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High-quality Thin Single-Crystal Y2O3 films Grown on Si (111) C.-W. NIEH, W.-C. LEE, Z.-K. YANG, Y.-J. LEE, PEN CHENG, T.-D. LIN, M. HONG, Dept. Mat. Sci. Eng., Natl Tsing Hua U, Taiwan, J. KWO, Dept. of Phys., Natl Tsing Hua U, Hsinchu, Taiwan, C.-H. HSU, Natl Synchrotron Rad. Res. Ctr. Taiwan — High-quality nano thick (~3nm) single-crystal Y2O3 films have been MBE-grown epitaxially on Si (111) despite a 2% lattice mismatch. Studies carried out by x-ray diffraction, x-ray reflectivity, and cross-sectional HRTEM show the excellent structural properties. In-situ RHEED was used to monitor the growth quality, showing a sharp pattern of a (4x4) reconstruction. The strong oscillations of x-ray reflectivity and Pendellosung fringes surrounding the Y2O3 diffraction peaks point out that the film surfaces and the oxide/Si interfaces are atomically sharp and uniform. A record small FWHM of 0.01 degree in rocking scans was observed at Y2O3 (444), indicating the excellent quality of the nano films. The films are well aligned with the substrate with an orientation relationship of Si (111) // Y2O3(111), and an in-plane expitacy of Si [-110]// Y2O3 [-101]. In the thickness range of microelectronics applications, the nano Y2O3 layers have achieved a degree of perfection rarely observed in hetero-structures of oxide/semiconductor.

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