Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Atomistic mechanisms and diameter selection during nanorod growth DA-JUN SHU, XIANG XIONG, ZHAO-WU WANG, National Laboratory of Solid State Microstructures and Department of Physics, Nanjing University, Nanjing 210093, China, ZHENYU ZHANG, Materials Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA, MU WANG, NAI-BEN MING, National Laboratory of Solid State Microstructures and Department of Physics, Nanjing University, Nanjing 210093, China — We report that two growth modes of nanorods can be realized, depending on a characteristic radius which increases with the ratio of the interlayer hopping rate limited by the two-dimensional Ehrlich-Schwoebel barrier (ESB) to the deposition rate of the growth units. When the radius of the initial island is larger than this characteristic radius, the growth morphology evolves from a taper-like structure to a nanorod with radius equal to the characteristic radius after some transient layers. Otherwise the nanorod morphology can be maintained during the growth, with stable radius being limited by both the radius of the initial island and the three-dimensional ESB. The theoretical predictions are in good agreement with experimental observations of ZnO growth. This work was supported in part by MOST of China (2004CB619005 and 2006CB921804), NSF of China (10625417 and 10874068) and Jiangsu Province (BK2008012). Z. Zhang acknowledges partial support by USDOE (grant No. DE-FG02-05ER46209, the Division of Materials Sciences and Engineering, Office of Basic Energy Sciences), and USNSF grant No. DMR-0906025.

Da-Jun Shu
National Laboratory of Solid State Microstructures and
Department of Physics, Nanjing University,
Nanjing 210093, China

Date submitted: 17 Nov 2009 Electronic form version 1.4