

Description

The invention relates to a wire electrode for cutting workpieces by means of spark erosion, comprising an erosion wire and a cover layer surrounding this erosion wire.

A wire electrode of this type, having a covering, is already known from DE patent specification 29 06 245. Covering the erosion wire has the advantage that a high-tensile erosion wire can be used, which, during erosion, can be held under high tensile force by means of clamping devices, so that a clean cut is achieved. Thread breakage during cutting can now be prevented in that the metal layer of the covering forms a thermal shield, which, as a result of its small thickness is rapidly broken through by the discharge crater, and alloy components with a low vaporization temperature, such as zinc for example, are released. In this way the use of a covered wire electrode is much more advantageous than an electrode which is not covered.

Also already known from Japanese unexamined and published application 50-102999, cited in DE patent specification 29 06 245, column 2, lines 20 to 24, is the covering of a wire electrode made of high tensile material with a highly conductive metal, such as gold or silver, to protect the electrode from a loss of flexibility due to becoming dirty during discharge. An improvement in the cutting properties of such a wire electrode (see *ibid*) could not be determined. Rather, the cutting properties only correspond to those of the silver layer and, after wearing thereof, the electrode wire itself. As, on the one hand, silver or gold is expensive, and on the other only produce moderate cutting performances, such wire electrodes with silver coverings have not been able to gain acceptance, whereas those with coverings of metals or metal alloys which have at least one fraction with a low melting point, have done so.

In each case it is required that the cutting performance, i.e. erosion in mm^2/min and/or the surface quality are further improved.

The object of the invention is therefore to put forward a wire electrode of the type described in the introduction, in which the erosion performance and/or the obtained surface quality are further improved without substantial additional costs. In accordance with the invention this task is solved by way of the features of claim 1. It is advantageous if the core of the erosion wire consists of a material which is a good electrical conductor, such as copper, brass, (Cu-Zn), bronze, (Cu-Sn), steel with a Cu covering or similar.

In DE patent specification 29 06 245 cited above, the idea was considered of covering the erosion wire with a copper or silver coating, which is then covered with the metal layer acting as the thermal protection. However, an improvement in cutting performance could not be achieved in this manner. The invention does not follow the two paths detailed above: on the one hand the highly conductive layer is not applied between the erosion wire and the covering, but as an external sheath, if a covered erosion wire is used at all. On the other hand it is kept extremely thin, and it is this extremely thin layer thickness which increases cutting performance by around 20% and improves the surface quality. The uniformly thin silver covering, which reduces electrode wear, increases the current density through its high conductivity. At the same time the extremely thin and highly conductive layer does not hinder the vaporization of the underlying alloy components with a lower vaporization point, as is the case in the state of the art. The action of the skin effect may conceivably form an explanation for this phenomenon.

The invention will be explained in more detail below by way of an example of an embodiment.

The graph show the results of measurement comparing a bare brass erosion electrode with various brass erosion wires, which are covered with a pure silver coating in different ways. In erosion wires with a diameter 0.33 mm a considerable increase in the erosion performance can be established if the erosion wire is covered with silver. The coatings of 2 to 10 g/kg brass indicated in the graph produce a silver covering of 0.12 to 0.64 μm at this diameter.

The tests shown in the graph were carried out on modern cutting installations with 200 to 300 kHz generators. In these tests it was shown that spark discharge was transmitted precisely and cleanly without loss, whereas uncovered erosion electrodes tend to dampen spark transmission.

Furthermore, this highly conductive layer produces very even erosion, which has advantages, particularly in fine and precision cutting. The high current density, in accordance with the skin effect, has the effect of reducing electrode wear vis-a-vis normal electrodes. In fine and precision cutting the throughput rate of the wire electrode can consequently be reduced (saving costs), while at the same time crater formation is flatter so that less surface roughness is produced. Through the ductile layer of highly conductive material the slippage resistance at the electrical contact is substantially improved. Wear is reduced, there is much less vibration and the wire runs down gently with a precise cut.

Due to the high conductivity of the thin covering the surface has a high contact capacity. In this way more precise and rapid positioning accuracy is achieved during initial setting, and, consequently, considerable savings of time and costs. The eroded silver and gold particles etc also produce improved conductivity in the cutting channel, so that spark transmission is also improved. Furthermore, the ductile covering produces a reduction in the stress corrosion of the core material. Finally, the service life of the electrode wire is thus increased.



Claims

1. Wire electrode for cutting workpieces by means of spark erosion, comprising an erosion wire and a cover layer surrounding this erosion wire, characterised in that the cover layer consists of an electrically highly-conductive material, such as silver, gold, rhodium, palladium or iridium, or alloys thereof, and in that the cover layer is 0.05 to 0.8 μm in thickness.
2. Wire electrode according to claim 1, characterised in that the cover layer is of silver.
3. Wire electrode according to claim 1 or 2, characterised in that a further casing layer with one or more metallic alloy components with a low vaporization point, such as zinc, cadmium, lead, antimony, bismuth, graphite, is arranged under the cover layer.
4. Wire electrode according to claim 1, characterised in that the core of the erosion wire consists of a material which is a good electrical conductor such as copper, copper core with brass, brass, (Cu-Zn), bronze, (Cu-Sn), steel with a Cu covering, tungsten, molybdenum or similar.