In situ Optical Monitoring and Modeling of Vertically-Aligned Carbon Nanotube Array Growth During Chemical Vapor Deposition

A. A. PURETZKY, D. B. GEOHEGAN, H. CUI, G. ERES, I. N. IVANOV, Condensed Matter Sciences Division, Oak Ridge National Laboratory, and Dep. of Mat. Sci. and Eng., Univ. of Tennessee — A detailed experimental study of vertically aligned carbon nanotube array (VANTAs) growth by chemical vapor deposition (CVD) based on time-resolved reflectivity and direct remote microscope imaging as a diagnostic to measure and control the length of VANTAs in situ was performed. The VANTA growth was investigated between 500 °C and 900 °C on Si substrates with different evaporated multilayer catalysts and different feedstock gases. Nanotube lengths were controlled by rapid evacuation of the chamber. A kinetic model was developed to explain the observed growth kinetics, to discuss the main processes responsible for the growth of VANTAs, and to predict optimal growth conditions for single-wall carbon nanotube (SWNT) arrays. High quality VANTAs containing SWNTs were synthesized and characterized using Raman Spectroscopy.

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