

**CPC****COOPERATIVE PATENT CLASSIFICATION****C22B****PRODUCTION AND REFINING OF METALS ( [electrolytic C25](#) ) ;  
PRETREATMENT OF RAW MATERIALS****NOTE**

In this subclass, groups for obtaining metals include obtaining the metals by non-metallurgical processes, and obtaining metal compounds by metallurgical processes, {as far as specifically indicated in the relevant groups } . Thus, for example, group [C22B 11/00](#) covers the production of silver by reduction of ammoniacal silver oxide in solution, and group [C22B 17/00](#) includes the production of cadmium oxide by a metallurgical process. Furthermore, although compounds of arsenic and antimony are classified in [C01G](#) , production of the elements themselves is included in [C22B](#) , as well as the production of their compounds by metallurgical processes.

**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:

[C22B 3/26](#) to [C22B 3/40](#) covered by [C22B 3/0005](#)

**Guidance heading:****C22B 1/00****Preliminary treatment of ores or scrap ( [furnaces, sintering apparatus F27B](#) )**

- C22B 1/005 . { Preliminary treatment of scrap ( [C22B 1/02](#) up to [C22B 1/26](#) take precedence ) }
- C22B 1/02 . Roasting processes ( [C22B 1/16](#) takes precedence )
- C22B 1/04 . . Blast roasting
- C22B 1/06 . . Sulfating roasting
- C22B 1/08 . . Chloridising roasting
- C22B 1/10 . . in fluidised form
- C22B 1/11 . Removing sulfur, phosphorus or arsenic other than by roasting
- C22B 1/14 . Agglomerating ; Briquetting ; Binding ; Granulating
- C22B 1/16 . . Sintering ; Agglomerating
- C22B 1/18 . . . in sinter pots
- C22B 1/20 . . . in sintering machines with movable grates
- C22B 1/205 . . . { regulation of the sintering process }
- C22B 1/212 . . . in tunnel furnaces
- C22B 1/214 . . . in shaft furnaces
- C22B 1/216 . . . in rotary furnaces
- C22B 1/22 . . . in other sintering apparatus

- C22B 1/24 . . . Binding ; Briquetting; { Granulating }
- C22B 1/2406 . . . { pelletizing }
- C22B 1/2413 . . . { enduration of pellets }
- C22B 1/242 . . . with binders
- C22B 1/243 . . . . . inorganic
- C22B 1/244 . . . . . organic
- C22B 1/245 . . . . . with carbonaceous material for the production of coked agglomerates
- C22B 1/248 . . . of metal scrap or alloys

- C22B 1/26 . . . Cooling of roasted, sintered, or agglomerated ores

## **C22B 3/00      Extraction of metal compounds from ores or concentrates by wet processes**

### **NOTE**

This group covers methods directed to the extraction of three or more metals. For the recovery of one or two metals, see the other groups of this subclass concerning these metals

- C22B 3/0001 . . { Leaching of ores } { not used, see subgroups }
- C22B 3/0002 . . { Leaching with an ammoniacal liquor or with a hydroxide of an alkali or an alkaline earth metal }

### **WARNING**

Group [C22B 3/0002](#) is no longer used for the classification of new documents from May 1st, 2005. The backlog of this group is being continuously transferred to the relevant groups of [C22B](#)

- C22B 3/0004 . . { Treatment or purification of solutions, e.g. obtained by leaching ( [C22B 3/04](#) takes precedence ) } { WARNING: Not used, see subgroups }
- C22B 3/0005 . . { by liquid-liquid extraction using organic compounds, e.g. acyclic or carbocyclic compounds, heterocyclic compounds, organo- metallic compounds, alcohols, ethers, or the like ( [C22B 3/205](#) takes precedence ) }
- C22B 3/0006 . . . { using acyclic or carbocyclic compounds }
- C22B 3/0008 . . . . { using acyclic or carbocyclic compounds of a single type }
- C22B 3/0009 . . . . . { using alcohols or phenols }
- C22B 3/001 . . . . . { using amines ( amino acids [C22B 3/0024](#) ) }
- C22B 3/0012 . . . . . { using aliphatic amines }
- C22B 3/0013 . . . . . { using aromatic amines }
- C22B 3/0014 . . . . . { using amino-alcohols }
- C22B 3/0016 . . . . . { using quaternary ammonium }
- C22B 3/0017 . . . . . { using oximes }
- C22B 3/0018 . . . . . { using ethers or epoxides }
- C22B 3/002 . . . . . { using crown ethers }
- C22B 3/0021 . . . . . { using ketones or aldehydes }

C22B 3/0022	.....	{ using organic acids ( <a href="#">C22B 3/0031</a> or <a href="#">C22B 3/0035</a> or <a href="#">C22B 3/004</a> takes precedence ) }
C22B 3/0024	.....	{ using acids of the carboxylic type or derivatives thereof, e.g. amino acids, nitriles, amides, hydroxamic acids }
C22B 3/0025	.....	{ using oxalic acids }
C22B 3/0027	.....	{ using naphthenic acids }
C22B 3/0028	.....	{ using ramified chain carboxylic acids or derivatives thereof, e.g. "versatic" acids }
C22B 3/0029	.....	{ using cyanic acids or derivatives thereof ( <a href="#">C22B 3/0031</a> or <a href="#">C22B 3/0035</a> or <a href="#">C22B 3/004</a> takes precedence ) }
C22B 3/0031	.....	{ using organic compounds containing sulfur atom(s), e.g. sulfonium ( <a href="#">C22B 3/004</a> takes precedence ) }
C22B 3/0032	....	{ using mixtures of acyclic or carbocyclic compounds of different types ( <a href="#">C22B 3/0035</a> or <a href="#">C22B 3/004</a> takes precedence ) }
C22B 3/0033	.....	{ using organic acids added to oximes }
C22B 3/0035	...	{ using heterocyclic compounds ( <a href="#">C22B 3/0018</a> , <a href="#">C22B 3/002</a> and <a href="#">C22B 3/0031</a> take precedence ) }
C22B 3/0036	....	{ using heterocyclic compounds of a single type }
C22B 3/0037	.....	{ using quinoline }
C22B 3/0039	....	{ using a mixture of organic agents wherein one agent at least is a heterocyclic compound ( <a href="#">C22B 3/004</a> takes precedence ) }
C22B 3/004	...	{ using organo-metallic compounds or organo compounds of boron, silicon, phosphorus, selenium or tellurim }
C22B 3/0041	....	{ using organo-metallic compounds of a single type }
C22B 3/0043	.....	{ using phosphorus-based acid derivatives }
C22B 3/0044	.....	{ of a single type }
C22B 3/0045	.....	{ Acyclic compounds }
C22B 3/0047	.....	{ of the phosphine or phosphane (PH <sub>3</sub> ) type }
C22B 3/0048	.....	{ Primary (RPH <sub>2</sub> ) compounds }
C22B 3/005	.....	{ Secondary (R <sub>2</sub> PH) compounds }
C22B 3/0051	.....	{ Tertiary (R <sub>3</sub> PH) compounds }
C22B 3/0052	.....	{ Chalcogenides of phosphine, e.g. (R <sub>3</sub> P=X) type with X = O, S, Se or Te; Oxides, Thio-oxides of phosphine }
C22B 3/0054	.....	{ of the phosphorane (PH <sub>5</sub> ) type }
C22B 3/0055	.....	{ of the phosphonium (PR <sub>4</sub> ) type }
C22B 3/0056	.....	{ Mononuclear oxyacids of tervalent phosphorus or their esters(-ite) }
C22B 3/0058	.....	{ Phosphenous (HOPO) type }
C22B 3/0059	.....	{ Phosphinous (H <sub>2</sub> POH) type }
C22B 3/006	.....	{ Phosphonous ( H <sub>2</sub> P(OH) <sub>2</sub> ) type }
C22B 3/0062	.....	{ Phosphorous ( P(OH) <sub>3</sub> ) type }
C22B 3/0063	.....	{ Mononuclear oxyacids of pentavalent phosphorus or their esters(-ate) }
C22B 3/0064	.....	{ Phosphenic ( HOP(O) <sub>2</sub> ) or metaphosphoric type }
C22B 3/0066	.....	{ Phosphinic ( H <sub>2</sub> P(O)(OH) ) type }
C22B 3/0067	.....	{ Phosphonic ( H <sub>2</sub> P(O)(OH) <sub>2</sub> ) type }

C22B 3/0068	.....	{ Phosphoric ( $(\text{O})\text{P}(\text{OH})_3$ ) type }
C22B 3/007	.....	{ Thiophosphoric acids or their esters }
C22B 3/0071	.....	{ Dinuclear or polynuclear oxyacids and their derivatives }
C22B 3/0072	.....	{ Compounds with phosphorus-nitrogen ( $\text{P}=\text{N}$ ) double bonds }
C22B 3/0074	.....	{ compounds with (P-P) bonds }
C22B 3/0075	.....	{ compounds with (P-Xn-P) bonds ( n, 0, X: other than P ), e.g. pyro- or di- }
C22B 3/0077	.....	{ Cyclic compounds e.g. aryl-, phenyl-, benzyl-compounds }
C22B 3/0078	.....	{ using a mixture of phosphorus-based acid derivatives of different types }
C22B 3/0079	.....	{ of the acyclic type }
C22B 3/0081	.....	{ two or more of the phosphine type }
C22B 3/0082	.....	{ two or more of the phosphine oxides or sulfides type }
C22B 3/0083	.....	{ two or more of the phosphorane type }
C22B 3/0085	.....	{ two or more of the phosphonium type }
C22B 3/0086	.....	{ two or more of the mononuclear oxyacids of tervalent phosphorus or their esters }
C22B 3/0087	.....	{ two or more mononuclear oxyacids of quinquivalent phosphorus or their esters }
C22B 3/0089	.....	{ two or more thiophosphoric acids or their esters }
C22B 3/009	.....	{ two or more dinuclear or polynuclear oxyacids or their derivatives }
C22B 3/0091	.....	{ combinations of the above }
C22B 3/0093	.....	{ comprising cyclic compounds only }
C22B 3/0094	.....	{ comprising cyclic and acyclic compounds }
C22B 3/0095	....	{ using a mixture of organic agents wherein one agent at least is an organo-metallic compound }
C22B 3/0097	...	{ using a solution of normally solid organic compounds, e.g. dissolved polymers, sugars, or the like }
C22B 3/0098	..	{ by ion exchange extraction or by adsorption on solid substances, e.g. by extraction with solid resins ( <a href="#">C22B 3/0097</a> takes precedence ) }

### **WARNING**

Group [C22B 3/0098](#) is no longer used for the classification of new documents from May 1st, 2005. The backlog of this group is being continuously transferred to the relevant groups of [C22B](#)

C22B 3/02	.	Apparatus therefor
C22B 3/04	.	by leaching ( <a href="#">C22B 3/18</a> takes precedence )
C22B 3/045	..	{ Leaching using electrochemical processes }
C22B 3/06	..	in inorganic acid solutions, { e.g. with acids generated in situ; in inorganic salt solutions other than ammonium salt solutions }
C22B 3/065	...	{ Nitric acids or salts thereof }
C22B 3/08	...	Sulfuric acid, { other sulfated acids or salts thereof }

- C22B 3/10 . . . Hydrochloric acid, { other halogenated acids or salts thereof }
- C22B 3/12 . . . in inorganic alkaline solutions
- C22B 3/14 . . . containing ammonia or ammonium salts

#### **WARNING**

Group [C22B 3/14](#) was introduced on May 1st, 2005. This group covers the subject-matter of group [C22B 3/0002](#) which is no longer used for classification of new documents

- C22B 3/16 . . . in organic solutions
- C22B 3/1608 . . . { Leaching with acyclic or carbocyclic agents }
- C22B 3/1616 . . . . { Leaching with acyclic or carbocyclic agents of a single type }
- C22B 3/1625 . . . . . { with amines ( amino acids [C22B 3/165](#) ) }
- C22B 3/1633 . . . . . { with oximes }
- C22B 3/1641 . . . . . { with ketones or aldehydes }
- C22B 3/165 . . . . . { with organic acids }
- C22B 3/1658 . . . . { Leaching with acyclic or carbocyclic agents of different types in admixture, e.g. with organic acids added to oximes }
- C22B 3/1666 . . . { Leaching with heterocyclic compounds }
- C22B 3/1675 . . . . { Leaching with a mixture of organic agents wherein one agent at least is a heterocyclic compounds ( [C22B 3/1683](#) takes precedence ) }
- C22B 3/1683 . . . { Leaching with organo-metallic compounds }
- C22B 3/1691 . . . . { Leaching with a mixture of organic agents wherein at least one agent is an organo-metallic compound }
  
- C22B 3/18 . . with the aid of micro-organisms or enzymes, e.g. bacteria or algae
  
- C22B 3/20 . . Treatment or purification of solutions, e.g. obtained by leaching ( [C22B 3/18](#) takes precedence )
- C22B 3/205 . . { using adducts or inclusion complexes }
- C22B 3/22 . . by physical processes, e.g. by filtration, by magnetic means, { by thermal decomposition } ( [C22B 3/26](#) takes precedence )
- C22B 3/24 . . . by adsorption on solid substances, e.g. by extraction with solid resins

#### **WARNING**

Group [C22B 3/24](#) was introduced on May 1st, 2005. This group covers the subject-matter of group [C22B 3/0098](#) which is no longer used for classification of new documents

- C22B 3/42 . . by ion-exchange extraction

#### **WARNING**

Group [C22B 3/42](#) was introduced on May 1st, 2005. This group covers the subject-matter of group [C22B 3/0098](#) which is no longer used for classification of new documents

- C22B 3/44 . . by chemical processes ( [C22B 3/0005](#) to [C22B 3/20D2P](#) take precedence )
- C22B 3/46 . . . by substitution, e.g. by cementation

- C22B 4/00 Electrothermal treatment of ores or metallurgical products for obtaining metals or alloys ( obtaining iron or steel [C21B](#) , [C21C](#) )**
- C22B 4/005 . { using plasma jets ( smelting, remelting, refining of metals using a plasma as heat source [C22B 9/22](#) ; Generating or handling plasma in general [H05H 1/00](#) ; Gas-filled discharge tubes for processing materials in general [H01J 37/32](#) ) }
- C22B 4/02 . Light metals { ( [C22B 4/005](#) takes precedence ) }
- C22B 4/04 . Heavy metals { ( [C22B 4/005](#) takes precedence ) }
- C22B 4/06 . Alloys { ( [C22B 4/005](#) takes precedence ) }
- C22B 4/08 . Apparatus ( { [C22B 4/005](#) takes precedence; } electric heating elements [H05B](#) )
- C22B 5/00 General methods of reducing to metals**
- C22B 5/02 . Dry methods { smelting of sulfides or formation of mattes }
- C22B 5/04 . . by aluminium, other metals or silicon
- C22B 5/06 . . by carbides or the like
- C22B 5/08 . . by sulfides ; Roasting reaction methods
- C22B 5/10 . . by solid carbonaceous reducing agents
- C22B 5/12 . . by gases
- C22B 5/14 . . . fluidised material
- C22B 5/16 . . with volatilisation or condensation of the metal being produced
- C22B 5/18 . . Reducing step-by-step
- C22B 5/20 . . from metal carbonyls
- C22B 7/00 Working up raw materials other than ores, e.g. scrap, to produce non-ferrous metals and compounds thereof; { Methods of a general interest or applied to the winning of more than two metals ( briquetting of scrap [C22B 1/248](#) ; preliminary treatment of scrap [C22B 1/005](#) ) }**
- C22B 7/001 . { Dry processes }
- C22B 7/002 . . { by treating with halogens, sulfur or compounds thereof; by carburising, by treating with hydrogen (hydriding) }
- C22B 7/003 . . { only remelting, e.g. of chips, borings, turnings; apparatus used therefor }
- C22B 7/004 . . { separating two or more metals by melting out (liquation) i.e. heating above the temperature of the lower melting metal component(s); by fractional crystallisation ( controlled freezing ) }
- C22B 7/005 . { Separation by a physical processing technique only, e.g. by mechanical breaking }
- C22B 7/006 . { Wet processes }
- C22B 7/007 . . { by acid leaching }
- C22B 7/008 . . { by an alkaline or ammoniacal leaching }
- C22B 7/009 . { General processes for recovering metals or metallic compounds from spent catalysts }

( for recovering specific metals [C22B 11/00](#) to [C22B 61/00](#) ) }

[C22B 7/02](#) . Working-up flue dust

[C22B 7/04](#) . Working-up slag

**[C22B 9/00](#) General processes of refining or remelting of metals ; Apparatus for electroslag or arc remelting of metals**

[C22B 9/003](#) . { by induction }

[C22B 9/006](#) . { with use of an inert protective material including the use of an inert gas }

[C22B 9/02](#) . Refining by liquating, filtering, centrifuging, distilling, or supersonic wave action { including acoustic waves; ( [C22B 9/003](#) , [C22B 9/006](#) , [C22B 9/05](#) , [C22B 9/22](#) take precedence ) }

[C22B 9/023](#) . . { By filtering ( filtration of aluminium [C22B 21/066](#) ) }

[C22B 9/026](#) . . { by acoustic waves, e.g. supersonic waves }

[C22B 9/04](#) . Refining by applying a vacuum

[C22B 9/05](#) . Refining by treating with gases, e.g. gas flushing { also refining by means of a material generating gas in situ }

[C22B 9/055](#) . . { while the metal is circulating, e.g. combined with filtration }

[C22B 9/10](#) . with refining or fluxing agents ; use of materials therefor, { e.g. slagging or scorifying agents } ( [C22B 9/18](#) takes precedence ) { ( [C22B 9/006](#) takes precedence ) }

[C22B 9/103](#) . . { Methods of introduction of solid or liquid refining or fluxing agents }

[C22B 9/106](#) . . { the refining being obtained by intimately mixing the molten metal with a molten salt or slag }

[C22B 9/14](#) . Refining in the solid state

[C22B 9/16](#) . Remelting metals ( liquating [C22B 9/02](#) )

[C22B 9/18](#) . . Electroslag remelting { ( electroslag casting [B22D 23/10](#) ) }

[C22B 9/20](#) . . Arc remelting

[C22B 9/22](#) . . With heating by wave energy or particle radiation ( { by acoustic waves [C22B 9/026](#) } )

[C22B 9/221](#) . . . { by electromagnetic waves, e.g. by gas discharge lamps }

[C22B 9/223](#) . . . . { by laser beams ( working by laser beam [B23K 26/00](#) ) }

[C22B 9/225](#) . . . . { by microwaves }

[C22B 9/226](#) . . . { by electric discharge, e.g. plasma ( [C22B 9/20](#) takes precedence; apparatus therefor [H01J](#) , [H05B](#) , [H05H](#) ; chemical reactions with metals in a plasma [C22B 4/005](#) ) }

[C22B 9/228](#) . . . { by particle radiation, e.g. electron beams }

**[C22B 11/00](#) Obtaining noble metals**

[C22B 11/02](#) . by dry processes

- C22B 11/021 . . { Recovery of noble metals from waste materials }
- C22B 11/023 . . . { from pyrometallurgical residues, e.g. from ashes, dross, flue dust, mud, skim, slag, sludge }
- C22B 11/025 . . . { from manufactured products, e.g. from printed circuit boards, from photographic films, paper, or baths }
- C22B 11/026 . . . { from spent catalysts }
- C22B 11/028 . . . . { using solid sorbents, e.g. getters or catchment gauzes }
  
- C22B 11/04 . by wet processes { ( [C22B 3/16](#) takes precedence; treatment or purification of solutions by liquid-liquid extraction [C22B 3/0005](#) , by ion exchange or by adsorption [C22B 3/00](#) , [C01G](#) ; [C22B 3/16](#) , [C22B 3/0005](#) ) }
- C22B 11/042 . . { Recovery of noble metals from waste materials }
- C22B 11/044 . . . { from pyrometallurgical residues, e.g. from ashes, dross, flue dust, mud, skim, slag, sludge }
- C22B 11/046 . . . { from manufactured products, e.g. from printed circuit boards, from photographic films, paper or baths }
- C22B 11/048 . . . { from spent catalysts }
  
- C22B 11/06 . chloridising
- C22B 11/08 . by cyaniding
- C22B 11/10 . by amalgamating
- C22B 11/12 . . Apparatus therefor
  
- C22B 13/00** **Obtaining lead**
  - C22B 13/02 . by dry processes
  - C22B 13/025 . . { Recovery from waste materials }
  
  - C22B 13/04 . by wet processes
  - C22B 13/045 . . { Recovery from waste materials }
  
  - C22B 13/06 . Refining
  - C22B 13/08 . . Separating metals from lead by precipitating, e.g. Parkes process
  - C22B 13/10 . . Separating metals from lead by crystallising, e.g. by Pattison process
  
- C22B 15/00** **Obtaining copper**
  - C22B 15/0002 . { Preliminary treatment }
  - C22B 15/0004 . . { without modification of the copper constituent }
  - C22B 15/0006 . . . { by dry processes }
  - C22B 15/0008 . . . { by wet processes ( by flotation [B03D](#) ) }
  - C22B 15/001 . . { with modification of the copper constituent }
  - C22B 15/0013 . . . { by roasting }
  - C22B 15/0015 . . . . { Oxidizing roasting }



C22B 15/0017	....	{ Sulfating or sulfiding roasting }
C22B 15/0019	....	{ Chloridizing roasting ( <a href="#">segregation C22B 15/0023</a> ) }
C22B 15/0021	...	{ by reducing in gaseous or solid state ( <a href="#">slag reduction C22B 15/0054</a> ) }
C22B 15/0023	....	{ Segregation }
C22B 15/0026	.	{ Pyrometallurgy }
C22B 15/0028	..	{ Smelting or converting }
C22B 15/003	...	{ Bath smelting or converting }
C22B 15/0032	....	{ in shaft furnaces, e.g. blast furnaces }
C22B 15/0034	....	{ in rotary furnaces, e.g. kaldo-type furnaces }
C22B 15/0036	....	{ in reverberatory furnaces }
C22B 15/0039	....	{ in electric furnaces }
C22B 15/0041	....	{ in converters }
C22B 15/0043	.....	{ in rotating converters }
C22B 15/0045	....	{ in muffles, crucibles, or closed vessels }
C22B 15/0047	...	{ flash smelting or converting }
C22B 15/005	...	{ in a succession of furnaces }
C22B 15/0052	...	{ Reduction smelting or converting }
C22B 15/0054	..	{ Slag, slime, speiss, or dross treating }
C22B 15/0056	..	{ Scrap treating }
C22B 15/0058	...	{ Spent catalysts }
C22B 15/006	..	{ working up of molten copper, e.g. refining }
C22B 15/0063	.	{ Hydrometallurgy }
C22B 15/0065	..	{ Leaching or slurring ( <a href="#">with organic compounds C22B 3/16</a> ) }
C22B 15/0067	...	{ with acids or salts thereof }
C22B 15/0069	....	{ containing halogen }
C22B 15/0071	....	{ containing sulfur }
C22B 15/0073	....	{ containing nitrogen }
C22B 15/0076	.....	{ Cyanide groups }
C22B 15/0078	...	{ with ammoniacal solutions, e.g. ammonium hydroxide }
C22B 15/008	...	{ with non-acid solutions containing salts of alkali or alkaline earth metals }
C22B 15/0082	...	{ with water }
C22B 15/0084	..	{ Treating solutions ( <a href="#">with organic compounds C22B 3/0004</a> ) }
C22B 15/0086	...	{ by physical methods }
C22B 15/0089	...	{ by chemical methods }
C22B 15/0091	....	{ by cementation }
C22B 15/0093	....	{ by gases, e.g. hydrogen or hydrogen sulfide }
C22B 15/0095	.	{ Process control or regulation methods }
C22B 15/0097	..	{ Sulfur release abatement }

**C22B 17/00**      **Obtaining cadmium**

C22B 17/02 . by dry processes

C22B 17/04 . by wet processes

C22B 17/06 . Refining

## **C22B 19/00      Obtaining zinc or zinc oxide**

C22B 19/02 . Preliminary treatment of ores ; Preliminary refining of zinc oxide

C22B 19/04 . Obtaining zinc by distilling

C22B 19/06 . . in muffle furnaces

C22B 19/08 . . in blast furnaces

C22B 19/10 . . in reverberatory furnaces

C22B 19/12 . . in crucible furnaces

C22B 19/14 . . in vertical retorts

C22B 19/16 . . Distilling vessels

C22B 19/18 . . . Condensers, Receiving vessels

C22B 19/20 . Obtaining zinc otherwise than by distilling

C22B 19/22 . . with leaching with acids

C22B 19/24 . . with leaching with alkaline solutions, e.g. ammonia

C22B 19/26 . . Refining solutions { containing zinc values, e.g. } obtained by leaching zinc ores ( { treatment or purification of solutions by liquid-liquid extraction, by ion exchange or by adsorption [C22B 3/00](#) } )

C22B 19/28 . from muffle furnace residues

C22B 19/30 . from metallic residues or scraps

C22B 19/32 . Refining zinc

C22B 19/34 . Obtaining zinc oxide ( [purifying zinc oxide C01G 9/02](#) )

C22B 19/36 . . in blast or reverberatory furnaces

C22B 19/38 . . in rotary furnaces

## **C22B 21/00      Obtaining aluminium**

C22B 21/0007 . { Preliminary treatment of ores or scrap or any other metal source ( Bayer processes [C01F](#) ) }

C22B 21/0015 . { by wet processes ( [C22B 21/02](#) , [C22B 21/04](#) and [C22B 21/06](#) take precedence ) }

C22B 21/0023 . . { from waste materials }

C22B 21/003 . . . { from spent catalysts }

C22B 21/0038 . { by other processes ( electrolysis [C25C](#) ; [C22B 21/02](#) and [C22B 21/04](#) take precedence ) }

- C22B 21/0046 . . { from aluminium halides }
- C22B 21/0053 . . { from other aluminium compounds }
- C22B 21/0061 . . . { using metals, e.g. Hg or Mn }
- C22B 21/0069 . . { from scrap, skimmings or any secondary source aluminium e.g. recovery of alloy constituents ( [C22B 21/0046](#) , [C22B 21/0053](#) and [C22B 21/0092](#) take precedence ) }
- C22B 21/0076 . . . { from spent catalysts }
- C22B 21/0084 . { melting and handling molten aluminium ( [C22B 21/02](#) , [C22B 21/04](#) and [C22B 21/06](#) take precedence ) }
- C22B 21/0092 . . { Remelting scrap, skimmings or any secondary source aluminium }
- C22B 21/02 . with reducing { ( [C22B 21/04](#) takes precedence ) }
- C22B 21/04 . with alkali metals { earth alkali metals included }
- C22B 21/06 . refining { electrolytic refining [C25C](#) ; ( [C22B 21/0046](#) , [C22B 21/0061](#) take precedence ) }
- C22B 21/062 . . { using salt or fluxing agents ( [C22B 21/064](#) , [C22B 21/066](#) , and [C22B 21/068](#) take precedence ) }
- C22B 21/064 . . { using inert or reactive gases ( [C22B 21/066](#) and [C22B 21/068](#) take precedence ) }
- C22B 21/066 . . { Treatment of circulating aluminium, e.g. by filtration ( [C22B 21/068](#) takes precedence ) }
- C22B 21/068 . . { handling in vacuum }

## **C22B 23/00      Obtaining nickel or cobalt**

- C22B 23/005 . { Preliminary treatment of ores, e.g. by roasting or by the Krupp-Renn process }
- C22B 23/02 . by dry processes
- C22B 23/021 . . { by reduction in solid state, e.g. by segregation processes }
- C22B 23/023 . . { with formation of ferro-nickel or ferro-cobalt }
- C22B 23/025 . . { with formation of a matte or by matte refining or converting into nickel or cobalt, e.g. by the Oxford process ( leaching of mattes [C22B 23/04](#) ) }
- C22B 23/026 . . { from spent catalysts }
- C22B 23/028 . . { separation of nickel from cobalt }
- C22B 23/04 . by wet processes ( { recovery or separation of nickel or cobalt using organic agents [C22B 3/00](#) } )
- C22B 23/0407 . . { Leaching processes }
- C22B 23/0415 . . . { with acids or salt solutions except ammonium salts solutions }
- C22B 23/0423 . . . . { Halogenated acids or salts thereof }
- C22B 23/043 . . . . { Sulfurated acids or salts thereof }
- C22B 23/0438 . . . . { Nitric acids or salts thereof }
- C22B 23/0446 . . . { with an ammoniacal liquor or with a hydroxide of an alkali or alkaline-earth metal }
- C22B 23/0453 . . { Treatment or purification of solutions, e.g. obtained by leaching ( [C22B 23/0407](#) takes precedence ) }

- C22B 23/0461 . . . { by chemical methods }
- C22B 23/0469 . . . . { by chemical substitution, e.g. by cementation }
- C22B 23/0476 . . { Separation of nickel from cobalt }
- C22B 23/0484 . . . { in acidic type solutions }
- C22B 23/0492 . . . { in ammoniacal type solutions }

- C22B 23/06 . refining
- C22B 23/065 . . { carbonyl methods }

## **C22B 25/00      Obtaining tin**

- C22B 25/02 . by dry processes
- C22B 25/04 . by wet processes
- C22B 25/06 . from scrap, especially tin scrap ( by electrolytic procedure [C25C 1/14](#) )
- C22B 25/08 . Refining

## **C22B 26/00      Obtaining alkali, alkaline earth metals or magnesium**

- C22B 26/10 . Obtaining alkali metals
- C22B 26/12 . . Obtaining lithium
- C22B 26/20 . Obtaining alkaline earth metals or magnesium
- C22B 26/22 . . Obtaining magnesium

## **C22B 30/00      Obtaining antimony, arsenic or bismuth**

- C22B 30/02 . Obtaining antimony
- C22B 30/04 . Obtaining arsenic { ( [C22B 3/16](#) , [C22B 3/0005](#) and [C22B 3/0098](#) take precedence ) }
- C22B 30/06 . Obtaining bismuth

## **C22B 34/00      Obtaining refractory metals**

- C22B 34/10 . Obtaining titanium, zirconium or hafnium
- C22B 34/12 . . Obtaining titanium { or titanium compounds from ores or scrap by metallurgical processing; preparation of titanium compounds from other titanium compounds see [C01G 23/00](#) to [C01G 23/08](#) }
- C22B 34/1204 . . . { preliminary treatment of ores or scrap to eliminate non- titanium constituents, e.g. iron, without attacking the titanium constituent }
- C22B 34/1209 . . . . { by dry processes, e.g. with selective chlorination of iron or with formation of a titanium bearing slag }
- C22B 34/1213 . . . . { by wet processes, e.g. using leaching methods or flotation techniques }
- C22B 34/1218 . . . { obtaining titanium or titanium compounds from ores or scrap by dry processes }

- }
- C22B 34/1222 . . . . { using a halogen containing agent }
- C22B 34/1227 . . . . { using an oxygen containing agent }
- C22B 34/1231 . . . . { treatment or purification of titanium containing products obtained by dry processes, e.g. condensation }
- C22B 34/1236 . . . { obtaining titanium or titanium compounds from ores or scrap by wet processes, e.g. by leaching }
- C22B 34/124 . . . . { using acidic solutions or liquors }
- C22B 34/1245 . . . . { containing a halogen ion as active agent }
- C22B 34/125 . . . . { containing a sulfur ion as active agent }
- C22B 34/1254 . . . . { using basic solutions or liquors }
- C22B 34/1259 . . . . { treatment or purification of titanium containing solutions or liquors or slurries ( [C01G 23/001](#) takes precedence ) }
- C22B 34/1263 . . . { obtaining metallic titanium from titanium compounds, e.g. by reduction ( [C22B 34/129](#) takes precedence ) }
- C22B 34/1268 . . . . { using alkali or alkaline-earth metals or amalgams }
- C22B 34/1272 . . . . { reduction of titanium halides, e.g. Kroll process }
- C22B 34/1277 . . . . { using other metals, e.g. Al, Si, Mn }
- C22B 34/1281 . . . . { using carbon containing agents, e.g. C, CO, carbides ( [34/12H8](#) takes precedence ) }
- C22B 34/1286 . . . . { using hydrogen containing agents, e.g. H<sub>2</sub>, CaH<sub>2</sub>, hydrocarbons }
- C22B 34/129 . . . { obtaining metallic titanium from titanium compounds by dissociation, e.g. thermic dissociation of titanium tetraiodide, or by electrolysis or with the use of an electric arc }
- C22B 34/1295 . . . { Refining, melting, remelting, working up of titanium }
- C22B 34/14 . . Obtaining zirconium or hafnium { Treatment or purification of solutions by liquid-liquid extraction, by ion exchange or by adsorption [C22B 3/00](#) , [C01G 25/003](#) , [C01G 27/003](#) }
  
- C22B 34/20 . Obtaining niobium, tantalum or vanadium
- C22B 34/22 . . Obtaining vanadium
- C22B 34/225 . . . { from spent catalysts }
- C22B 34/24 . . Obtaining niobium or tantalum
  
- C22B 34/30 . Obtaining chromium, molybdenum or tungsten
- C22B 34/32 . . Obtaining chromium
- C22B 34/325 . . . { from spent catalysts }
- C22B 34/34 . . Obtaining molybdenum { ( [C22B 3/0005](#) , [C22B 3/0098](#) and [C01G 39/003](#) take precedence; from catalyst or superalloy scrap : see also [C22B 7/00](#) ) }
- C22B 34/345 . . . { from spent catalysts }
- C22B 34/36 . . Obtaining tungsten
- C22B 34/365 . . . { from spent catalysts }
  
- C22B 35/00** **Obtaining beryllium**
  
- C22B 41/00** **Obtaining germanium { ( [C22B 3/0005](#) and [C22B 3/0098](#) takes precedence ) }**

**C22B 43/00**      **Obtaining mercury****C22B 47/00**      **Obtaining manganese**

- C22B 47/0009 . { from spent catalysts }
- C22B 47/0018 . { Treating ocean floor nodules }
- C22B 47/0027 .. { Preliminary treatment }
- C22B 47/0036 .. { by dry processes, e.g. smelting }
- C22B 47/0045 .. { by wet processes }
- C22B 47/0054 ... { leaching processes }
- C22B 47/0063 .... { with acids or salt solutions ( [C22B 47/0072](#) takes precedence ) }
- C22B 47/0072 .... { with an ammoniacal liquor or with a hydroxide of an alkali or alkaline-earth metal }
- C22B 47/0081 ... { Treatment or purification of solutions, e.g. obtained by leaching ( [C22B 47/0054](#) takes precedence ) }
- C22B 47/009 .. { refining, e.g. separation of metals obtained by the above methods }

**C22B 58/00**      **Obtaining gallium or indium { ( treatment or purification of solutions by liquid-liquid extraction, by ion exchange or by adsorption [C22B 3/0004](#) ) }****C22B 59/00**      **Obtaining rare earth metals****C22B 60/00**      **Obtaining metals of atomic number 87 or higher, i.e. radioactive metals**

- C22B 60/02 . Obtaining thorium, uranium, or other actinides
- C22B 60/0204 .. { obtaining uranium }
- C22B 60/0208 ... { preliminary treatment of ores or scrap }
- C22B 60/0213 ... { by dry processes }
- C22B 60/0217 ... { by wet processes }
- C22B 60/0221 .... { by leaching }
- C22B 60/0226 ..... { using acidic solutions or liquors }
- C22B 60/023 ..... { halogenated ion as active agent }
- C22B 60/0234 ..... { sulfured ion as active agent }
- C22B 60/0239 ..... { nitric acid containing ion as active agent }
- C22B 60/0243 ..... { phosphorated ion as active agent }
- C22B 60/0247 ..... { using basic solutions or liquors }
- C22B 60/0252 .... { treatment or purification of solutions or of liquors or of slurries ( [C22B 60/0221](#) takes precedence ) }
- C22B 60/0256 ..... { using biological agents, e.g. micro organisms or algae }
- C22B 60/026 ..... { liquid-liquid extraction with or without dissolution in organic solvents }
- C22B 60/0265 ..... { extraction by solid resins }

C22B 60/0269	.....	{ Extraction by activated carbon containing adsorbents }
C22B 60/0273	.....	{ Extraction by titanium containing adsorbents, e.g. by hydrous titanium oxide ( <a href="#">C22B 60/0269</a> takes precedence ) }
C22B 60/0278	.....	{ by chemical methods ( <a href="#">C22B 60/0256</a> , <a href="#">C22B 60/026</a> , or <a href="#">C22B 60/0265</a> take precedence ) }
C22B 60/0282	.....	{ Solutions containing P ions, e.g. treatment of solutions resulting from the leaching of phosphate ores or recovery of uranium from wet-process phosphoric acid }
C22B 60/0286	...	{ refining, melting, remelting, working up uranium }
C22B 60/0291	..	{ obtaining thorium }
C22B 60/0295	..	{ obtaining other actinides except plutonium }
C22B 60/04	..	Obtaining plutonium
<b>C22B 61/00</b>		<b>Obtaining metals not elsewhere provided for in this subclass ( <a href="#">iron C21</a> )</b>