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Short Communication

X-ray Analisis of the Powder of Micro- and Nanometer Fractions, Obtained from Wastes of Alloy T15K6 in Aqueous Medium

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The results of conducting X-ray analysis of the powders, obtained by the electroerosive dispersing of hard alloy wastes brand T15K6 in distilled water are presented. It was established experimentally, that the obtained powder particles consist of the following main phases: W, TiC, W2C, WC, Co and CoO.

Keywords: Waste of hard alloy, Electroerosive dispersion, Distilled water, Phase.

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1. INTRODUCTION

Nowadays, the method of electroerosive dispersion (EED) finds the increasing distribution for conductive materials wastes processing with the aim of their reusing into powders [1, 2].

The processes occurring during electroerosive dispersion of recyclable materials are carried out in the inter-electrode space, filled with working fluid (WF), which is in the working area and exerts physical, chemical, detergent and mechanical effect on the process, the electrodes, the material and the products of erosion. This influence affects all stages of the EED. At the stage of formation of the electrode gap breakdown, dielectric strength of WF and its viscosity are affecting. Viscosity determines time of formation of electrically conductive particles in a "bridge", on which there is a breakdown of WF [3-9].

At the electrical discharge, when there is a destruction of material, processes of decomposition of WF, oxidation, polymerization and condensation of hydrocarbons flow. The chemical elements of WF, vaporized from the surface of the electrodes, under the discharge form compounds with oxide films, covering the electrodes, and form new chemical compounds. These new structures have different strength, heat resistance and electrical activity; they change the heat balance of the discharge, which affects the speed of the electric erosion. On the surfaces of the electrodes there is a formation of the protective films. The flow of all these processes is largely determined by the physicochemical properties of WF. In the next stage, when there is a removal of erosion products and decomposition products from the discharge zone, viscosity of WF has particular importance. With increasing of viscosity, degree of capture of erosion products increases, and the process of their removal is improved. However, if the IEP is small, the motion of a viscous WF is difficult, and the process of removing deteriorated. At the same time, WF cools the work area and prevents melting of the electrode surfaces and pieces of dispersible material [3-9].

Taking into account all mentioned, WF must satisfy the following basic requirements: providing high technological indicators of EED, the thermal stability of physical and chemical properties under the influence of electrical discharges with the parameters, corresponding to used during EED; low corrosivity dispersible materials; high dielectric strength; high flash point and low volatility; good filterability; absence of smell, low toxicity, high cooling capacity and low cost.

The type and condition of WF have a strongly influence on the technological characteristics of EED. In the EED hydrocarbon liquids of different viscosities, which constitute complex compounds, including various hydrocarbons asphaltic- resin substances, sulfur compounds and acid, received the most application.

Apart from hydrocarbon environments, water is used during EED as a WF, which has a number of advantages. In water a lot of different substances dissolves and colloidal solutions and suspensions are produced. Water is cheaper than hydrocarbon liquids and has a high heat capacity. Emulsols can be used, which are applied during machining. Emulsol basis is water, industrial mineral oil (grades IS-12 and IS-20), surface active agents are introduced as additives. Caustic soda, ethanol and other components of emulsoles perform the same role as that in mechanical machining i.e. they have a cooling, lubricating and cleaning impact. Silicon- organic fluids and also water solutions of dihydric alcohols are used to a small extent.

Distilled water in the greatest degree correspond all the above requirements (GOST 6709-72).

Depending on the type of WF, as a pure metal powder, such and oxides and carbides can be obtained by dispersing of various materials.

2. MATERIALLY AND METHODS

The aim of this work was to conduct X-ray analysis of the powders, obtained by the electroerosive dispersing of hard alloy waste brand T15K6 in distilled water.

To achieve this goal hard alloy wastes brand T15K6 were loaded into a reactor, filled with working fluid – distilled water. Dispersing was carried out at the fol-

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lowing electrical parameters: voltage – 100 V, capacitance of discharge capacitors – 55 uF, the pulse repetition rate – 100 Hz.

Worn, sub-standard and new multifaceted disposable plates were used as a starting (dispersible) material, designed for soldering and mechanical fastening on the cutting tool from medium-grained sintered hard alloys brand T15K6 (Fig. 1), consisting of tungsten carbide (79 %), titanium carbide (15 %) and cobalt (6 %).

The fulfilled multifaceted disposable plates from the corresponding grades of sintered hard alloys are also used as electrodes.

Fig. 1 – Waste of sintered hard alloy brand T15K6

3. EXPERIMENTAL RESULTS AND DISCATIONS

To study the structure of the particles of obtained powders, X-ray analysis was conducted on the X-ray diffractometer Rigaku Ultima IV (Fig. 2).

Fig. 2 – X-ray diffractometer «Rigaku Ultima IV»

The test sample powder was poured into cuvette of 20 mm diameter and 0,5 mm in depth and compressed, so that the surface of the sample was parallel to the edges of the cuvette. The cuvette is placed in a holder, whereby on the adjusted goniometer the surface of the sample coincides with the plane of focusing.

Shooting options: range: 10-95 degrees 2Θ; step – 0,020 degrees, the rate of – 1 degrees / min, the operating voltage – 40 kV, current – 40 mA.

Processing profile of diffractogram: a program PDXL; Smoothing – a method of Savitzky-Golay; background calculation – Sonnevelda-Visser method, peak search – peak top method.

The following are the results of experimental studies (Fig. 3).

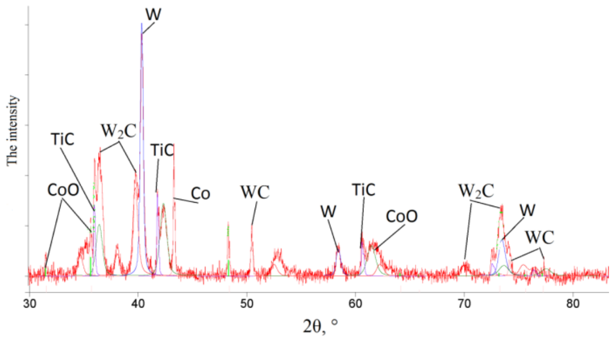

Fig. 3 – X-ray analysis of the powder obtained by EED of hard alloy waste T15K6 in water

It was experimentally established that the powder particles, obtained by the electroerosive dispersing of hard alloy waste grade T15K6 in distilled water, consist of the following main phases: W, TiC, W_2C, WC, Co and CoO.

Thus, the experimentally found that when electroerosive dispersion then the passage of an electric current through the working fluid (distilled water) implies its hydrolysis, which resulted in the end products of disintegration are hydrogen, oxygen and carbon. Gases (H_2 and O_2) during the dispersion come to the surface of WF, and carbon and partially oxygen react with the products of erosion.

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