Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

The effect of gaseous ambients on catalytic nanoparticles and the impact on nanotube chirality selection SEUNG MIN KIM, DMITRI N. ZAKHAROV, Purdue University, AVETIK R. HARTYUNYAN, Honda Research Institute USA, ERIC A. STACH, Purdue University — We have shown that single-wall carbon nanotubes (SWNT) with metallic conductivity can be preferentially grown (with 91% population) by varying the nobel gas environment (He / Ar) during thermal annealing of the Fe catalysts used to mediate nanotube growth, and in combination with residual pressures of hydrogen and water. Real time transmission electron microscopy observations of Fe nanoparticles show that the catalysts are strongly facetted in the presence of He ambient, but rounded in Ar ambients. Additionally, the presence of different ambients and different thermal annealing durations prior to nanotube nucleation leads to different populations of semiconducting and metallic nanotubes. These observations indicate that both the shape and the size distribution of the catalysts strongly affect the resulting nanotube chirality. It is well known that the shape of the particles also affects the coarsening behavior: it is crucial to fully understand how the affect of different ambients modifies coarsening behavior. We will describe in-situ annealing experiments conducted in an environmental-cell transmission electron microscope. These observations will be compared with recent coarsening models that describe how coarsening proceeds differently in particles with different equilibrium shapes.

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Date submitted: 29 Nov 2009 Electronic form version 1.4