ABSTRACT

Master thesis: 120 p., 32 fig., 14 tabl., 56 ref., 2 app.

IMPULSE LASER TREATMENT, LASER ALLOYING, ALLOYED ZONE, CALCULATION OF THE PARAMETERS OF LASER TREATMENT, STRUCTURAL CHANGES IN COPPER, 3D MODELING, MOLECULAR DYNAMICS, DISLOCATIONS INTERACTION.

The objects of research: processes of structural transportations in copper and Cu-Cr-Zr alloy, as a result of impulse laser irradiation, including laser alloying with chromium.

The objective of research: research of structural transformations in the metallic materials under laser irradiation

Research methods: impulse laser alloying, optical and scanning electron microscopy, micro hardness measurement, study by molecular dynamics simulations, theoretical (model) calculations of thermal fields during alloying.

Scientific novelty of the results:

1. Two types of microstructures were obtained by alloying of the Cu-Cr-Zr alloy with chromium. For the first time detected a fine - grained layer with a higher hardness in the boundary between the crystallized melt and solid matrix.
2. It was established that laser alloying with using liquid N2 makes a positive effect on the thickness of the fine-grained layer and significantly slows the mixing rate of chrome with molten matrix.
3. It is shown that the dislocations motion possible at low temperatures due to striving of system to minimize its energy by reducing stress fields around dislocations.
4. The presented experimental and theoretical methodic allows to optimize the parameters and modes of impulse laser treatment for obtaining desired

structural changes.

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 method of increasing the ability of copper and copper alloy to absorb infrared radiation. 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.