. if water is used as a mixing medium for a powder, whereas normally an organic mixing medium is used or if not the standard alpha-alumina is used to make an alumina ceramic but gamma-alumina in stead.

- C04B 2235/30 . . Constituents and secondary phases not being of a fibrous nature

NOTES

1. Indexing codes [C04B 2235/30](#) to [C04B 2235/549](#) are to be given to constituents or additives only if:
 - a. it is not obvious from the end product as such that the constituent or additive has been used for making the end product.
 Examples:

C04B 2235/30

(continued)

- in case spinel is made from a certain clay instead of from alumina and silica, the clay is coded,
- when calcium zirconate and titania are used to make calcium zirconium titanate, a code should be given for the calcium zirconate constituent while normally calcium oxide or calcium carbonate and zirconia are used.

The titania constituent of the starting mixture is not coded since it is to be expected that a single metal oxide is used to make a mixed metal oxide.

- b. it is not obvious from the "invention information" symbols that this constituent has been used to make the end product, e.g. if the "invention information" symbol given indicates that a zirconia-alumina composite is prepared it is common practice that zirconia and alumina constituents have been used and thus no codes for zirconia or alumina are given. In the same way, if an allocation indicates that an oxide ceramic contains carbon, no code for the addition of carbon is given. However for an alumina composite product comprising titania, the main symbol for composites based on alumina is given together with an indexing code for titania.

2. In groups [C04B 2235/32](#) to [C04B 2235/349](#) oxides are considered to comprise also metal salts from which they are formed by heating.

C04B 2235/32

- . . . Metal oxides, mixed metal oxides, or oxide-forming salts thereof, e.g. carbonates, nitrates, (oxy)hydroxides, chlorides

NOTE

In groups [C04B 2235/32](#) to [C04B 2235/349](#) metal salts are classified according to the oxides that are formed by heating the metal salts.

C04B 2235/3201	. . . .	Alkali metal oxides or oxide-forming salts thereof
C04B 2235/3203	. . . .	Lithium oxide or oxide-forming salts thereof
C04B 2235/3205	. . . .	Alkaline earth oxides or oxide forming salts thereof, e.g. beryllium oxide
C04B 2235/3206	. . . .	Magnesium oxides or oxide-forming salts thereof
C04B 2235/3208	. . . .	Calcium oxide or oxide-forming salts thereof, e.g. lime
C04B 2235/321	. . . .	Dolomites, i.e. mixed calcium magnesium carbonates
C04B 2235/3212	. . . .	Calcium phosphates, e.g. hydroxyapatite
C04B 2235/3213	. . . .	Strontium oxides or oxide-forming salts thereof
C04B 2235/3215	. . . .	Barium oxides or oxide-forming salts thereof
C04B 2235/3217	. . . .	Aluminum oxide or oxide forming salts thereof, e.g. bauxite, alpha-alumina
C04B 2235/3218	. . . .	Aluminium (oxy)hydroxides, e.g. boehmite, gibbsite, alumina sol
C04B 2235/322	. . . .	Transition aluminas, e.g. delta or gamma aluminas
C04B 2235/3222	. . . .	Aluminates other than alumino-silicates, e.g. spinel (MgAl_2O_4)
C04B 2235/3224	. . . .	Rare earth oxide or oxide forming salts thereof, e.g. scandium oxide
C04B 2235/3225	. . . .	Yttrium oxide or oxide-forming salts thereof
C04B 2235/3227	. . . .	Lanthanum oxide or oxide-forming salts thereof
C04B 2235/3229	. . . .	Cerium oxides or oxide-forming salts thereof

C04B 2235/3231	. . . .	Refractory metal oxides, their mixed metal oxides, or oxide-forming salts thereof
C04B 2235/3232	. . . .	Titanium oxides or titanates, e.g. rutile or anatase
C04B 2235/3234	. . . .	Titanates, not containing zirconia
C04B 2235/3236	. . . .	Alkaline earth titanates
C04B 2235/3237	. . . .	Substoichiometric titanium oxides, e.g. Ti_2O_3
C04B 2235/3239	. . . .	Vanadium oxides, vanadates or oxide forming salts thereof, e.g. magnesium vanadate
C04B 2235/3241	. . . .	Chromium oxides, chromates, or oxide-forming salts thereof
C04B 2235/3243	. . . .	Chromates or chromites, e.g. aluminum chromate, lanthanum strontium chromite
C04B 2235/3244	. . . .	Zirconium oxides, zirconates, hafnium oxides, hafnates, or oxide-forming salts thereof
C04B 2235/3246	. . . .	Stabilised zirconias, e.g. YSZ or cerium stabilised zirconia
C04B 2235/3248	. . . .	Zirconates or hafnates, e.g. zircon
C04B 2235/3249	. . . .	containing also titanium oxide or titanates, e.g. lead zirconate titanate (PZT)
C04B 2235/3251	. . . .	Niobium oxides, niobates, tantalum oxides, tantalates, or oxide-forming salts thereof
C04B 2235/3253	. . . .	Substoichiometric niobium or tantalum oxides, e.g. NbO
C04B 2235/3255	. . . .	Niobates or tantalates, e.g. silver niobate
C04B 2235/3256	. . . .	Molybdenum oxides, molybdates or oxide forming salts thereof, e.g. cadmium molybdate
C04B 2235/3258	. . . .	Tungsten oxides, tungstates, or oxide-forming salts thereof
C04B 2235/326	. . . .	Tungstates, e.g. scheelite
C04B 2235/3262	. . . .	Manganese oxides, manganates, rhenium oxides or oxide-forming salts thereof, e.g. MnO
C04B 2235/3263	. . . .	Mn_3O_4
C04B 2235/3265	. . . .	Mn_2O_3
C04B 2235/3267	. . . .	MnO_2
C04B 2235/3268	. . . .	Manganates, manganites, rhenates or rhenites, e.g. lithium manganite, barium manganate, rhenium oxide
C04B 2235/327	. . . .	Iron group oxides, their mixed metal oxides, or oxide-forming salts thereof
C04B 2235/3272	. . . .	Iron oxides or oxide forming salts thereof, e.g. hematite, magnetite
C04B 2235/3274	. . . .	Ferrites
C04B 2235/3275	. . . .	Cobalt oxides, cobaltates or cobaltites or oxide forming salts thereof, e.g. bismuth cobaltate, zinc cobaltite
C04B 2235/3277	. . . .	Co_3O_4
C04B 2235/3279	. . . .	Nickel oxides, nickelates, or oxide-forming salts thereof
C04B 2235/3281	. . . .	Copper oxides, cuprates or oxide-forming salts thereof, e.g. CuO or Cu_2O
C04B 2235/3282	. . . .	Cuprates
C04B 2235/3284	. . . .	Zinc oxides, zincates, cadmium oxides, cadmates, mercury oxides, mercurates or oxide forming salts thereof

C04B 2235/3286	. . . .	Gallium oxides, gallates, indium oxides, indates, thallium oxides, thallates or oxide forming salts thereof, e.g. zinc gallate
C04B 2235/3287	. . . .	Germanium oxides, germanates or oxide forming salts thereof, e.g. copper germanate
C04B 2235/3289	. . . .	Noble metal oxides
C04B 2235/3291	. . . .	Silver oxides
C04B 2235/3293	. . . .	Tin oxides, stannates or oxide forming salts thereof, e.g. indium tin oxide [ITO]
C04B 2235/3294	. . . .	Antimony oxides, antimonates, antimonites or oxide forming salts thereof, indium antimonate
C04B 2235/3296	. . . .	Lead oxides, plumbates or oxide forming salts thereof, e.g. silver plumbate
C04B 2235/3298	. . . .	Bismuth oxides, bismuthates or oxide forming salts thereof, e.g. zinc bismuthate
C04B 2235/34	. . . .	Non-metal oxides, non-metal mixed oxides, or salts thereof that form the non-metal oxides upon heating, e.g. carbonates, nitrates, (oxy)hydroxides, chlorides
C04B 2235/3409	. . . .	Boron oxide, borates, boric acids, or oxide forming salts thereof, e.g. borax
C04B 2235/3418	. . . .	Silicon oxide, silicic acids, or oxide forming salts thereof, e.g. silica sol, fused silica, silica fume, cristobalite, quartz or flint (glass constituents C04B 2235/36)
C04B 2235/3427	. . . .	Silicates other than clay, e.g. water glass
C04B 2235/3436	. . . .	Alkaline earth metal silicates, e.g. barium silicate
C04B 2235/3445	. . . .	Magnesium silicates, e.g. forsterite
C04B 2235/3454	. . . .	Calcium silicates, e.g. wollastonite
C04B 2235/3463	. . . .	Alumino-silicates other than clay, e.g. mullite
C04B 2235/3472	. . . .	Alkali metal alumino-silicates other than clay, e.g. spodumene, alkali feldspars such as albite or orthoclase, micas such as muscovite, zeolites such as natrolite
C04B 2235/3481	. . . .	Alkaline earth metal alumino-silicates other than clay, e.g. cordierite, beryl, micas such as margarite, plagioclase feldspars such as anorthite, zeolites such as chabazite
C04B 2235/349	. . . .	Clays, e.g. bentonites, smectites such as montmorillonite, vermiculites or kaolines, e.g. illite, talc or sepiolite
C04B 2235/36	. . . .	Glass starting materials for making ceramics, e.g. silica glass
C04B 2235/365	. . . .	Borosilicate glass
C04B 2235/38	. . . .	Non-oxide ceramic constituents or additives
C04B 2235/3804	. . . .	Borides
C04B 2235/3808	. . . .	Magnesium borides
C04B 2235/3813	. . . .	Refractory metal borides
C04B 2235/3817	. . . .	Carbides
C04B 2235/3821	. . . .	Boron carbides
C04B 2235/3826	. . . .	Silicon carbides
C04B 2235/383	. . . .	Alpha silicon carbide
C04B 2235/3834	. . . .	Beta silicon carbide
C04B 2235/3839	. . . .	Refractory metal carbides

C04B 2235/3843	. . . . .	Titanium carbides
C04B 2235/3847	. . . . .	Tungsten carbides
C04B 2235/3852	. . . . .	Nitrides, e.g. oxynitrides, carbonitrides, oxycarbonitrides, lithium nitride, magnesium nitride
C04B 2235/3856	. . . . .	Carbonitrides, e.g. titanium carbonitride, zirconium carbonitride

NOTE

When indexing in group [C04B 2235/3856](#) indexing according to the metal is also made in groups [C04B 2235/3865](#) to [C04B 2235/3886](#)

C04B 2235/386	. . . . .	Boron nitrides
C04B 2235/3865	. . . . .	Aluminium nitrides
C04B 2235/3869	. . . . .	Aluminium oxynitrides, e.g. AlON, sialon
C04B 2235/3873	. . . . .	Silicon nitrides, e.g. silicon carbonitride, silicon oxynitride
C04B 2235/3878	. . . . .	Alpha silicon nitrides
C04B 2235/3882	. . . . .	Beta silicon nitrides
C04B 2235/3886	. . . . .	Refractory metal nitrides, e.g. vanadium nitride, tungsten nitride
C04B 2235/3891	. . . . .	Silicides, e.g. molybdenum disilicide, iron silicide
C04B 2235/3895	. . . . .	Non-oxides with a defined oxygen content, e.g. SiOC, TiON
C04B 2235/40	. . . . .	Metallic constituents or additives not added as binding phase
C04B 2235/401	. . . . .	Alkaline earth metals
C04B 2235/402	. . . . .	Aluminium
C04B 2235/404	. . . . .	Refractory metals
C04B 2235/405	. . . . .	Iron group metals
C04B 2235/407	. . . . .	Copper
C04B 2235/408	. . . . .	Noble metals
C04B 2235/42	. . . . .	Non metallic elements added as constituents or additives, e.g. sulfur, phosphor, selenium or tellurium
C04B 2235/421	. . . . .	Boron
C04B 2235/422	. . . . .	Carbon
C04B 2235/424	. . . . .	Carbon black
C04B 2235/425	. . . . .	Graphite
C04B 2235/427	. . . . .	Diamond
C04B 2235/428	. . . . .	Silicon
C04B 2235/44	. . . . .	Metal salt constituents or additives chosen for the nature of the anions, e.g. hydrides or acetylacetonate
C04B 2235/441	. . . . .	Alkoxides, e.g. methoxide, tert-butoxide
C04B 2235/442	. . . . .	Carbonates
C04B 2235/443	. . . . .	Nitrates or nitrites
C04B 2235/444	. . . . .	Halide containing anions, e.g. bromide, iodate, chlorite
C04B 2235/445	. . . . .	Fluoride containing anions, e.g. fluosilicate
C04B 2235/446	. . . . .	Sulfides, tellurides or selenides

C04B 2235/447	.	.	.	.	Phosphates or phosphites (calcium phosphates C04B 2235/3212), e.g. orthophosphate, hypophosphite
C04B 2235/448	.	.	.	.	Sulphates or sulphites
C04B 2235/449	.	.	.	.	Organic acids, e.g. EDTA, citrate, acetate, oxalate
C04B 2235/46	.	.	.	.	Gases other than oxygen used as reactant, e.g. nitrogen used to make a nitride phase
C04B 2235/465	.	.	.	.	Ammonia
C04B 2235/48	.	.	.	.	Organic compounds becoming part of a ceramic after heat treatment, e.g. carbonising phenol resins
C04B 2235/483	.	.	.	.	Si-containing organic compounds, e.g. silicone resins, (poly)silanes, (poly)siloxanes or (poly)silazanes
C04B 2235/486	.	.	.	.	Boron containing organic compounds, e.g. borazine, borane or boranyl
C04B 2235/50	.	.	.	.	Constituents or additives of the starting mixture chosen for their shape or used because of their shape or their physical appearance
C04B 2235/52	.	.	.	.	Constituents or additives characterised by their shapes
C04B 2235/5204	.	.	.	.	Monocrystalline powders
C04B 2235/5208	.	.	.	.	Fibers
C04B 2235/5212	.	.	.	.	Organic
C04B 2235/5216	.	.	.	.	Inorganic
C04B 2235/522	.	.	.	.	Oxidic
C04B 2235/5224	.	.	.	.	Alumina or aluminates
C04B 2235/5228	.	.	.	.	Silica and alumina, including aluminosilicates, e.g. mullite
C04B 2235/5232	.	.	.	.	Silica or silicates other than aluminosilicates, e.g. quartz
C04B 2235/5236	.	.	.	.	Zirconia
C04B 2235/524	.	.	.	.	Non-oxidic, e.g. borides, carbides, silicides or nitrides
C04B 2235/5244	.	.	.	.	Silicon carbide
C04B 2235/5248	.	.	.	.	Carbon, e.g. graphite
C04B 2235/5252	.	.	.	.	having a specific pre-form
C04B 2235/5256	.	.	.	.	Two-dimensional, e.g. woven structures
C04B 2235/526	.	.	.	.	characterised by the length of the fibers
C04B 2235/5264	.	.	.	.	characterised by the diameter of the fibers
C04B 2235/5268	.	.	.	.	Orientation of the fibers
C04B 2235/5272	.	.	.	.	Fibers of the same material with different length or diameter
C04B 2235/5276	.	.	.	.	Whiskers, spindles, needles or pins
C04B 2235/528	.	.	.	.	Spheres
C04B 2235/5284	.	.	.	.	Hollow fibers, e.g. nanotubes
C04B 2235/5288	.	.	.	.	Carbon nanotubes
C04B 2235/5292	.	.	.	.	Flakes, platelets or plates
C04B 2235/5296	.	.	.	.	with a defined aspect ratio, e.g. indicating sphericity (spherical constituents C04B 2235/528)
C04B 2235/54	.	.	.	.	Particle size related information
C04B 2235/5409	.	.	.	.	expressed by specific surface values

- C04B 2235/5418 expressed by the size of the particles or aggregates thereof
- C04B 2235/5427 millimeter or submillimeter sized, i.e. larger than 0,1 mm
- C04B 2235/5436 micrometer sized, i.e. from 1 to 100 micron
- C04B 2235/5445 submicron sized, i.e. from 0,1 to 1 micron
- C04B 2235/5454 nanometer sized, i.e. below 100 nm
- C04B 2235/5463 Particle size distributions
- C04B 2235/5472 Bimodal, multi-modal or multi-fraction
- C04B 2235/5481 Monomodal
- C04B 2235/549 the particle size being expressed by crystallite size or primary particle size
- C04B 2235/60 Aspects relating to the preparation, properties or mechanical treatment of green bodies or pre-forms
- C04B 2235/602 Making the green bodies or pre-forms by moulding
- C04B 2235/6021 Extrusion moulding
- C04B 2235/6022 Injection moulding
- C04B 2235/6023 Gel casting
- C04B 2235/6025 Tape casting, e.g. with a doctor blade
- C04B 2235/6026 Computer aided shaping, e.g. rapid prototyping
- C04B 2235/6027 Slip casting
- C04B 2235/6028 Shaping around a core which is removed later
- C04B 2235/604 Pressing at temperatures other than sintering temperatures
- C04B 2235/605 Making or treating the green body or pre-form in a magnetic field
- C04B 2235/606 Drying
- C04B 2235/608 Green bodies or pre-forms with well-defined density
- C04B 2235/61 Mechanical properties, e.g. fracture toughness, hardness, Young's modulus or strength
- C04B 2235/612 Machining
- C04B 2235/614 Gas infiltration of green bodies or pre-forms
- C04B 2235/616 Liquid infiltration of green bodies or pre-forms
- C04B 2235/65 Aspects relating to heat treatments of ceramic bodies such as green ceramics or pre-sintered ceramics, e.g. burning, sintering or melting processes
- C04B 2235/652 Reduction treatment ([C04B 2235/664 takes precedence](#))
- C04B 2235/656 characterised by specific heating conditions during heat treatment
- C04B 2235/6562 Heating rate
- C04B 2235/6565 Cooling rate
- C04B 2235/6567 Treatment time
- C04B 2235/658 Atmosphere during thermal treatment
- C04B 2235/6581 Total pressure below 1 atmosphere, e.g. vacuum
- C04B 2235/6582 Hydrogen containing atmosphere
- C04B 2235/6583 Oxygen containing atmosphere, e.g. with changing oxygen pressures
- C04B 2235/6584 at an oxygen percentage below that of air
- C04B 2235/6585 at an oxygen percentage above that of air

C04B 2235/6586	. . .	Processes characterised by the flow of gas
C04B 2235/6587	. . .	Influencing the atmosphere by vaporising a solid material, e.g. by using a burying of sacrificial powder
C04B 2235/6588	. . .	Water vapor containing atmospheres
C04B 2235/66	. .	Specific sintering techniques, e.g. centrifugal sintering
C04B 2235/661	. . .	Multi-step sintering
C04B 2235/662	. . . .	Annealing after sintering
C04B 2235/663	. . . . .	Oxidative annealing
C04B 2235/664	. . . . .	Reductive annealing
C04B 2235/665	. . .	Local sintering, e.g. laser sintering
C04B 2235/666	. . .	Applying a current during sintering, e.g. plasma sintering [SPS], electrical resistance heating or pulse electric current sintering [PECS]
C04B 2235/667	. . .	Sintering using wave energy, e.g. microwave sintering
C04B 2235/668	. . .	Pressureless sintering
C04B 2235/70	. .	Aspects relating to sintered or melt-casted ceramic products
C04B 2235/72	. .	Products characterised by the absence or the low content of specific components, e.g. alkali metal free alumina ceramics
C04B 2235/721	. . .	Carbon content
C04B 2235/722	. . .	Nitrogen content
C04B 2235/723	. . .	Oxygen content
C04B 2235/724	. . .	Halogenide content
C04B 2235/725	. . .	Metal content
C04B 2235/726	. . .	Sulfur content
C04B 2235/727	. . .	Phosphorus or phosphorus compound content
C04B 2235/728	. . .	Silicon content
C04B 2235/74	. .	Physical characteristics
C04B 2235/75	. . .	Products with a concentration gradient
C04B 2235/76	. . .	Crystal structural characteristics, e.g. symmetry

NOTE

Codes [C04B 2235/76](#) to [C04B 2235/768](#) are to be used only if the crystal structure is not identified by the classification.

C04B 2235/761	. . . .	Unit-cell parameters, e.g. lattice constants
C04B 2235/762	. . . .	Cubic symmetry, e.g. beta-SiC
C04B 2235/763	. . . . .	Spinel structure AB_2O_4
C04B 2235/764	. . . . .	Garnet structure $A_3B_2(CO_4)_3$
C04B 2235/765	. . . .	Tetragonal symmetry
C04B 2235/766	. . . .	Trigonal symmetry, e.g. alpha-Si ₃ N ₄ or alpha-Sialon
C04B 2235/767	. . . .	Hexagonal symmetry, e.g. beta-Si ₃ N ₄ , beta-Sialon, alpha-SiC or hexa-ferrites
C04B 2235/768	. . . .	Perovskite structure ABO_3

C04B 2235/77	. . . Density
C04B 2235/775	. . . . Products showing a density-gradient
C04B 2235/78	. . . Grain sizes and shapes, product microstructures, e.g. acicular grains, equiaxed grains, platelet-structures
C04B 2235/781	. . . . Nanograined materials, i.e. having grain sizes below 100 nm
C04B 2235/782	. . . . Grain size distributions
C04B 2235/783	. . . . . Bimodal, multi-modal or multi-fractional
C04B 2235/784	. . . . . Monomodal
C04B 2235/785	. . . . Submicron sized grains, i.e. from 0,1 to 1 micron
C04B 2235/786	. . . . Micrometer sized grains, i.e. from 1 to 100 micron
C04B 2235/787	. . . . Oriented grains
C04B 2235/788	. . . . Aspect ratio of the grains
C04B 2235/79	. . . Non-stoichiometric products, e.g. perovskites (ABO_3) with an A/B-ratio other than 1
C04B 2235/80	. . Phases present in the sintered or melt-cast ceramic products other than the main phase

NOTES

1. In this group the term "phases other than the main phase" refers to any phase that is not the main phase, i.e. the phase that is present in the largest amount
2. Codes chosen from groups [C04B 2235/30](#) to [C04B 2235/5296](#) are used for identifying the phases other than the main phase

C04B 2235/81	. . . Materials characterised by the absence of phases other than the main phase, i.e. single phase materials
C04B 2235/83	. . . Ferrites containing Fe^{2+}
C04B 2235/85	. . . Intergranular or grain boundary phases
C04B 2235/87	. . . Grain boundary phases intentionally being absent
C04B 2235/94	. . Products characterised by their shape
C04B 2235/945	. . . Products containing grooves, cuts, recesses or protusions
C04B 2235/95	. . Products characterised by their size, e.g. microceramics
C04B 2235/96	. . Properties of ceramic products, e.g. mechanical properties such as strength, toughness, wear resistance

NOTE

Codes [C04B 2235/96](#) to [C04B 2235/9692](#) are to be used only if the property is not identified already by an "invention information" symbol, e.g. by a symbol out of subclass [H01L](#) indicating that the ceramic is dielectric, piezoelectric or magnetic.

C04B 2235/9607	. . . Thermal properties, e.g. thermal expansion coefficient
C04B 2235/9615	. . . . Linear firing shrinkage
C04B 2235/9623	. . . . Ceramic setters properties
C04B 2235/963	. . . Surface properties, e.g. surface roughness

C04B 2235/9638	. . . . Tolerance; Dimensional accuracy
C04B 2235/9646	. . . . Optical properties
C04B 2235/9653	. . . . Translucent or transparent ceramics other than alumina
C04B 2235/9661	. . . . Colour
C04B 2235/9669	. . . . Resistance against chemicals, e.g. against molten glass or molten salts
C04B 2235/9676	. . . . against molten metals such as steel or aluminium
C04B 2235/9684	. . . . Oxidation resistance
C04B 2235/9692	. . . . Acid, alkali or halogen resistance
C04B 2237/00	Aspects relating to ceramic laminates or to joining of ceramic articles with other articles by heating
C04B 2237/02	. Aspects relating to interlayers, e.g. used to join ceramic articles with other articles by heating
C04B 2237/04	. . Ceramic interlayers
C04B 2237/06	. . . Oxidic interlayers
C04B 2237/062	. . . . based on silica or silicates
C04B 2237/064	. . . . based on alumina or aluminates
C04B 2237/066	. . . . based on rare earth oxides
C04B 2237/068	. . . . based on refractory oxides, e.g. zirconia
C04B 2237/08	. . . Non-oxidic interlayers
C04B 2237/083	. . . . Carbide interlayers, e.g. silicon carbide interlayers
C04B 2237/086	. . . . Carbon interlayers
C04B 2237/09	. . . wherein the active component for bonding is not the largest fraction of the interlayer
C04B 2237/095	. . . . The active component for bonding being silicon
C04B 2237/10	. . Glass interlayers, e.g. frit or flux
C04B 2237/12	. . Metallic interlayers
C04B 2237/121	. . . based on aluminium
C04B 2237/122	. . . based on refractory metals
C04B 2237/123	. . . based on iron group metals, e.g. steel
C04B 2237/124	. . . based on copper
C04B 2237/125	. . . based on noble metals, e.g. silver
C04B 2237/126	. . . wherein the active component for bonding is not the largest fraction of the interlayer
C04B 2237/127	. . . . The active component for bonding being a refractory metal
C04B 2237/128	. . . . The active component for bonding being silicon
C04B 2237/16	. . Silicon interlayers
C04B 2237/30	. Composition of layers of ceramic laminates or of ceramic or metallic articles to be joined by heating, e.g. Si substrates
C04B 2237/32	. . Ceramic
C04B 2237/34	. . . Oxidic
C04B 2237/341	. . . . Silica or silicates

C04B 2237/343	. . . . Alumina or aluminates
C04B 2237/345	. . . . Refractory metal oxides
C04B 2237/346	. . . . . Titania or titanates
C04B 2237/348	. . . . . Zirconia, hafnia, zirconates or hafnates
C04B 2237/36	. . . Non-oxidic
C04B 2237/361	. . . . Boron nitride
C04B 2237/363	. . . . Carbon
C04B 2237/365	. . . . Silicon carbide
C04B 2237/366	. . . . Aluminium nitride
C04B 2237/368	. . . . Silicon nitride
C04B 2237/38	. . . Fiber or whisker reinforced
C04B 2237/385	. . . . Carbon or carbon composite
C04B 2237/40	. . Metallic
C04B 2237/401	. . . Cermets
C04B 2237/402	. . . Aluminium
C04B 2237/403	. . . Refractory metals
C04B 2237/404	. . . Manganese or rhenium
C04B 2237/405	. . . Iron metal group, e.g. Co or Ni
C04B 2237/406	. . . . Iron, e.g. steel
C04B 2237/407	. . . Copper
C04B 2237/408	. . . Noble metals, e.g. palladium, platina or silver
C04B 2237/50	. Processing aspects relating to ceramic laminates or to the joining of ceramic articles with other articles by heating
C04B 2237/52	. . Pre-treatment of the joining surfaces, e.g. cleaning, machining
C04B 2237/525	. . . by heating
C04B 2237/54	. . Oxidising the surface before joining
C04B 2237/55	. . Pre-treatments of a coated or not coated substrate other than oxidation treatment in order to form an active joining layer
C04B 2237/555	. . . on a substrate not containing an interlayer coating, leading to the formation of an interlayer coating
C04B 2237/56	. . Using constraining layers before or during sintering
C04B 2237/561	. . . Constraining layers not covering the whole surface of the layers to be sintered, e.g. constraining layers with holes
C04B 2237/562	. . . made of alumina or aluminates
C04B 2237/564	. . . made of glass
C04B 2237/565	. . . made of refractory metal oxides, e.g. zirconia
C04B 2237/567	. . . made of metal
C04B 2237/568	. . . made of non-oxide ceramics
C04B 2237/58	. . Forming a gradient in composition or in properties across the laminate or the joined articles
C04B 2237/582	. . . by joining layers or articles of the same composition but having different additives

- C04B 2237/584 the different additives being fibers or whiskers
- C04B 2237/586 . . . by joining layers or articles of the same composition but having different densities
- C04B 2237/588 . . . by joining layers or articles of the same composition but having different particle or grain sizes
- C04B 2237/59 . . Aspects relating to the structure of the interlayer
- C04B 2237/592 . . . whereby the interlayer is not continuous, e.g. not the whole surface of the smallest substrate is covered by the interlayer
- C04B 2237/595 . . . whereby the interlayer is continuous, but heterogeneous on macro-scale, e.g. one part of the interlayer being a joining material, another part being an electrode material
- C04B 2237/597 . . . whereby the interlayer is continuous but porous, e.g. containing hollow or porous particles, macro- or micropores or cracks
- C04B 2237/60 . . Forming at the joining interface or in the joining layer specific reaction phases or zones, e.g. diffusion of reactive species from the interlayer to the substrate or from a substrate to the joining interface, carbide forming at the joining interface
- C04B 2237/61 . . Joining two substrates of which at least one is porous by infiltrating the porous substrate with a liquid, such as a molten metal, causing bonding of the two substrates, e.g. joining two porous carbon substrates by infiltrating with molten silicon
- C04B 2237/62 . . Forming laminates or joined articles comprising holes, channels or other types of openings
- C04B 2237/64 . . Forming laminates or joined articles comprising grooves or cuts
- C04B 2237/66 . . Forming laminates or joined articles showing high dimensional accuracy, e.g. indicated by the warpage
- C04B 2237/68 . . Forming laminates or joining articles wherein at least one substrate contains at least two different parts of macro-size, e.g. one ceramic substrate layer containing an embedded conductor or electrode
- C04B 2237/70 . . Forming laminates or joined articles comprising layers of a specific, unusual thickness
- C04B 2237/702 . . . of one or more of the constraining layers
- C04B 2237/704 . . . of one or more of the ceramic layers or articles
- C04B 2237/706 . . . of one or more of the metallic layers or articles
- C04B 2237/708 . . . of one or more of the interlayers
- C04B 2237/72 . . Forming laminates or joined articles comprising at least two interlayers directly next to each other
- C04B 2237/74 . . Forming laminates or joined articles comprising at least two different interlayers separated by a substrate
- C04B 2237/76 . . Forming laminates or joined articles comprising at least one member in the form other than a sheet or disc, e.g. two tubes or a tube and a sheet or disc
- C04B 2237/765 . . . at least one member being a tube
- C04B 2237/78 . . Side-way connecting, e.g. connecting two plates through their sides
- C04B 2237/80 . . Joining the largest surface of one substrate with a smaller surface of the other substrate, e.g. butt joining or forming a T-joint
- C04B 2237/82 . . Two substrates not completely covering each other, e.g. two plates in a staggered position

- C04B 2237/84
 - · Joining of a first substrate with a second substrate at least partially inside the first substrate, where the bonding area is at the inside of the first substrate, e.g. one tube inside another tube
- C04B 2237/86
 - · Joining of two substrates at their largest surfaces, one surface being complete joined and covered, the other surface not, e.g. a small plate joined at it's largest surface on top of a larger plate
- C04B 2237/88
 - · Joining of two substrates, where a substantial part of the joining material is present outside of the joint, leading to an outside joining of the joint
- C04B 2290/00
 - **Organisational aspects of production methods, equipment or plants**
- C04B 2290/10
 - Business methods aspects
- C04B 2290/20
 - Integrated combined plants or devices, e.g. combined foundry and concrete plant