Synthesis of Size-controllable Hollow Carbon Spheres

Chun-Kuo Tsai (蔡俊國)[1] and H. Paul Wang (王鴻博)[1,2]

**[1]Department of Environmental Engineering,
National Cheng Kung University, Tainan, Taiwan
[2]Sustainable Environment Research Center,
National Cheng Kung University, Tainan, Taiwan**

Nanosize controllable hollow carbon spheres (^{H}@C) with cage diameters of 7-20 nm can be synthesized by leaching of core metallic copper (Cu) in the Cu@C core-shell nanoparticles. Oxygen and hydrogen are not found in the outer shell carbons of the Cu@C or ^{H}@C nanoparticles which are consisted of diamond-like and graphite carbons by Raman spectroscopy. The core Cu can be leached out controllably through channels of the carbon shell having the openings of about 0.5 nm. The small angle X-ray scattering (SAXS) studies show that the ^{H}@C nanoparticles have average diameters of 7, 14, and 20 nm with a narrow size distribution. The ^{H}@C can be refilled with metals (such as Cr, Pd, and Cu).

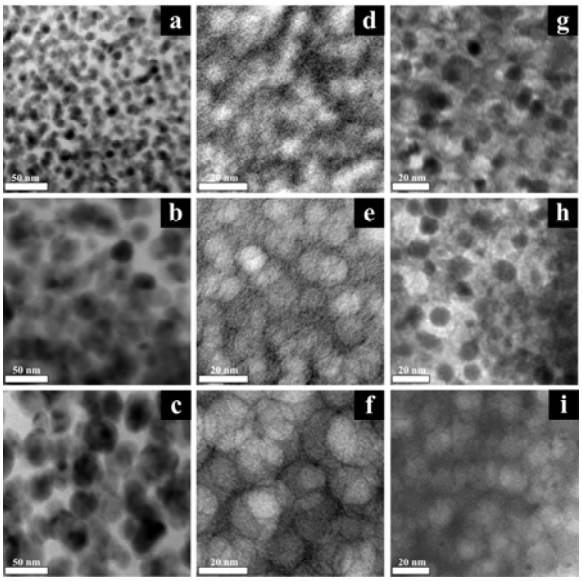

Fig. 1: The TEM images of the Cu@C having Cu diameters of (a) 7, (b) 14, and (c) 20 nm and the ^{H}@C having cage diameters of (d) 7, (e) 14, and (f) 20 nm.

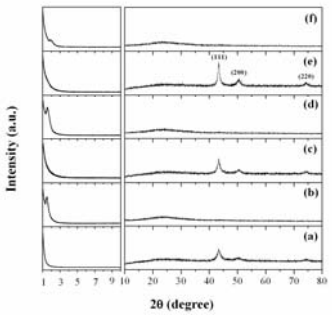

Fig. 2: X-ray diffraction patterns of the Cu@C having core Cu diameters of (a)7, (b) 14, and (c) 20 nm and ^{H}@C having cage diameters of (d) 7, (e) 14, and (f) 20 nm.

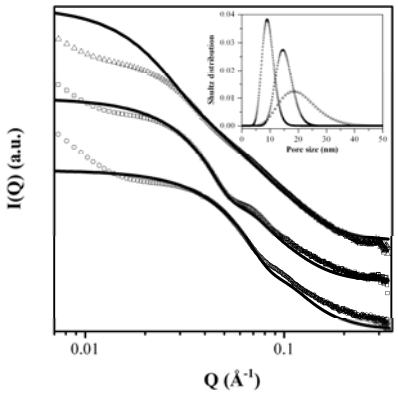

Fig. 3: Cage diameters (7 (○), 14 (□), and 20 nm (△)) in the ^{H}@C studied by SAXS.

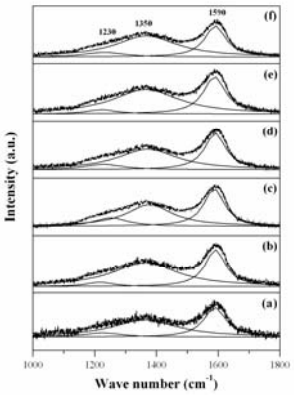

Fig. 4: Raman spectra of the Cu@C having Cu diameters of (a) 7, (c) 14, and (e) 20 nm and the ^{H}@C having cage diameters of (b) 7, (d) 14, and (f) 20 nm.