THE ENERGY FLUX ONTO SUBSTRATE DURING COATING DEPOSITION USING MAGNETRON WITH LIQUID METAL TARGET

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Experimental and theoretical studies showed that the use of liquid-phase targets in the magnetron sputtering systems (MSS) can significantly increase the rate of coating deposition. This effect is created due to evaporation on the very heated target surface in addition to sputtering. The hot target and vaporized particles in the deposited flow can significantly affect the structure and properties of produced coatings and heating of substrate.

To find out the features of heating the substrate and the amount of energy supplied to it depending on the parameters of the MSS with the liquid target the experiments were carried out. The growth rate of the copper coating and substrate temperature were measured. The heating rate reached almost 2 K/s, which is much higher than at conventional magnetron sputtering.

The mathematical model was developed to determine structure of the energy flux coming to the substrate and the dependence of its components on the MSS parameters. It describes erosion processes in the target, transfer of atoms from target to the substrate and substrate heating. Calculations and comparison with the experimental results show that for power density of the MSS with liquid target from 10 to 100 W/cm^2, the energy flux is composed of the following components: heat radiation (from 70 to 98 %), energy released due to condensation and kinetic energy of deposited atoms (less 2 %). The dependence of energy coming to the substrate per a deposited particle on magnetron power very differs from the case of deposition with cold target.

***Keywords:** magnetron sputtering, evaporation, energy flux onto substrate, liguid-phase target.*