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Liquefaction of Catalyst Nanoparticles during Carbon Single-Walled Nanotubes Growth ELENA MORA, ARTHUR EPSTEIN, The Ohio State University, TOSHIO TOKUNE, AVETIK HARUTYUNYAN, Honda Research Institute, THE OHIO STATE UNIVERSITY TEAM, HONDA RESEARCH INSTITUTE TEAM — Despite the discovery of carbon single walled nanotubes (SWNTs) over a decade ago, the growth mechanism is still not fully understood. The question of whether the catalyst remains solid or not during the growth is still the subject of intense research. In the study reported here, two groups of catalysts with spherical and disk shape cobalt nanoparticles were used to grow SWNTs by chemical vapor deposition. The Raman spectra of the carbon deposits confirmed the formation of SWNTs. Additionally, electron microscopy images revealed that the disk shaped particles with diameter less than 20 nm were transformed into spheres during the synthesis. This implies that SWNTs were formed on the liquefied metal nanoparticles. However, calorimetric studies conducted on the pristine catalyst showed that the synthesis temperature was lower than the melting point of the catalyst nanoparticles. According to the cobalt-carbon binary phase diagram, the saturation of the metal with carbon atoms causes a decrease in the melting point. Based upon our results, we believe that SWNTs grow on the liquefied nanoparticles and that the liquefaction is caused by the diffusion of carbon atoms in the nanoparticles.

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