

Abstract Submitted
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Real-Time Study of the Kinetics of Vertically Aligned Single Wall Carbon Nanotube Array Nucleation and Growth GYULA ERES, Oak Ridge National Laboratory, H. CUI, C. M. ROULEAU, A. A. PURETZKY, D. B. GEOHEGAN — A molecular beam of carbon containing molecules in conjunction with time resolved reflectivity was used to study the kinetics of nucleation and growth of vertically aligned single wall carbon nanotube arrays. The molecular beam environment decouples the source gas and the substrate temperature dependent variables and eliminates secondary gas phase reactions, to allow carbon nanotube growth by surface reactions only [1]. The incidence rate of the carbon containing species is the key variable that through the nucleation density determines all the important properties of the arrays including the type, the diameter, and the packing density of the nanotubes. The addition of trace amounts of impurities such as water and oxygen enhances the nucleation density but does not affect growth. This highly controlled reaction environment reveals that carbon nanotube growth is a complex multicomponent reaction in which not just C but also H and O play a critical role. The picture that emerges from this study is at odds with the conventionally accepted dissolution/precipitation model for carbon nanotube growth. Instead, we explain the observed results by a new mechanism that is based on carbon network formation and stabilization by stepwise addition of acetylene type species. [1] G. Eres *et al.* *J. Phys. Chem. B* **109**, 16684 (2005).

Gyula Eres
Oak Ridge National Laboratory

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