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(71) Applicant: **Umicore**
1000 Brussels (BE)

(72) Inventor: **Kuster, Ulrich**
2250 Olen (BE)

(54) Metal element for use in a metal basket serving as an anode

(57) Metal element for use in a metal basket serving as an anode in a device for electroplating, which metal element comprises a casting which is substantially in the shape of a cuboid with edge lengths of between 8 mm and 20 mm.

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Description

[0001] The invention relates to a metal element, in particular a metal element for use in a metal basket serving as an anode in an electroplating device.

[0002] Electroplating devices in which the anode comprises a metal basket into which metal elements made from a metal which is to be applied to an object to be electroplated are introduced are known. This object which is to be electroplated is electrically conductively connected to the cathode.

[0003] The metal basket of the anode usually consists of iron (steel) or of a precious or noble metal, for example platinum or titanium.

[0004] This "metal basket anode" and the cathode (with the object which is to be electroplated connected to it) are immersed in a bath comprising an electrolyte.

[0005] Corresponding electroplating devices are known in particular for the galvanization of steel. In this case, the metal elements therefore consist of zinc. Alkaline electrolytes, for example sodium hydroxide solution, in which the zinc dissolves, are used as electrolyte.

[0006] To counteract the chemical dissolution of the metal basket anodes, which occurs in particular in strong alkaline solutions in which the zinc dissolves rapidly, what are known as "zinc generators" are used: the principle of these zinc generators consists in the metal basket anodes not being suspended in the electrolyte directly in the electroplating vessel, but rather in a special vessel, where they are both chemically and electrolytically dissolved. Electroplating vessel and zinc generator are connected to one another in a bypass, and a control unit - which is set or controlled on the basis of measurements - ensures that the zinc concentration in the galvanizing part (the electroplating vessel) is kept within the desired limits.

[0007] Corresponding electroplating installations are also known in which the object which is to be electroplated (for example a wire) is moved continuously through the electroplating vessel. These installations are also known as continuous installations.

[0008] Metal elements which are soluble in the electrolyte are introduced into the metal basket. The metal of the metal elements which is dissolved in the electrolyte migrates through the electrolyte, in the form of ions, to the object which is to be electroplated.

[0009] The advantage of a metal basket anode of this type with metal elements located therein over "solid" anodes (for example a rod or a plate) is in particular that the metal basket anode can be continuously provided with the metal elements which are to dissolve in the electrolyte and therefore overall the device can be operated continuously. By contrast, a "solid" anode which consists of the metal which is to be dissolved in the electrolyte has completely dissolved after a certain time and has to be replaced; this operation of replacing the solid metal anode involves an interruption to the electroplating.

[0010] By way of example, elements in the form of billets, rods, pellets, plates, balls or half-balls are known as metal elements for use in a metal basket anode.

[0011] By way of example, it is also known to divide a metal wire into small pieces and for these pieces to be used as metal elements for the metal basket anode.

[0012] These metal elements which are cut from a metal wire have an irregular geometric shape, since the metal elements are not separated from the wire along a "clean" cut edge, but rather the metal elements are "pinched" off the wire. A "burr", which generally tapers to a point and the position of which on the metal element cannot be accurately defined, is formed along this "pinched edge". The overall result is the formation of an irregular polygon with dimensions, which cannot be defined from the outset.

[0013] However, for the following reason it is desirable for the metal elements which are used in a metal basket anode to have defined geometric dimensions: the quantity of metal ions which is dissolved from the metal elements per unit time can be set as a function firstly of the size of the surface area with which the metal elements located in the metal basket anode are in contact with the electrolyte with respect to the volume of these metal elements ("specific surface area" of the metal elements) and secondly of the quantity of electrolyte which can flow through between the metal elements per unit time.

[0014] To enable the necessary "packing density" of the metal elements which is required in order to control the quantity of metal ions to be dissolved to be set, these elements have to be of a defined geometric shape.

[0015] Furthermore, the metal elements must not lie too close together, i.e. the spaces between adjacent metal elements must not be too small, since in this case it is virtually impossible for any further electrolyte to flow through between the metal elements. This may be the case in particular if the metal elements - in terms of their absolute dimensions - are too small of if the surfaces of adjacent metal elements come to bear arealy against one another.

[0016] At the same time, once again in terms of absolute dimensions, the metal elements must not be too large, since in this case an insufficient surface area of the metal elements is in contact with the electrolyte, and accordingly too little metal can be dissolved out of the metal elements by the electrolyte.

[0017] Metal elements having defined geometric dimensions have been described in FR 2667081. The elements are cylindrical having diameters between 8 and 20 mm and lengths between 10 and 60 mm. They are made by cutting a cylindrical wire in such conditions that the creation of "burrs" is prevented. Although these elements have no burrs, they still have sharp edges at the circumferences of the bottom and top surfaces of the cylinders. Also, any process of cutting a wire will inevitably provoke squeezing of the material near the cutting edges. Furthermore there is always a certain contamination of greases used in the cutting operation.

[0018] The invention is based on the object of providing a metal element for use in a metal basket serving as an anode in an electroplating device which can be produced easily and in defined dimensions and which has a geometric shape and geometric size which enable it to be dissolved by the electrolyte in an advantageous way in the metal basket. The problems cited before are solved by the use of the metal elements according to the invention.

[0019] To achieve this object, the invention proposes a metal element for use in a metal basket serving as an anode in an electroplating device, which comprises a casting, which is substantially in the form of a cuboid with edge lengths of between 8 and 20 mm.

[0020] Therefore, on account of the fact that the metal element is provided as a casting, its dimension can be defined and can easily be stipulated.

[0021] The prior art which is known for the casting of metal can be used to produce the casting.

[0022] A metal casting technique allows a casting of defined dimensions to be produced in a simple and economic way.

[0023] For example, the metal element can be produced by being cast into a crucible of defined dimensions. The dimension of the metal element can therefore be fixed directly during casting of the metal element and does not have to be changed further at a subsequent stage.

[0024] At the same time, a significantly wider range of shapes are available for a casting than for a metal element cut from a wire.

[0025] A shape which substantially corresponds to a cuboid has proven advantageous for the shape of a cast metal element in accordance with the application. It is necessary for one or more (i.e. for example including all) of the edges to be rounded or chamfered.

[0026] In this context, the term "shape of a cuboid" is not to be understood in a strict mathematical sense as used by the present application. Rather, the statement that the metal element is "substantially in the shape of a cuboid" means that the metal element approximates to the shape of a cuboid, i.e. substantially has 6 faces (main surfaces), with in each case 2 faces arranged substantially opposite one another.

[0027] According to the invention, the metal element is provided with a larger main surface and a smaller main surface on the opposite side, in which case the metal element tapers from the larger main surface to the smaller main surface. In other words, the metal element resembles a cuboid, which tapers towards one side face (main surface).

[0028] The shape of the metal element is thus an irregular hexahedron having 6 faces and 4 edges per face. One of the faces has a larger surface than the face on the opposite side, the metal element tapering from this larger face towards the smaller face.

[0029] According to one embodiment, the metal element in accordance with the application has edges of substantially equal length, i.e. its shape substantially corresponds to that of a cube.

[0030] According to another embodiment, the metal element has different edge lengths.

[0031] The opposite larger and smaller main surfaces may each be substantially square in shape.

[0032] It has emerged that the substantially cuboidal metal elements comprising a casting in accordance with the application can be advantageously dissolved by an electrolyte in particular (when these metal elements are arranged in a metal basket anode) if the metal elements each have an edge length of between 8 and 20 mm.

[0033] The edges may, for example, also be of a length of between 10 and 19 mm, between 12 and 18 mm or between 13 and 17 mm.

[0034] The abovementioned embodiment of a cuboidal metal element which tapers towards one side offers the advantage in particular that with a metal element of this type it is in practice not possible for a plurality of these metal elements to be arranged in a "tightly packed" form, i.e. such that no space through which electrolyte could flow remains between them, since a "wedge-shaped" gap through which electrolyte can flow generally remains between adjacent tapering cuboidal metal elements. This fact also distinguishes them from the proposed cylindrical form in FR 2667081.

[0035] According to the application, the abovementioned metal element which tapers towards one side may, for example, be dimensioned in such a manner that the edge lengths of the large main surface are between 12 and 18 mm, the edge lengths of the small main surface are between 9 and 15 mm, and the distance between these opposite main surfaces is between 13 and 19 mm. Accordingly, therefore, the edge lengths of the large main surface may also be between 14 and 16 mm, the edge lengths of the small main surface may be between 11 and 13 mm and the distance between the two main surfaces may be between 14 and 18 mm.

[0036] The metal element may consist of any desired metal, for example of zinc, tin, copper or silver.

[0037] The application also encompasses an electroplating device which as anode has a metal basket in which metal elements in accordance with the application are arranged.

[0038] The invention also covers a process for the manufacturing of metal elements, comprising the steps of casting the metal elements using a casting belt with moulds in the form of the cuboid which was described before, and subsequently subjecting the metal elements to a tumbling process in a rotating drum, thereby smoothening the surface of the elements until at least one of the edges of each cuboid is rounded off. The tumbling operation also cleans the elements mechanically. Perfectly rounded grease-free edges and are obtained, and the elements are free of compression. All these advantages lead to an easy filling of the metal baskets and an easy soluting of the metal into the electrolyte.

[0039] The electrolyte used may be acidic or alkaline.

If metal elements made from zinc are used, it is possible in particular to use an alkaline electrolyte, for example sodium hydroxide solution.

[0040] Metal elements in accordance with the application made from zinc may in particular also be used in what are known as zinc generators or in continuous electroplating installations.

[0041] Figure 1 represents an enlarged view of an example of a cast metal element with rounded edges and having two parallel main surfaces, one of which being a rectangle of 16 mm by 15 mm, the other being a square with a side of 12 mm, and the distance between these surfaces being 16 mm. This element is preferentially subjected to a tumbling process afterwards.

Claims

1. Metal element for use in a metal basket serving as an anode in a device for electroplating, which element comprises a casting which is substantially in the form of a cuboid with edge lengths of between 8 mm and 20 mm, said cuboid having one or more rounded edges, and having a main surface which is larger than the main surface on the opposite side, the metal element tapering from the larger main surface towards the smaller main surface.

2. Metal element according to claim 1 with differing edge lengths.

3. Metal element according to claim 2, in which the larger main surface and the smaller main surface are each square in shape.

4. Metal element according to claim 1 or 2, in which the edge lengths of the larger main surface are between 12 and 18 mm, the edge lengths of the smaller main surface are between 9 and 15 mm and the distance between the larger and smaller main surfaces is between 13 and 19 mm.

5. Metal element according to anyone of claims 1 to 4, in which the metal is zinc, tin, copper or silver.

6. Electroplating device having an anode in the form of a metal basket in which metal elements according to claim 1 to 5 are arranged.

7. Process for the manufacturing of metal elements, comprising the steps of casting the metal elements using a casting belt with moulds yielding the form of a cuboid according to anyone of claims 1 to 4, and subsequently subjecting the metal elements to a tumbling process in a rotating drum, thereby smoothening the surface of the elements until at least one of the edges of each cuboid is rounded off.

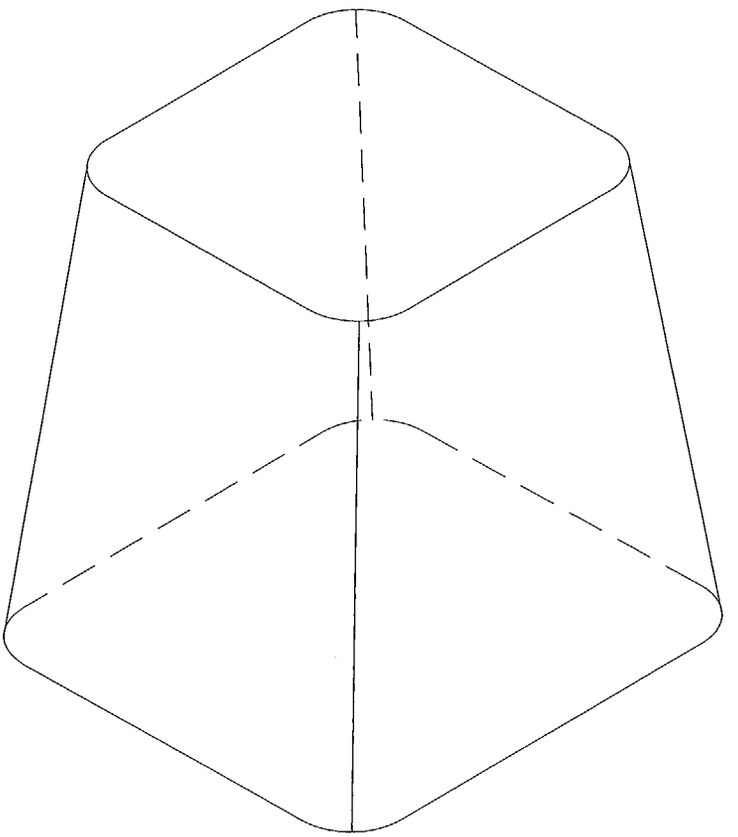

Fig. 1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 07 5134

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 June 2004	Zech, N

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EPO FORM 1503 03.82 (P04C01)

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EUROPEAN SEARCH REPORT

Application Number
EP 04 07 5134

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X : particularly relevant if taken alone
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