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Growth Kinetics of Water-Assisted Single-Walled Carbon Nanotube Synthesis-"Super-Growth" DON N. FUTABA, KENJI HATA, KOHEI MIZUNO, TAKEO YAMADA, MOTOO YUMURA, SUMIO IIJIMA, Research Center for Advanced Carbon Materials, National Institute of Advanced Industrial Science and Technology (AIST) — Recently, we have reported the highly efficient synthesis of vertically aligned, highly dense and pure single-walled carbon nanotubes (SWNT) by chemical vapor deposition through the introduction of a small, controlled level of water in the growth ambient [1]. The dramatic increase in catalyst efficiency resulted in the growth of SWNT forests as tall as 2.5 millimeters in a 10-minute growth time. The need to fully utilize the catalytic enhancement by water requires the optimization of the growth conditions and the understanding of the growth mechanism. Here we report the growth kinetics describing water-assisted SWNT synthesis, which we attained through a systematic investigation of the yield [2]. Our extensive analysis of water-assisted growth revealed an unexpected simplicity, in that the growth evolution could be completely described by two characteristic quantities: the initial growth rate and the catalytic lifetime. Furthermore, our studies revealed how these quantities reflected changes in the relative water and ethylene levels. [1] K. Hata *et al*, Science, **306,** 1362 (2004). [2] D.N. Futaba *et al*, Nature Materials (*submitted*).

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