# INFLUENCE OF METALS AND REACTION CONDITIONS ON THE CHEMICAL VAPOR DEPOSITION PRODUCTION OF CARBON NANOTUBES OVER SOL-GEL CATALYSTS

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Gaining knowledge on the effect of the different parameters that take part in the production of carbon nanotubes (CNTs) is crucial in order to optimize the synthesis method of such materials. The fact that different potential applications need carbon nanotubes with specific properties and that those properties are very sensitive to synthesis conditions make the control of the production process even more important. Nevertheless, in order to apply these materials to certain applications such as hydrogen adsorption (where high capacity selective adsorbents are needed) and energy storage, easily scalable processes for massive production of CNTs in high yields are still required in order to make the synthesis costly efficient. Thus, this communication studies the influence of the catalysts and reaction conditions on the production of carbon nanotubes by the CVD method which has been claimed as the best one for large-scale production [1].

Catalysts using MgO as metal support were obtained by the sol-gel technique based on the process described in Ref. [2]. Transition metals like Co, Ni, Y, Mo and their mixtures were employed. Different flow rates of methane (carbon source) and hydrogen (reduction agent) were used while controlling reaction temperature and time. The samples obtained have been characterized by various techniques such as electron microscopy (SEM and TEM), Raman spectroscopy, XRD, EDX, ICPS, TGA and adsorption isotherms.

The decomposition of methane over this type of catalyst generated large production of carbon material which depending on the catalyst employed can reach up to 40 times the weight of the catalyst. Analysis by SEM and TEM (Figure 1) indicates that these samples contain high yield of carbon nanotubes with very low presence of amorphous carbon and small amounts of metal particles, this last confirmed by ICPS and EDX results. Nitrogen adsorption results have shown high $S_{BET}$ areas in comparison with nanotubes obtained from other methods. The diameters and morphology of the tubes is found to depend on the nature of the catalysts and the reaction conditions. More detailed results on the influence of the different parameters on the production process and a deeper characterization of the samples will be presented at the conference. These results are very promising for the future of certain applications in order to reduce the production costs due the high yields obtained and the easily scalable nature of the synthesis method.

**References:**

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**Figures:**

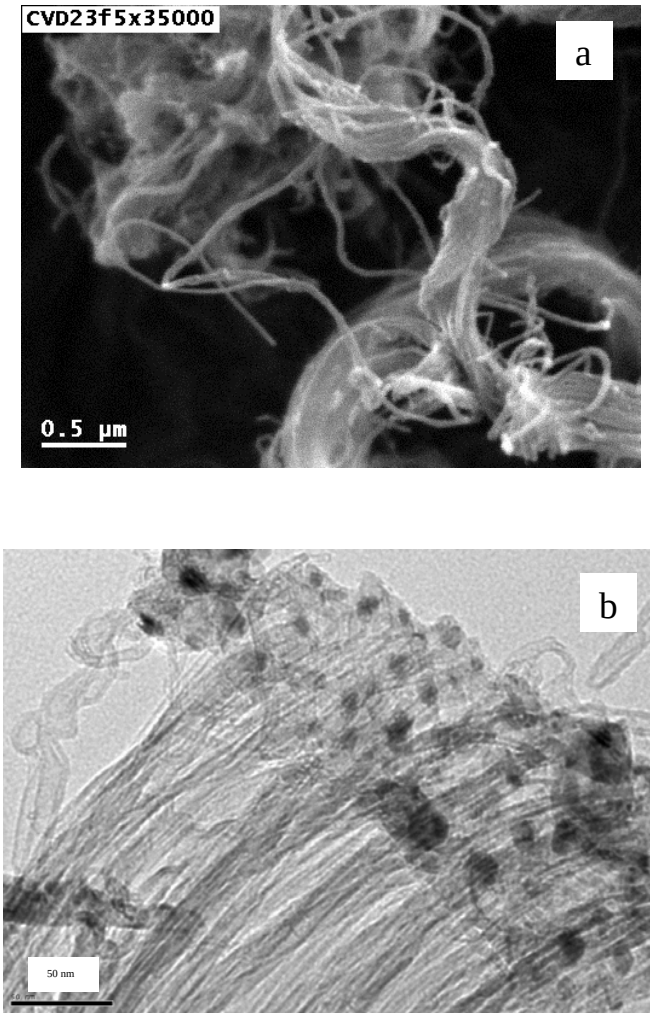


Figure 1: SEM (a) and TEM (b) images of CNTs obtained from Co/Mo catalyst.

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