HETEROGENEOUSITY OF PLASTIC DEFORMATION OF AN ADDITIVELY GROWN AL-MG ALLOY*

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The present work is devoted to studying the features of the inhomogeneity of plastic deformation of an additively grown aluminum alloy.

Aluminum alloy AMg5 was produced on a laboratory electron beam additive installation at the Institute of Strength Physics and Materials Science of the Siberian Branch of the Russian Academy of Sciences [1]. An electron gun with indirect heating of the cathode was used as a heat source. The residual air pressure in the vacuum chamber did not exceed $5 \cdot 10^{-5}$ Pa. For multilayer electron beam deposition, a wire with a diameter of 1.2 mm of standard composition made of AMg5 alloy was used. The surfacing process was carried out under the following parameters: accelerating voltage 30 kV, table movement speed 440 m/min, beam diameter 5 mm. The electron beam current decreased from 26 to 16 mA as deposition progressed [1]. The grown samples reached overall dimensions of $100 \cdot 70 \cdot 40$ mm^3.

Specimens for uniaxial tensile mechanical tests and analysis of local strain distributions using the Digital Image Correlation (DIC) method [2] were made in the shape of a double-sided blade.

The plastic flow of the alloy is accompanied by stress jumps of up to 3 MPa on the tensile diagram immediately after the yield point. At the yield point, single localized deformation fronts nucleate and move along the tensile axis of the sample.

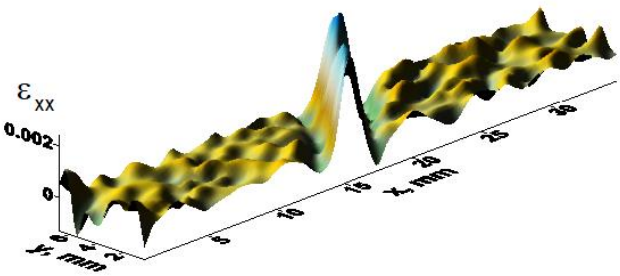

Fig.1. Local strain distribution at the initial stage of plastic flow in Al-Mg alloy

The general appearance and parameters of the evolution of the components of the plastic distortion tensor indicate the connection of this process with the self-organization of the defect subsystem in a deformable medium [3-5] and the autowave mechanism of plasticity [2]. In this case, in the initial section of deformation up to 6-7% of the total deformation, the continuous movement of single localized deformation fronts from one grip of the testing machine to another predominates (Fig. 1). As the total deformation increases, the movement of deformation fronts occurs randomly.

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