

40 Non-ferrous metallurgy, metal alloys, electrometallurgy, refinement of metals and metal alloys

40a Metallurgy

40a (IPC: C22B) Production and refining of metals; Pretreatment of raw materials; Treatment of slags

40b Alloys

40b (IPC: C22C) Non-ferrous alloys; Ferrous alloys; treatment thereof

40c Metal extraction by electrolytic or electrothermic methods, including powdered metals

40c (IPC: C22D) Electrolytic and electrothermic production and refining of metals

40d Refining nonferrous metals and alloys

40d (IPC: C22F) Changing the physical structure of non-ferrous metals and non-ferrous alloys

40a Metallurgy

Preparation and roasting of ores, production of metallic compounds as intermediate products for metal extraction

40a-1/01 Disintegration of ores and smelting products, e.g. by quenching, steam treatment (1a-33; 1a-34; 1c-9)

40a-1/20 Briquetting and forming of lumps, granulation of ores (10a-18; 10b; 18a-2; 80a-25; granulation also 80c, 80b)

40a-2/01 Roasting processes, in general (1a-33; 1b-2; 12g-1; 12i; 18a-1; 80c)

40a-2/10 Cooling roasted ores (18a-1; 80c)

40a-2/20 Blast roasting

40a-2/30 Agglomeration processes (18a-1; 80b)

40a-2/40 Calcination (18a; 80c)

40a-2/50 Sulphatising roasting and sulphatising of ores by dry methods (12i; 12m; 12n)

40a-2/60 Chloridising roasting and chlorination (12i; 12m; 12n)

40a-2/80 Production of metallic compounds other than oxides, sulphates, chlorides as intermediate products for metal extraction, e.g. sulphuration of metals

Furnaces for roasting, sintering and agglomerating ores

40a-3/01 Roasting shaft furnaces

40a-3/50 Sintering ladles and pots

40a-3/60 Sintering [agglomeration] apparatus with movable blasting grates, e.g. Dwight-Lloyd apparatus

40a-4/01 Roasting furnaces with stationary hearths without mechanical stirring or conveying devices, e.g. continuous furnaces

40a-4/10 Mechanical roasting furnaces with rectangular hearths

40a-4/20 Single-deck mechanical roasting furnaces with round or ring-shaped hearths

40a-4/30 Multi-deck mechanical roasting furnaces with round or ring-shaped hearths

40a-4/40 Roasting furnaces of special structure

40a-4/50 Shafts and levers for mechanical roasting furnaces

40a-4/51 Stirring teeth for mechanical roasting furnaces

40a-4/52 Drives for mechanical roasting furnace stirrers

40a-4/53 Cooling apparatus for mechanical roasting furnace stirrers

- 40a-4/54 Devices for the prevention of dust losses and the formation of bears [accretions] in roasting furnaces with mechanical stirring
- 40a-5/01 Rotary cylindrical furnaces (10a-26; 80c-14; 82a-19)
- 40a-5/50 Rotary cylindrical furnace elements, e.g. driving devices
- 40a-6/01 Furnaces with movable hearths, e.g. tunnel furnaces
- 40a-6/50 Charging and discharging devices for roasting furnaces

Reducing and refining furnaces for metallurgy

- 40a-7/01 Smelting shaft furnaces (18a-4; 31a-1)
- 40a-7/10 Shaft furnaces for reducing ores without smelting the charge (40a-3/01)
- 40a-8/01 Reverberatory furnaces (heating 24a-14; 24c-9)
- 40a-8/40 Cylinder reverberatory furnaces and tilting furnaces
- 40a-9/01 Crucible furnaces and crucibles (heating 24c)
- 40a-9/20 Testing [assay] furnaces
- 40a-10/01 Charging and discharging devices for metallurgical furnaces, in general, except roasting furnaces and retorts (18a-6; 18b-15)
- 40a-10/10 Charging and discharging devices for retorts
- 40a-10/30 Furnace parts in general, e.g. roofs, bottoms, walls, doors, tuyeres
- 40a-10/50 Furnace tools
- 40a-10/60 Metallurgical furnace taps

Reduction processes

- 40a-11/01 Reducing with aluminium or other metals and silicon as reducing agents
- 40a-11/15 Reducing with carbides and the like materials
- 40a-11/30 Reducing with sulfides, roasting reaction method
- 40a-11/40 Reducing with solid carbonaceous reducing agents (18a)
- 40a-11/50 Reducing with gases and liquids, e.g. hydrocarbons
- 40a-11/60 Precipitation methods
- 40a-11/70 Reducing methods not related to a specific reducing agent (18a, 18)
- 40a-12/01 Extraction of metals by sublimation, general
- 40a-12/70 Step-by-step extraction of metals from mixed ores by dry methods

Metal extraction by wet processes

- 40a-13/01 Methods for the extraction of metals by wet processes, in general
- 40a-13/50 Processing of mixed ores by wet methods
- 40a-14 Apparatus and devices for metal extraction by wet processes (12c-1; 12g-2)

Refining processes

- 40a-15/01 Refining processes, in general
- 40a-15/10 Metal fluxing and purifying agents
- 40a-15/20 Purification and separation of metals by liquation, also filtering and centrifuging
- 40a-15/30 Purification and separation of metals by vacuum treatment
- 40a-15/50 Purification of metals by poling
- 40a-15/60 Melting processes for metals and metal scrap

Processing of slag and furnace dust

- 40a-16 Metallurgical slag processing methods
- 40a-17 Collection and utilisation of furnace dust in order to extract the metals contained therein (10a-19; 12e-2; 18a-18; 24g-6; 26d-1; 26d-5)

Special metal extraction methods

- 40a-18/01 Lead extraction by dry methods
- 40a-18/50 Lead extraction by wet methods
- 40a-19/01 Refining lead, in general (40a-20)
- 40a-19/30 Separation of metals from lead, by precipitation reactions in the melt, e.g. by the Parkes process

40a-19/50	Separation of metals from lead by means of fractional crystallisation, e.g. by the Pattinson process
40a-20/01	Silver extraction by dry methods
40a-20/50	Extraction of the other precious metals by dry methods
40a-21/01	Extraction of precious metals by amalgamation
40a-21/50	Amalgamation devices
40a-22	Extraction of precious metals by wet methods, except cyaniding and chlorination
40a-23	Extraction of precious metals by cyaniding
40a-24	Extraction of precious metals by chlorination
40a-25	Precipitation of precious metals from solutions, in general, e.g. extraction of gold from sea water
40a-26	Copper extraction, in general (roasting 40a-2)
40a-27	Copper extraction by smelting in shaft furnaces
40a-28	Copper extraction by smelting in reverberatory furnaces
40a-29	Copper extraction by smelting in converters
40a-30	Refining copper
40a-31/01	Extraction of copper by wet processes by leaching with acids and salt solutions (40c-9)
40a-31/30	Extraction of copper by leaching with ammonia or ammonium salt solutions
40a-31/60	Precipitation of copper from solutions
40a-33/01	Extraction of cadmium by dry methods
40a-33/30	Extraction of cadmium by wet methods
40a-33/80	Refining cadmium
40a-34/01	Preliminary treatment of zinc ores (roasting 40a-2)
40a-34/10	Extraction of zinc by distillation, in general (40c-13; 40c-16)
40a-34/30	Extraction of zinc, except by distillation
40a-34/50	Processing of retort residues
40a-34/60	Processing of non-metallic zinc-containing residues, except muffle residues
40a-34/70	Extraction of zinc from metallic residues, e.g. from alloys, zinc-coated plates, zinc dust
40a-34/80	Refining zinc
40a-35	Zinc distillation vessels
40a-36	Condensers for zinc distillation vessels (10a-1; 10a-9; 26a-16)
40a-37	Retort furnaces for zinc distillation (heating 24c)
40a-39/01	Zinc extraction in shaft furnaces
40a-39/50	Zinc extraction in reverberatory furnaces
40a-40/01	Zinc extraction in crucible furnaces
40a-40/50	Zinc extraction in vertical retorts
40a-41/01	Extraction of zinc oxide as metallurgical product in shaft or reverberatory furnaces, and general processes (12n; 22f-4)
40a-41/50	Extraction of zinc oxide as metallurgical product in rotary furnaces
40a-41/80	Purification and preparation of zinc oxide for smelting
40a-42/01	Zinc extraction by wet methods by leaching with acids (40c-11)
40a-42/30	Zinc extraction by wet methods by leaching with ammonia
40a-42/50	Purification of zinc solutions
40a-42/80	Precipitation of zinc from solutions
40a-43/01	Extraction of nickel and cobalt by dry methods
40a-43/30	Extraction of nickel and cobalt by wet methods (40c-8; 12n-4)
40a-43/70	Refining nickel and cobalt
40a-44/01	Extraction of tin by dry methods
40a-44/30	Extraction of tin by wet methods
40a-44/60	Extraction of tin from scrap, in particular from tin plate scrap (40c-10)
40a-44/80	Refining tin

40a-45/01	Extraction and refining of antimony (12i-32; 12n-8)
40a-45/20	Extraction and refining of arsenic
40a-45/40	Extraction and refining of bismuth
40a-45/60	Extraction and refining of mercury
40a-46/01	Extraction and refining of chromium (12n-3; 12n-10; 12m-8; 12i-32)
40a-46/10	Extraction and refining of manganese (12n-3; 12n-10; 12m-8; 12i-32)
40a-46/20	Extraction and refining of tungsten (12n-3; 12n-10; 12m-8; 12i-32)
40a-46/30	Extraction and refining of molybdenum (12n-3; 12n-10; 12m-8; 12i-32)
40a-46/40	Extraction and refining of vanadium (12n-3; 12n-10; 12m-8; 12i-32)
40a-46/50	Extraction and refining of heavy metals which have not been mentioned previously, e.g. germanium, titanium, tantalum, rhenium (12n-3; 12n-10; 12m-8; 12i-32)
40a-47/01	Extraction and refining of alkali metals
40a-47/20	Extraction and refining of alkaline earth metals
40a-48/01	Extraction and refining of magnesium
40a-48/20	Extraction and refining of beryllium
40a-49	Extraction of aluminium with alkali metals as reducing agents
40a-50/01	Extraction of aluminium with reducing agents other than alkali metals
40a-50/20	Refining aluminium
40a-51	Extraction and refining of the rare earth metals (12i-39; 12m-9; 21g-21/01)

40a Production and refining of metals (electrothermic 40c); 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. Thus, for example, group 40a-11/00 covers the production of silver by reduction of ammoniacal silver oxide in solution, and group 40a-17/00 includes the production of cadmium oxide by a metallurgical process. Furthermore, although compounds of arsenic and antimony are classified in 12i, production of the elements themselves is included in 40a, as well as the production of their compounds by metallurgical processes.

40a-1/00	Preliminary treatment of ores in general
40a-1/02	. Roasting processes (40a-1/16 takes precedence)
40a-1/04	. . Blast roasting
40a-1/06	. . Sulphating roasting
40a-1/08	. . Chloridising roasting
40a-1/10	. . in fluidised form
40a-1/12	. Forming intermediary products, other than oxides, sulphates, chlorides, otherwise than by roasting
40a-1/14	. Agglomerating; Briquetting; Binding; Granulating
40a-1/16	. . Sintering; Agglomerating
40a-1/18	. . . in sinter pots
40a-1/20	. . . in sintering machines with movable grates
40a-1/22	. . . in other sintering apparatus
40a-1/24	. . Binding; Briquetting
40a-1/26	. Cooling of roasted, sintered, or agglomerated ores
40a-3/00	Extraction of metal compounds from ores by wet methods
40a-3/02	. Apparatus therefor
40a-5/00	General methods of reducing to metals
40a-5/02	. Dry methods
40a-5/04	. . by aluminium, other metals, or silicon
40a-5/06	. . by carbides or the like
40a-5/08	. . by sulphides; Roasting reaction methods

40a-5/10	. . by solid carbonaceous reducing agents
40a-5/12	. . by gases
40a-5/14	. . . fluidised material
40a-5/16	. . with volatilisation or condensation of the metal being produced
40a-5/18	. . Reducing step-by-step
40a-5/20	. . from metal carbonyls
40a-7/00	Working-up raw materials other than ores, e.g. scrap, to produce non-ferrous metals or compounds thereof
40a-7/02	. Working-up flue dust
40a-7/04	. Working-up slag
40a-9/00	General methods of refining metals
40a-9/02	. by liquating, filtering, centrifuging, distilling, supersonic wave action, or other non-chemical methods
40a-9/04	. . by applying a vacuum
40a-9/06	. by poling
40a-9/08	. by chemical means
40a-9/10	. . with fluxing and refining agents
40a-9/12	. . Refining molten metals
40a-9/14	. in the solid state
40a-11/00	Obtaining noble metals
40a-11/02	. by dry processes
40a-11/04	. by wet processes
40a-11/06	. chloridising
40a-11/08	. by cyaniding
40a-11/10	. by amalgamating
40a-11/12	. . Apparatus therefor
40a-13/00	Obtaining lead
40a-13/02	. by dry processes
40a-13/04	. by wet processes
40a-13/06	. Refining
40a-13/08	. . Separating metals from lead by precipitating, e.g. by Parkes process
40a-13/10	. . Separating metals from lead by crystallising, e.g. by Pattison process
40a-15/00	Obtaining copper
40a-15/02	. in blast furnaces
40a-15/04	. in reverberatory furnaces
40a-15/06	. in converters
40a-15/08	. with leaching with acids and salt solutions
40a-15/10	. with leaching with ammonia or ammonia-salt solutions
40a-15/12	. by precipitating from solutions
40a-15/14	. Refining
40a-17/00	Obtaining cadmium
40a-17/02	. by dry process
40a-17/04	. by wet process
40a-17/06	. Refining
40a-19/00	Obtaining zinc or zinc oxide
40a-19/02	. Preliminary treatment of ores; Preliminary refining of zinc oxide
40a-19/04	. Obtaining zinc by distilling
40a-19/06	. . in muffle furnaces
40a-19/08	. . in blast furnaces
40a-19/10	. . in reverberatory furnaces
40a-19/12	. . in crucible furnaces
40a-19/14	. . in vertical retorts
40a-19/16	. . Distilling vessels
40a-19/18	. . . Condensers; Receiving vessels
40a-19/20	. Obtaining zinc otherwise than by distilling
40a-19/22	. . with leaching with acids

40a-19/24	. . with leaching with alkaline solutions, e.g. ammonia
40a-19/26	. . Refining solutions obtained by leaching zinc ores
40a-19/28	. from muffle furnace residues
40a-19/30	. from metallic residues or scraps
40a-19/32	. Refining zinc
40a-19/34	. Obtaining zinc oxide (purifying zinc oxide 12n)
40a-19/36	. . in blast or reverberatory furnaces
40a-19/38	. . in rotary furnaces
40a-21/00	Obtaining aluminium
40a-21/02	. with reducing
40a-21/04	. with alkali metals
40a-21/06	. Refining
40a-23/00	Obtaining nickel or cobalt
40a-23/02	. by dry processes
40a-23/04	. by wet processes
40a-23/06	. Refining
40a-25/00	Obtaining tin
40a-25/02	. by dry processes
40a-25/04	. by wet processes
40a-25/06	. from scrap, especially tin scrap (detinning electrolytically 40c-1/20)
40a-25/08	. Refining
40a-27/00	Alkali metals
40a-29/00	Alkaline-earth metals
40a-31/00	Antimony
40a-33/00	Arsenic
40a-35/00	Beryllium
40a-37/00	Bismuth
40a-39/00	Chromium
40a-41/00	Germanium
40a-43/00	Mercury
40a-45/00	Magnesium
40a-47/00	Manganese
40a-49/00	Molybdenum
40a-51/00	Columbium and/or tantalum
40a-53/00	Titanium
40a-55/00	Vanadium
40a-57/00	Tungsten
40a-59/00	Metals of the rare earths
40a-61/00	Other metals not mentioned before in subclass 40a (iron 18)
40a-61/02	. Zirconium; Hafnium
40a-61/04	. Thorium, uranium, plutonium, and other actinides
40a-61/06	. Gallium; Indium
40b	Alloys (ferrous alloys 18b-20; 18d; electrolytic and electrothermal production of alloys 40c-14, 40c-15, 40c-16/04)
40b-1	Production of alloys by melting
40b-2	Production of alloys by methods other than melting, e.g. by pressing or sintering

40b-3/10	Deoxidisation agents and production of deoxidisation agents
40b-3/20	Non-metallic inclusions
40b-3/30	Porous alloys
40b-3/40	Separation of alloys

Alloy compositions and use of alloys for general technological purposes
(use of alloys for special technological purposes in the appropriate special classes)

Alloys

40b-4	with high precious metal content
40b-5	with predominant mercury content, amalgams (amalgams for dental purposes 30h-12/01)
40b-6	with predominant copper content, in general, without nickel and lead
40b-7	with predominant copper content and addition of lead
40b-8	with predominant copper content and addition of nickel, without lead
40b-9	with predominant copper content and addition of silicon
40b-10	with predominant lead content, in general, without alkali and alkaline earth metals
40b-11	with predominant lead content and addition of alkali and alkaline earth metals
40b-12	with predominant tin content
40b-13	with predominant zinc content
40b-14	with predominant nickel and/or cobalt content, except hard alloys
40b-15	with high content of high-melting metals, except hard [carbide-type] alloys
40b-16	Hard alloys with predominant nickel and/or cobalt content
40b-17	Hard alloys in general
40b-18	Alloys with predominant aluminium content, in general
40b-19	Alloys with predominant aluminium content and addition of silicon
40b-20	Light metal alloys, except those in 40b-18, 40b-19, especially with predominant magnesium content
40b-21	Alloys in general, except those in 40b-4 – 40b-20

40b Non-ferrous alloys; Ferrous alloys

Note:

This subclass covers not only the composition of alloys, but also their use because of their properties. In some cases special groups are provided to cover such uses. In other cases the groups for compositions of alloys cover also the use

Non-ferrous alloys, i.e. alloys based essentially on metals other than iron (master alloys for iron and steel 40b-35/00)

40b-1/00	Making alloys (by electrolysis or electrothermic methods 40c)
40b-1/02	. by melting
40b-1/04	. by pressing or sintering (40b-1/08 takes precedence; working metallic powder 49I)
40b-1/05	. . Mixtures of metal powder with non-metallic powder (40b-1/08 take precedence)
40b-1/06	. with the use of special agents for refining or deoxidising
40b-1/08	. Alloys with open or closed pores
40b-1/10	. Alloys containing non-metals (40b-1/08 takes precedence)
40b-3/00	Removing material from alloys to produce alloys of different constitution
40b-5/00	Alloys with noble metals as the most important constituent
40b-7/00	Alloys based on mercury, i.e. amalgams
40b-9/00	Alloys based on copper
40b-9/02	. with tin as a principal alloying element (40b-9/06, 40b-9/08, 40b-9/10 take precedence)

- 40b-9/04 . with zinc as a principal alloying element (40b-9/06, 40b-9/08, 40b-9/10 take precedence)
- 40b-9/06 . with nickel or cobalt as a principal alloying element (40b-9/08, 40b-9/10 take precedence)
- 40b-9/08 . with lead as a principal alloying element (40b-9/10 take precedence)
- 40b-9/10 . with silicon as a principal alloying element
- 40b-11/00 Alloys based on lead**
- 40b-11/02 . with alkali or alkaline earth metals
- 40b-13/00 Alloys based on tin**
- 40b-15/00 Alloys based on titanium or zirconium**
- 40b-17/00 Alloys based on zinc or cadmium**
- 40b-19/00 Alloys based on nickel or cobalt**
- 40b-19/02 . Hard alloys; Stellites
- 40b-19/04 . with high creep-resistance
- 40b-21/00 Alloys based on aluminium**
- 40b-21/02 . with silicon
- 40b-21/04 . . Modified aluminium-silicon alloys
- 40b-23/00 Alloys based on magnesium**
- 40b-25/00 Alloys based on beryllium**
- 40b-27/00 Alloys based on high-melting or refractory metals not previously mentioned in subclass 40b** (40b-29/00 takes precedence)
- 40b-29/00 Hard alloys based on carbides, nitrides, borides or silicides**
- 40b-31/00 Non-ferrous alloys not mentioned before in subclass 40b**
- 40b-31/02 . containing small quantities of radioactive materials
- 40b-31/04 . containing less than 50% of non-metallic refractory materials (40b-29/00 takes precedence; refractories containing 50% or more of non-metallic materials 80b)

Ferrous alloys

- 40b-33/00 General methods for making ferrous alloys**
- 40b-33/02 . by pressing or sintering
- 40b-35/00 Master alloys used for iron and steel**
- 40b-37/00 Cast-iron alloys; Treatments thereof**
- 40b-37/02 . for making malleable castings
- 40b-37/04 . for making castings containing spheroidal graphite
- 40b-37/06 . containing chromium as an essential alloying element (40b-37/02, 40b-37/04 take precedence)
- 40b-37/08 . . containing chromium and nickel
- 40b-37/10 . containing aluminium or substantial amounts of silicon as essential alloying elements
- 40b-39/00 Steel alloys; Other ferrous alloys; Treatments thereof**
- 40b-39/02 . containing aluminium as an essential alloying elements
- 40b-39/04 . . containing aluminium and silicon as an essential alloying elements
- 40b-39/06 . . . Uses requiring resistance to heat, scaling, or corrosion
- 40b-39/08 . containing cobalt as an essential alloying element
- 40b-39/10 . . containing cobalt and nickel
- 40b-39/12 . . . Uses requiring special magnetic properties
- 40b-39/14 . containing chromium as an essential alloying element (40b-39/20, 40b-39/26 take precedence)
- 40b-39/16 . . containing 12% or more of chromium
- 40b-39/18 . . . Uses requiring resistance to scaling or corrosion

40b-39/20	. containing chromium and nickel as essential alloying elements (40b-39/26 takes precedence)
40b-39/22	. . Uses requiring resistance to scaling or corrosion
40b-39/24	. . Uses requiring special electric or magnetic properties
40b-39/26	. containing chromium and manganese as essential alloying elements
40b-39/28	. . Uses requiring resistance to abrasion
40b-39/30	. containing manganese as essential alloying element (40b-39/26 takes precedence)
40b-39/32	. . containing 10% or more of manganese
40b-39/34	. . . Uses requiring resistance to abrasion
40b-39/36	. containing nickel as essential alloying element (40b-39/10 and 40b-39/20 take precedence)
40b-39/38	. . Uses requiring special electric or magnetic properties
40b-39/40	. . containing 10% or more of nickel
40b-39/42	. . . Uses requiring resistance to corrosion
40b-39/44	. containing silicon as an essential alloying element (40b-39/04 takes precedence)
40b-39/46	. . Uses requiring special electric or magnetic properties
40b-39/48	. . Uses requiring resistance to scaling or corrosion
40b-39/50	. containing tungsten, molybdenum, or vanadium as essential alloying element(s)
40b-39/52	. . adapted for high speed tools
40b-39/54	. containing other elements as essential alloying element(s)
40b-41/00	Heat treatment of ferrous alloys
40b-41/02	. Hardening by precipitation
40b-41/04	. Hardening by cooling below 0 °C

40c Metal extraction by electrolytic or electro-thermal methods, including powdered metals (electro-deposition 48a)

Electrolytic processes and apparatus, in general

40c-1	Preparation of metals by cold flow electrolysis, in general
40c-2	Preparation of metals by electrolysis in fused bath, in general
40c-3	Structure of electrolytic cells and accessories, such as electrodes, diaphragms, etc., for the extraction of metals by cold flow electrolysis (electrodes and diaphragms for general electrolytic purposes 12h-2, 12h-3; for battery elements 21b-2, 21b-7; for electro-deposition 48a-15/01)
40c-4	Design of the electrolytic cells and accessories, such as electrodes, diaphragms, etc., for the extraction of metals by fused bath electrolysis (electrodes and diaphragms for general electrolytic purposes 12h-2, 12h-3; for battery elements 21b-2, 21b-7; for electro-deposition 48a-15/01)

Electrolytic production of light metals and earth metals: alkali, alkaline earth, and all earth metals, in particular the metals sodium, potassium, magnesium, barium, strontium, calcium, aluminium, and rare earth metals, e.g. thorium, vanadium, zirconium, cerium, didymium (electroplating 48a-5, 48a-6)

40c-5	Electrolytic production of light metals and earth metals in cold baths
	Processes and devices for the electrolytic production of light metals and earth metals in fused baths
40c-6/01	Alkali metals and alkaline earth metals
40c-6/02	Magnesium
40c-6/03	Beryllium
40c-6/04	Aluminium
40c-6/05	Other earth metals
40c-6/10	Light metals and alkaline earth metals, in general

Electrolytic production of heavy metals (electroplating 48a-5, 48a-6)

40c-7	Electrolytic production of precious metals: gold, silver, platinum metals by cold bath methods
40c-8	Electrolytic production of nickel and cobalt by cold bath methods

- 40c-9 Electrolytic production of copper by cold bath methods
- 40c-10 Electrolytic production of tin by cold bath methods, also de-tinning tin scrap (chemical de-tinning 40a-44/60)
- 40c-11 Electrolytic production of zinc and cadmium by cold bath methods
- 40c-12 Electrolytic production of the remaining heavy metals, e.g. iron, lead, chromium, manganese, by cold bath methods
- 40c-13 Electrolytic production of heavy metals, e.g. iron, zinc, lead, chromium, manganese in fused baths

Electrolytic production of alloys

- 40c-14 Electrolytic production of alloys, e.g. copper, zinc, or tin alloys, by cold bath methods
- 40c-15 Electrolytic production of alloys, e.g. sodium, aluminium, lead, tin, or zinc alloys, infused baths

Electrothermal treatment of ores and metallurgical products for the purpose of metal production (iron 18a; 18b; design of electric furnaces for melting metals 31a; provided that said treatment is determined by the electric processes in the furnace 21h)

- 40c-16/01 Processes and devices for operating electric furnaces for metal production
- 40c-16/02 Production of aluminium and other light metals and earth metals
- 40c-16/03 Production of zinc and other heavy metals
- 40c-16/04 Production of alloys

40c Electrolytic and electrothermic production and refining of metals

40c-1/00 Obtaining metals or alloys by electrolysis of solutions (depositing metals by galvanisation 48a)

- 40c-1/02 . Apparatus (electrodes or diaphragms for general electrolytic purposes 12h; electrodes for batteries 21b; for galvanisation 48a)
- 40c-1/04 . . with a mercury cathode
- 40c-1/06 . alkali metals, alkaline-earth metals, beryllium, aluminium, or magnesium
- 40c-1/08 . . Apparatus therefor
- 40c-1/10 . heavy metals,
- 40c-1/12 . . gold; silver; platinum metals
- 40c-1/14 . . nickel, cobalt
- 40c-1/16 . . copper
- 40c-1/18 . . tin
- 40c-1/20 . . . De-tinning (chemical de-tinning 40a-25/06)
- 40c-1/22 . . zinc; cadmium
- 40c-1/24 . . iron, lead, chromium, manganese, or other heavy metals
- 40c-1/26 . alloys

40c-3/00 Obtaining metals or alloys by electrolysis in fused electrolytes

- 40c-3/02 . Apparatus
- 40c-3/04 . light metals
- 40c-3/06 . . alkali or alkaline-earth metals
- 40c-3/08 . . magnesium
- 40c-3/10 . . beryllium
- 40c-3/12 . . aluminium
- 40c-3/14 . heavy metals
- 40c-3/16 . . lead
- 40c-3/18 . . manganese
- 40c-3/20 . alloys

40c-5/00 Obtaining metal powders or porous metal masses by electrolysis

40c-7/00 Electrothermal treatment of ores or metallurgical products for obtaining metals or alloys (obtaining iron and steel 18a, 18b)

- 40c-7/02 . light metals
- 40c-7/04 . heavy metals
- 40c-7/06 . alloys

40c-7/08 . Apparatus (electric heating elements 21h-14)

40d Refining nonferrous metals and alloys (iron and iron alloys 18c)

Refining processes, in general

- 40d-1/01 Heat treatment methods (bright annealing methods 40d-2)
- 40d-1/20 Refining by mechanical treatment only, or combined with a heat treatment
- 40d-1//30 Production of specific crystal structures, e.g. single crystals

Refining processes for specific metals and alloys

- 40d-1/50 Heat treatment of aluminium and aluminium alloys
- 40d-1/55 Heat treatment of magnesium and magnesium alloys
- 40d-1/60 Heat treatment of copper and copper alloys
- 40d-1/65 Heat treatment of nickel and nickel alloys
- 40d-1/70 Heat treatment of lead and lead alloys
- 40d-1/75 Heat treatment of precious metals and alloys of precious metals
- 40d-1/90 Heat treatment of tungsten, molybdenum, manganese, and other high-melting metals and their alloys
- 40d-1/95 Heat treatment of metals and alloys not specifically mentioned

Heat treatment apparatus

- 40d-2/10 Furnaces for the heat treatment of metals and alloys, with the exception of bright annealing furnaces
- 40d-2/20 Heating baths, e.g. salt baths
- 40d-2/30 Bright annealing furnaces
- 40d-2/31 Bright annealing agents, protection by means of solid, liquid and gaseous agents
- 40d-2/40 Auxiliary tools for heat treatment

40d Changing the physical structure of non-ferrous metals and non-ferrous alloys

40d-1/00 Changing the physical structure of non-ferrous metals or alloys by heat treatment or by hot or cold working

- 40d-1/02 . in inert or controlled atmosphere or vacuum (adjusting the composition of the atmosphere 18c-1/76)
- 40d-1/04 . of aluminium or alloys based thereon
- 40d-1/06 . of magnesium or alloys based thereon
- 40d-1/08 . of copper or alloys based thereon
- 40d-1/10 . of nickel or cobalt or alloys based thereon
- 40d-1/11 . of chromium or alloys based thereon
- 40d-1/12 . of lead or alloys based thereon
- 40d-1/14 . of noble metals or alloys based thereon
- 40d-1/16 . of other metals or alloys based thereon
- 40d-1/18 . . high-melting or refractory metals or alloys based thereon

40d-3/00 Changing the physical structure of non-ferrous metals or alloys by special physical methods, e.g. treatment with neutrons

- 40d-3/02 . by solidifying a melt controlled by supersonic waves or electric or magnetic fields

40d-5/00 Modification of the crystal structure of non-ferrous metals or alloys by particular physical processes, e.g. by treatment with neutrons

- 40d-5/02 . by unidirectional crystallisation of a melt by means of ultrasound or by means of electric or magnetic fields