

ABSTRACT

Master thesis: 110 p., 43 fig., 12 tabl., 58 ref., 1 app.

IMPULSE LASER TREATMENT, LASER ALLOYING, ALLOYED ZONE, SURFACE TOPOLOGY, X-RAY DIFFRACTION, SUPERSATURATED SOLID SOLUTION, MASS TRANSFER.

The objects of research: processes of phase transformations and mass transfer in Cu-Cr-Zr alloy as a result of impulse laser alloying by chromium.

The objective of research: mass transfer processes from chromium coatings in Cu-Cr-Zr matrix under impulse laser treatment.

Research methods: vacuum electron-beam deposition, impulse laser alloying, optical and scanning electron microscopy, energy dispersive spectrometry, X-ray diffraction analysis, measurement of electrical resistance.

Scientific novelty of the results:

1. The possibility of generation of the supersaturated solid solutions in the result of impulse laser treatment was shown on the metal system Cu-Cr-Zr - Cr.
2. It was found a gradual decrease in the concentration of chromium in the surface layer (~10 microns) characteristic to mass transfer of Cr into the matrix with generation of a supersaturated solid solution, as evidenced by X-ray diffraction.
3. It was established that a gradual decrease in the concentration is presented only in the sample where laser treatment was combined with using liquid nitrogen cooling, indicating that cooling makes effect on the kind of structural changes in the surface layers. This distribution is not typical for conventional convective mixing of liquids.
4. The results of the investigation can be used for the surface treatment of parts from metals and alloys to improve their performance, in particular,

increasing surface hardness and wear resistance.

The work carried out according to research theme “Physical phenomena in solids accompanying the mass transfer under impulse impact” of Physics Atomic Transport Processes Department of IMP G. V. Kurdyumov. Most of the research done at the KU Leuven (Belgium) in the frame of International Project Erasmus +.

The results of the master's thesis are novel and can be implemented as a startup project with the idea to develop an effective and reliable contact electrodes used in switches for switching of high electric networks by laser alloying with chromium. The results will be used in further research of the department (physics and atomic transport processes) and can be used in the course “Mesoscopic physics” for students-masters of Physics of Metal Department.