THE NUCLEATION AND GROWTH OF Fe UNDER INFLUENCE OF AN EXTERNAL MAGNETIC FIELD

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When thin films are deposited, the nucleation process will determine the physical properties of the film. Thus, the understanding of the earliest stages of a film growth and the influence of deposition parameters on it is of great importance for the process development and optimisation. It is known that a magnetic field applied during the deposition affects the process significantly [1-3].

The effect of an uniform magnetic field with a flux density up to 1T and different configurations relative to the electrode surface on the electrocrystallization of Fe was investigated. It was found, irrespective of the applied parameters, that the deposition proceeds through successive nucleation and growth steps. The first one related to 2D growth followed by a second nucleation and 3D diffusion controlled growth [3]. It was found by fitting of the Heerman-Tarallo model [4] to the experimental results, that the nucleation and growth at potentials of -1500 and -1550 mV_{MSE} proceeds via a progressive mode, while at -1650 mV_{MSE} it follows an almost instantaneous mode [3]. A strong influence of the parallel-to-electrode magnetic field on the nucleation processes was found for the progressive mode, which leads to the increase of the growth rate and as a consequence to retardation of the nucleation rate of the 3D step, i.e. a shift from progressive to instantaneous mode with a magnetic field [3]. This nucleation and growth mode change could be observed during the morphology evolution where in the parallel field more uniform gain size distribution was observed. No effect of a perpendicular-to-electrode magnetic field on the nucleation has been observed. But in this configuration a strong influence on the growth mode was observed [2].

The effects of a magnetic field on the nucleation and growth processes are discussed with respect to the magnetohydrodynamic effect (MHD) and confirmed by rotating disc electrode (RDE) experiments.

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