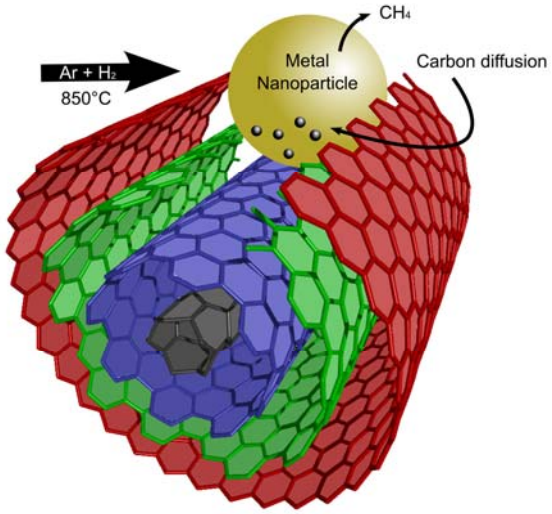
Longitudinal Cutting of Pure and Doped Carbon Nanotubes to Form Graphitic Nanoribbons Using Metal Clusters as Nanoscalpels

Ana Laura Elías,[1,2] Andrés R. Botello-Méndez,[1] David Meneses-Rodríguez,[1] Viviana Jehová González,[1] Daniel Ramírez-González,[1] Lijie Ci,[2] Emilio Muñoz-Sandoval,[1] Pulickel M. Ajayan,[2] Humberto Terrones,[1] Mauricio Terrones.[1]*

[1]Laboratory for Nanoscience and Nanotechnology Research (LINAN) and Advanced Materials Department, IPICyT, Camino a la Presa San José 2055, Col. Lomas 4a. sección, San Luis Potosí 78216, SLP, MÉXICO.

[2]Department of Mechanical Engineering and Materials Science, Rice University, Houston, TX 77005, USA



ABSTRACT

We report the use of transition metal nanoparticles (Ni or Co) to longitudinally cut open multi-walled carbon nanotubes in order to create graphitic nanoribbons. The process consists of catalytic hydrogenation of carbon, in which the metal particles cut sp^2 hybridized carbon atoms along nanotubes that result in the liberation of hydrocarbon species. Observations reveal the presence of unzipped nanotubes that were cut by the nanoparticles. The nanoribbons produced are typically 15 to 40 nm wide and 100 to 500 nm long. This method offers an alternative approach for making graphene nanoribbons, compared to the chemical methods reported recently in the literature.