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Morphology Evolution of Cobalt Thin Films on Al_2O_3 (110) Above the Roughening Transition: Formation of Gigantic Multilayered Islands[1] JORGE ESPINOSA, LEONARDO GOLUBOVIC, DAVID LEDERMAN, Department of Physics, West Virginia University — Co films, 4.0 nm thick, were grown on Al_2O_3 (110) at 315 °C via molecular beam epitaxy. Their surfaces were imaged via atomic force microscopy while annealing at $T \geq 535$ °C for several hours. The films exhibited a striking formation of multilayered islands that reach heights more than ten times larger than the initial film thickness. At the early stages of the annealing process ($t < 2$ hr) the islands' height h grows exponentially with time t, which is consistent with height instabilities of the film surface. For $t > 2$ hr, h continues increasing at a slower rate with a power law $h \sim t^{\gamma}$ with $\gamma = 0.20 - 0.25$, whereas, interestingly, the base areas of the multilayer islands do not appreciably change with time. This behavior is independent of T in the 535 ^{o}C to 590 ^{o}C range. These phenomena are discussed within an interface dynamics model incorporating both surface diffusion relaxation and de-wetting forces. The model is used to elucidate the physical origin of the observed island height growth in terms of strong up-hill surface currents caused by long range Casimir-like forces acting across the film.

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