RATE DEPENDENCE OF CaF_2 NANOROD GROWTH ON AMORPHOUS SUBSTRATES

by

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ABSTRACT

A series of samples of CaF_2 thermally evaporated onto oxide-coated Silicon substrates with no intentional heating at a 70^o oblique incident angle with respect to the substrate normal resulted in three-dimensional nanostructures. X-Ray Diffraction pole figures captured with an area detector enabled the analysis of the in and out-of-plane angular dispersion with resolutions of 1^o and 0.02^o, respectively. The incident flux rate varied and the in and out-of-plane angular dispersion of the [111]<121> oriented samples decreased from 32^o to 23^o and 15.85^o to 10.71^o, respectively with increasing rates between 4 and 42 nm-min^{-1}. The tilt of the (111) poles with respect to the substrate normal was also measured. The (111) direction tilted increasingly away from the flux as the deposition rate increased. Specifically, the (111) tilt angle was -9.41^o for the 4 nm-min^{-1} film and -14.90^o for the 42 nm-min^{-1} film. All three quantities followed a curve with exponential nature. The experiment showed that all three of these physical properties of three-dimensional nanostructures are related in their behavior with respect to varying incident flux rate. An attempt was made to explain the physics of the result in terms of surface diffusion for each successive incoming layer on the growing nanostructure.