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X-ray spectral analysis of sintered articles made of electroerosive lead bronze obtained in lighting kerosene

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Abstract. The article presents the results of X-ray spectral analysis of sintered products made of electroerosive materials of the BrS30 alloy obtained in lighting kerosene. It is shown that during uniaxial pressing and sintering in an argon atmosphere of electroerosive materials of the BrS30 alloy, the main elements on the surface of sintered products are carbon, copper, and lead.

1 Introduction

Bronze is widely used in modern mechanical engineering, rocketry, aviation, shipbuilding and other industries. Due to their resistance to mechanical abrasion and high corrosion resistance, bronze products are used for the manufacture of machine parts and devices that participate in moving units in the friction process.

Lead bronze has excellent antifriction properties, withstands shock loads well, and is also characterized by high strength and refractoriness.

Recently, bronzes have been widely used as components of powder antifriction materials or thin-walled porous coatings impregnated with solid lubricants [1].

To develop technologies for the practical application of powder materials obtained from lead bronze waste and to assess the effectiveness of their use, it is necessary to carry out comprehensive theoretical and experimental studies.

The aim of the work was to carry out X-ray spectral analysis of sintered samples from electroerosive materials of BrS30 alloy obtained in lighting kerosene.

2 Materials and Methods

For the implementation of the planned studies, waste of lead bronze grade BrS30 (GOST 493-79) was selected. Lighting kerosene is used as a working fluid. To obtain dispersed powder on an experimental setup [2], the waste was subjected to electroerosive dispersion.

The following electrical parameters of the installation were used:

- pulse repetition rate 95 ... 105 Hz;
- voltage across the electrodes 190 ... 200 V;

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- the capacity of the capacitors is 65.5 μF.

As a result of the local impact of short-term electrical discharges between the electrodes, the waste material was destroyed with the formation of dispersed powder particles [3-19] (Fig.1).

Fig. 1. Lead bronze EDM materials

To obtain the compacted materials, a HERZOG TP20 hydraulic table press for manual tablet compression was used. The pressing was carried out in a steel mold with a diameter of 10 mm, at a pressure of 1500 MPa, holding under a pressure of 2 minutes. Then, the compacted samples were sintered in a Nabertherm RS 80/300/13 / P470 folding tube furnace for 12 hours at a temperature of 827 ° C (1100 K) in an argon atmosphere.

Using an EDAX energy-dispersive X-ray analyzer built into a QUANTA 200 3D scanning electron microscope (Fig. 2), characteristic X-ray spectra were obtained at different points on the sample surface. X-ray spectral microanalysis is understood as the determination of the elemental composition of micro-objects from the characteristic X-ray radiation excited in them.

Fig. 2. Scanning electron microscope QUANTA 200 3D

3 Results

On the presented spectrogram, a certain chemical element corresponds to each peak of a certain height (Fig. 3).

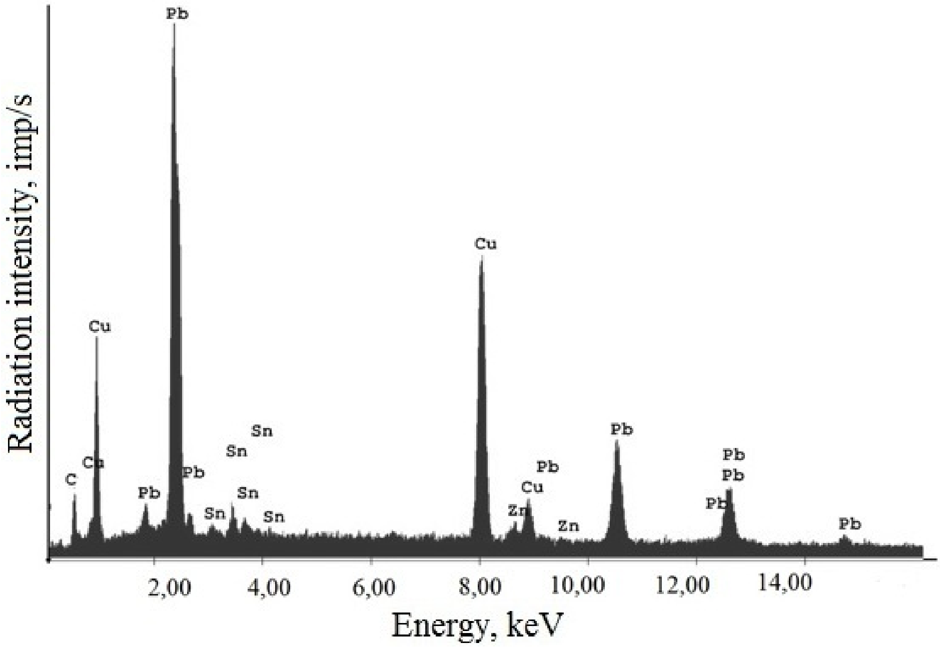

Fig. 3. Spectrogram of the surface of the sintered samples

The elemental composition obtained as a result of X-ray spectral microanalysis is presented in Table 1.

Table 1. Elemental composition of the studied samples

Element	Mass fraction, %	Atomic fraction, %
C	5,48	28,99
Sn	3,55	2,54
Cu	31,75	42,33
Zn	2,17	2,81
Pb	57,05	23,33
Total	100,00	100,00

According to the presented data, it was found that the main elements in a sintered sample of lead bronze electroerosive materials obtained in kerosene are carbon, copper, and lead. The rest of the elements are distributed relatively evenly.

4 Conclusion

X-ray microanalysis made it possible to determine the elemental composition of the sintered samples. Based on the results of the presented data, it was established that the main elements in a sintered sample of lead bronze electroerosive materials obtained in kerosene are carbon, copper, lead. The rest of the elements are distributed relatively evenly. The presence of free carbon on the surface is explained by the fact that the electroerosive materials were obtained in a carbon-containing liquid - lighting kerosene. The conducted research will determine the most relevant area of application of the samples obtained and will improve the quality of scientific and technical developments.

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