Modeling of Oxide Growth Processes on the Surface during the Diffusion in Thin Films in Conditions of “Oxygen Pump” Action

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In our work we suggested models that allow predicting kinetics of oxide growth on the surface of thin films. It is thought that material of “bottom” layer in bilayer system diffuses through the grain boundaries of the “upper” layer material to the external surface and reaction of it’s oxidation plays role of “oxygen pump”, which makes additional diffusion driving force. It is stated that diffusion mechanism makes considerable contribution on the shape and size of oxide layer and also it’s effective thickness. We also analyzed and compared influence of mass transfer parameters on the oxide growth rate index.

Phase formation processes that run on the external surface at increased temperature is thermodynamic reason for diffusion in the bulk. For instance, in thin film system “copper-nickel” atoms from “bottom” layer (Cu) diffuse through the “top” layer (Ni) due to the grain boundary mechanism and reaction of Cu oxidation on the external surface plays role of “oxygen pump” which serves as an additional driving force for the diffusion.

That is why our aim to make mathematical description and prediction of oxide’s growth kinetics on the surface of Ni layer in system Cu/Ni at different diffusion regimes – bulk through the oxide, surface through the interface “metal - oxide” etc.