MULTIWALLED CARBON NANOTUBES: ENVIRONMENTAL APPLICATION.

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The discovery of carbon nanotubes and the recognition of their exceptional chemical and physical properties [1] has retarded the introduction of these materials.

The high external surface area leads to a significant increase in the surface contact between the gaseous or liquid reactants and the active phase supported on this nanostructured host which is a prerequisite for its use as catalyst support, especially in liquid phase medium where diffusion rate is predominant [2]. Also, the strong interactions between the exposed prismatic planes and the deposited metallic phase provide a high dispersion, which in turn, significantly increases the metallic surface area for the reaction.

In this contribution, CNT-supported Ru nanoclusters (designated as Ru/CNT hereafter) are produced by incipient wetness impregnation with 1% or 2% Ru loading (1Ru(II)/CNT or 2Ru(II)/CNT) and excess solution impregnation with 1% or 2% Ru loading (1Ru(EI)/CNT or 2Ru(EI)/CNT) and their catalytic activities are investigated for phenol oxidation under temperature (140ºC) and pressure (2.0 MPa). The present communication reports one of the first uses of multiwalled carbon nanotubes as catalyst support for an environmental application, the catalytic wet air oxidation of phenol in liquid-phase (continuous trickle bed reactor).

Oxidation treatment on CNT´s introduces a certain amount of carboxylic groups that is necessary for preparing catalyst [3]. The mesoporous structure of Ru/CNT catalyst favors all active sites accessible for catalyst precursor during preparing process and decreases the diffusion limit of reactant and product during reaction.

The nitrogen adsorption isotherms of the Ru/CNT showed type II adsorption isotherms (IUPAC classification) (Fig. 1).

The activity of Ru/CNT catalyst is mainly related to the homogeneous distribution of ultrafine metallic ruthenium particles over CNT (Fig. 2), and the structure characteristics of the support are also favorable. The rate of phenol conversion and mineralization activity are greatly enhanced by the presence of heterogeneous catalysts for reaction times below 10 h.

References:

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[2] J. Garcia, H.T. Gomes, P. Serp, P. Kalck, F.L. Figueiredo, F.L. Faria, Catalysis Today, (2005) in press.
[3] B.C Satishkumar, E.M Vogl, A. Govindaraj, C.N.R. Rao, J. Phys. D: Appl. Phys., **29** (1996) 3173.

Figures:

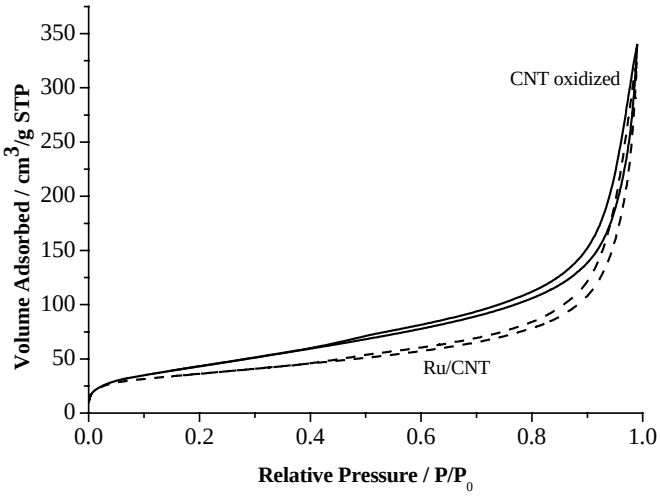

Figure 1. N_2 absorption/desorption isotherm of CNT support and Ru/CNT catalyst.

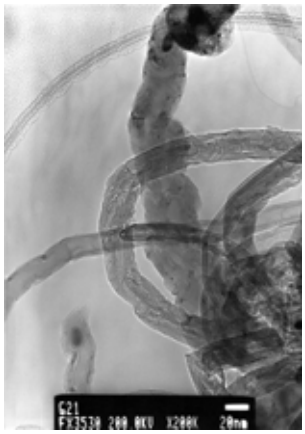

Figure 2. TEM images of the sample loaded with 1% Ru/CNT.

Acknowledgments

The authors gratefully acknowledge the financial support from the Ministerio de Educación y Ciencia (Project CTQ2004/05141) and from the Comunidad de Madrid (GR/AMB/06/09/2004).