

The invention relates to a method for producing an erosion electrode, in particular a wire electrode for the electrical discharge cutting of conductive materials, with a core made of copper or a copper alloy on which a coating layer of zinc is applied before the heat treatment, the erosion electrode being subjected to a heat treatment after application of the coating layer, producing a copper-zinc alloy which extends from the outer margin of the coating layer to the core.

An erosion electrode is known from CH-A5-646 083 which is composed of a core having good electrical conductivity and a coating layer made of an alloy of nickel and zinc. The zinc content of the coating layer increases towards the exterior of the layer. This varying zinc content in the coating layer is obtained by heat treatment and diffusion of the zinc.

A wire electrode for electrical discharge cutting is known from EP-A-185 492, composed of a copper-sheathed core and a coating layer made of a copper-zinc alloy. The coating layer has a thickness of 0.1 to 0.15 μm . The copper content of the cross-section of the core lies between 10 and 70 %. The zinc content in the copper-zinc alloy of the coating layer steadily increases towards the exterior of the coating layer, the average content of zinc in the copper-zinc alloy being less than 50 %, but not less than 10 %. As a result, alpha-, beta- and gamma-phases and the corresponding mixed phases form in the coating layer in dependence on the particular copper-zinc ratio. A relatively wear-resistant wire electrode is certainly obtained, but this known wire electrode has a relatively low cutting efficiency, attributable on the one hand to the reduced conductivity of the coating layer and on the other hand to irregular spark discharging.

In the electroerosive wire-cutting of a workpiece, a continuous wire-like, filamentary or similarly oblong

electrode of great length is moved axially from a feed side to a receiving side through a cutting zone of a workpiece which is washed with a machining fluid of dielectric character or an electrolyte of suitable conductivity.

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An electrical machining current flows between the continuous wire electrode and the workpiece via a small working gap formed therebetween.

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Until now, for technical reasons of manufacture, a wire made of an electrically conductive material, e.g. copper, brass, steel, molybdenum, tungsten or some other metal or metal alloy, or even so-called wrapped wires with a core and coating layers of metals and metal alloys having a low vaporization temperature have been employed as the continuous oblong electrode. These materials meet the requirements imposed on the electrode in electroerosive wire cutting only under certain conditions, namely again when the zinc content of the coating layer varies from the exterior towards the

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core.

The electrical discharge energy does not only vaporize the workpiece material, which is required, but also to a considerable extent the continuous electrode, producing measurement inaccuracies.

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The object of the invention is therefore to suggest an erosion electrode with a coating layer of the type specified in the introduction, in particular a wire electrode, which has in its outer coating layer a structural composition, of which the resistance to erosive wear is much greater than that of the standard erosion electrode, and which has more satisfactory erosion efficiency and a better cutting action.

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This object is achieved with the features of claim 1.

The reason for the high degree of stability of the

erosion electrode according to the invention lies, on the one hand, in that, with the method according to the invention, it is possible to produce coating layers made of alloys which cannot be manufactured conventionally by cold-forming, and which, in the case of copper-zinc alloys, form cubic body-centred beta-phase crystals which are considerably more stable in the eroding action than the cubic face-centred alpha-crystals which are thereby possible. As a result of the defined cooling down of the beta-phase and thus stabilization of the beta-phase, even at room temperature a low number of imperfections within the coating layer is obtained, moreover, further improving the eroding action.

The special feature of the invention is the fact that precisely this hard and brittle phase, which in its general technical meaning are [sic] undesired in the non-cutting forming process, has proved to be highly wear-resistant during the discharge pulses and at the same time improve [sic] the ionising ability of the discharge duct.

It is known that high energy pulses are generated with modern electrical discharge wire cutting installations which have caused a high degree of wear with the electrodes used hitherto. As a result the continuous electrode loses measurement accuracy. Since the electrical discharge erosion technique is a reproduction process and the distance of workpiece to electrode always remains the same, measurement inaccuracy of the electrode simultaneously produces measurement inaccuracy of the workpiece which is to be machined. This is avoided with an electrode according to the invention.

The directed heat treatment and a defined cooling down phase produces the structural composition on the electrode which is already coated with metal having low vaporization energy. In the case of copper-zinc alloys, the heat treatment temperature is 454° to 902° C.

Claims

1. A method for producing an erosion electrode, in particular a wire electrode for the electrical discharge cutting of conductive materials, with a core made of copper or a copper alloy on which a coating layer of zinc is applied before the heat treatment, the erosion electrode being subjected to a heat treatment after application of the coating layer, producing a copper-zinc alloy which extends from the outer margin of the coating layer to the core, characterised in that the heat treatment is conducted such that the critical time for the heat treatment lasts until complete alloying-on of the coating layer takes place and only a Beta-phase is formed in the part of the coating layer which wears away, and in that this Beta-phase is fixed by a defined cooling down process.

2. A method according to claim 1, characterised in that the diffusion temperatures for the heat treatment lie between 454° to 902° C, subject to the desired thickness and formation of the layers.

3. A method according to claim 2, characterised in that the cooling down period equals between 20 and 50 % of the critical time.

4. A method according to one of claims 1 to 3, characterised in that the heat treatment takes place in a continuous process.

5. A method according to one of claims 1 to 4, characterised in that the wire electrode is brought approximately to the final diameter by plastic deformation before the heat treatment.

6. A method according to claim 5, characterised in that the erosion electrode is calibrated after the heat treatment.

