Pd Nanoparticles Deposited in Multiwalled Carbon Nanotubes as Catalysts for C-C Coupling Reactions

Manoli Cano[a], *Ana M. Benito*[a], *Wolfgang K. Maser*[a], *Esteban Urriolabeitia*[b]
a Instituto de Carboquímica, CSIC, Zaragoza, E-50018, Spain
b Dept Compuestos Organometálicos, Instituto de Ciencia Materiales Aragon, CSIC-Univ. Zaragoza, E-50009 Zaragoza, Spain
mcanogaley@icb.csic.es

Metal nanoparticles are objects of great interest for an enormous number of applications in many fields such as electronics, optoelectronics, biology and catalysis (1,2). In catalysis, the large surface area-to-volume ratio of nanoparticles allows their effective utilization. In this context, catalyst support plays an important role on both catalytic activity and stability. Without suitable support metal particles aggregate, reducing surface area and restricting control over particle size. To overcome this problem several supports have been essayed to immobilize catalytic nanoparticles, e.g. carbon, metal oxides and zeolites (3). Carbon Nanotubes (CNTs) have proven to be a good alternative allowing small and highly dispersed nanoparticles in its structure (2).

In this work, palladium nanoparticles supported on carbon nanotubes were evaluated as catalyst for relevant C-C coupling reactions, for instance in Heck or Suzuki couplings (4).

Palladium nanoparticles were deposited by in-situ decomposition of a palladium complex, tris(dibenzylidenacetone) dipalladium (0), in presence of multiwalled carbon nanotubes under inert atmosphere in toluene. Characterization of the Pd-CNTs catalyst by TEM, SEM, DRX, ICP and elemental analysis was carried out. Homogeneous distribution of Pd nanoparticles on the carbon nanotubes sample, with sizes in the range 4-6 nm were obtained (Fig. 1).

The Pd-loaded CNTs material was used as catalyst for CC couplings between iodebenzene and methyl acrylate (Fig.2) or phenylboronic acid under Ar atmosphere. High yields were obtained, showing the high catalytic activity of the prepared catalysts. Characterization of the catalyst before and after the reaction was carried out.

References:

[1] Drake C, Deshpande, S, Bera, D, Seal, S., International Materials Reviews, 52 (2007) 5
[2] Anson, E. Lafuente, E. Urriolabeitia, E.P. et al., J. of Alloys and Compounds, 436 (2007) 294 [3] a) Liu Z., Ling, X.Y.; Su, X.; Lee, J. Y. J. Phys. Chem. B 108 (2004) 8234; b) Mallick, K.; Scurrel, M.S. Appl. Catal. A. 253 (2003) 527; c) Sun C.; Peltre, M. J.; Briend, M., Blanchard, J. et al. Appl. Catal. A. 245 (2003), 245.
[4] N. Karousis, G. Tsotsou, F. Evangelista et al. J. Phys. Chem. C 2008, 112, 13463-69.

Figures:

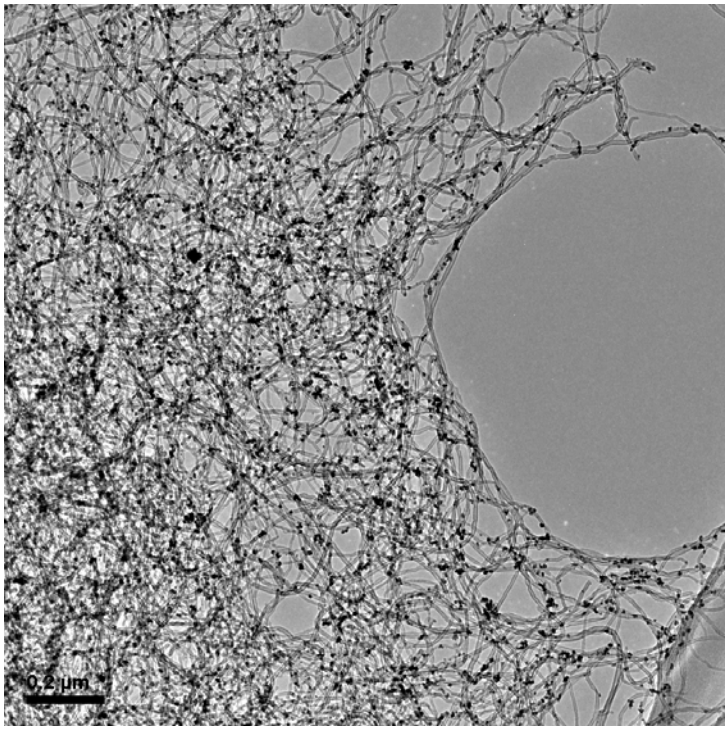

Fig. 1 TEM image of MWNTs loaded of palladium nanoparticles

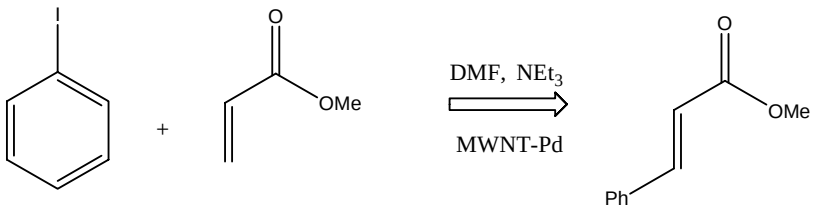

Fig. 2 Heck reaction with MWNT-Pd