

Abstract Submitted  
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**The role of carbon solubility in Fe-C nano-clusters on the growth of small single-walled carbon nanotubes** STEFANO CURTAROLO, NEHA AWASTHY, WAHYU SETYAWAN, Duke University, ELENA MORA, TOSHIO TOKUNE, Honda R.I., KIM BOLTON, Göteborg University, AVETIK HARUTYUNYAN, Honda R.I. — Various diameters of alumina-supported Fe catalysts are used to grow single-walled carbon nanotubes (SWCNTs) with chemical vapor decomposition. We find that the reduction of the catalyst size requires an increase of the minimum temperature necessary for the growth. We address this phenomenon in terms of solubility of C in Fe nanoclusters and, by using first principles calculations, we devise a simple model to predict the behavior of the phases competing for stability in Fe-C nanoclusters at low temperature. We show that, as a function particles size, there are three scenarios compatible with steady state-, limited- and no-growth of SWCNTs, corresponding to unaffected, reduced and no solubility of C in the particles. The result raises previously unknown concerns about the growth feasibility of small and very-long SWCNTs within the current Fe CVD technology, and suggests new strategies in the search of better catalysts. Research supported by Honda R.I. and NSF.

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