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STM study of MOCVD-grown a-plane ZnO thin films: film thickness, growth temperature, and substrate miscut effects O. DULUB, U. DIEBOLD, Department of Physics, Tulane University, New Orleans, Louisiana 70118, G. SARAF, Y. LU, Department of Electrical and Computer Engineering, Rutgers University, New Jersey 08854 — ZnO films with a-plane orientation were grown on r-plane (011bar2) sapphire substrates using metal-organic chemical vapor deposition (MOCVD). The surface morphology of ZnO films with various thicknesses (20 – 2000 nm), growth temperatures (300 - 580°C), and substrate miscut orientations and angles (0.2 - 2°) was characterized by low energy electron diffraction (LEED) and scanning tunneling microscopy (STM). Our results show strong dependence of surface morphology on growth parameters and the substrate miscut. STM images reveal uniform surfaces with small, rectangular terraces during the initial growth stage (20 nm-thick film). Films with thicknesses between 100 and 450 nm have a characteristic wave-like surface morphology with needle-shaped domains running predominantly along the crystallographic c-direction. Films with a thickness of 2000 nm exhibit more flat surfaces, but with c-oriented facets. We observed an increasing surface quality of the films with increasing growth temperature. Films grown at 580°C exhibit the flattest surface morphology. Film morphologies show strong dependency on the substrate miscut angle as well as on the miscut direction at all growth conditions.

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