Surface Roughness Evolution of Co Electrodeposits on Si

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This work investigates the surface roughness of Co electrodeposited on Si (100) substrates. The objective was to determine the influence of the nucleation mechanism, i. e. progressive or instantaneous, on the morphology of the Co layers. In order to compare deposits with different nucleation mechanisms, two series of samples were potentiostatically prepared from electrolytes containing two concentrations of cobalt sulfate (26 and 104 mM). Sodium sulfate (500 mM) was used as supporting electrolyte. The surface roughness was measured via atomic force microscopy. The low concentration bath resulted in progressive nucleation and the high concentration one in instantaneous nucleation, as determined from the current transients. The surface roughness showed a strong dependence on the nucleation mechanism for layer thicknesses below 260 nm. A factor higher than 5 for the interface width was observed in progressive samples as compared to instantaneous ones. However, for thicker layers the surface of both series of samples showed a very similar morphology. The surface roughness evolution of the layers was investigated in a quantitative way using the scaling analysis. The nucleation and growth of the deposits were studied by the Monte Carlo method applying an appropriate algorithm. The simulated results adequately described the experimental data. To demonstrate the influence of the surface roughness on the magnetic properties of the Co deposits, simultaneous transversal Kerr effect and magnetoresistance measurements were done.