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The Selected Properties of the Micro Electrical Discharge Alloying Process Using Tungsten Electrode on Aluminum

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Abstract

This paper presents a brief study of the effect of micro electro-discharge alloying (EDA) using tungsten electrode on the aluminum. The layers were investigated with metallographic methods and EDS analyses. Using the EDS analysis, types of alloying elements and the extent of diffusion from the electrode into to aluminum alloy were identified.
The paper deals also with a method of investigating traces made by micro electro-discharge alloying using scanning profilometer (SP) and optical microscopy with the image analysis system.
The results of investigations showed that there is a possibility of obtaining the satisfying layer between the aluminum and wolfram electrode using micro EDA.

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Keywords: EDM; EDA; ESD; scanning profilometer; surface layer;

1. Introduction

Electrical Discharge Machining (EDM) is a controlled metal-removal process that is used to remove metal by means of electric spark erosion [1-9]. The EDM is often included in the "non-traditional" or "non-conventional" group of machining methods together with processes such as electrochemical machining (ECM), water jet cutting

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(AWJ), laser cutting [10-12], micro-welding [13,14] and opposite to the "conventional" group turning, milling, grinding, drilling etc.

The EDM is undeniably classified as a removal process. However, the EDM process can also be used as a surface treatment method; then it is called ESD or EDA [15-18].

The surface alloying method using the composite electrode to improve the surface properties of the workpiece has been reported by a number of authors [19-25].

Due to the present trend in constructing machines, alloys of special properties are often used.

2. Experimental investigations

This research is aimed to estimate dimensions of individual craters and their volume generated in the electro-alloying process (EDA).

The surfaces of the aluminum samples, used for the electro spark deposition, were lapped with high accuracy so the roughness was low. Surface is a basis for determining the volume of craters and flashes.

Study of the impact energy of single discharge using a tungsten electrode included the following activities:

- gathering information on the size and volume of the crater using scanning profilometer,
- examination of the microstructure using the SEM,
- determining the relationship between process parameters and dimensions and volumes of craters.

2.1. Craters analysis using a microscope and scanning profilometer

To present traces of individual discharge on the prepared surfaces, the optical microscopy by Microscope Nikon Eclipse MA 200 with the image analysis system NIS 4.20 for metallographic specimens testing, was used.

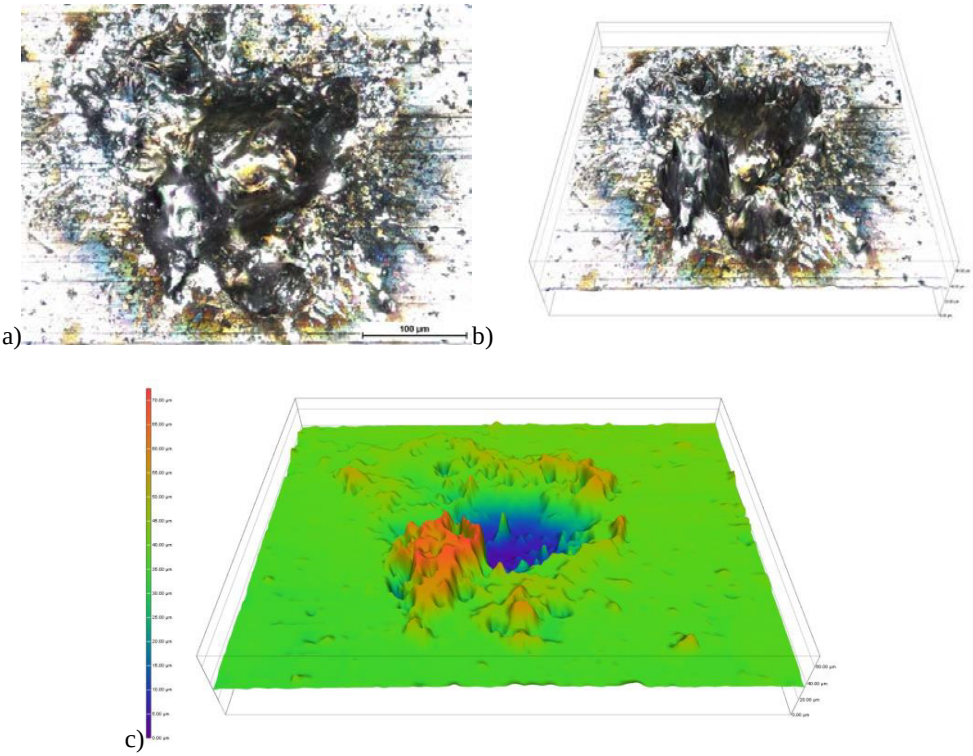

Fig. 1. View of single discharge, made by Nikon Eclipse MA 200 microscope, mag. 200 x, a) typical image, b) view 3D, c) view 3D with a high map