Carbon nanotubes growth over Fe-Co, Fe-Ni and Co-Ni bimetallic catalysts supported on MgO by the catalytic chemical vapor deposition

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ABSTRACT

MgO supported bimetallic catalysts containing a combination of Fe-Ni, Fe-Co and Ni-Co metals in 1:1 ratio at varying loadings (from 1 to 50 wt %) were prepared by a wet impregnation method. Carbon nanotubes were synthesized over the prepared catalysts by the catalytic decomposition of acetylene for different reaction conditions. The effect of metals, reaction temperature, reaction time and metal loading to the yield, structural perfection and morphology, of the synthesized carbon products were investigated using a combination of powder X-Ray diffraction (XRD), thermal analysis (TGA/DTA), Scanning- Electron (SEM) and Scanning Tunneling (STM) microscopies as well as Raman and Ultra Violet Photoemission (UPS) spectroscopies. The results revealed that the selection of the metals, the growing conditions and the metal loading are critical for the nature of the synthesized carbon nanotubes and can assign their yield and their overall quality. The synthesized carbon nanotubes, exhibit extended crystallinity while they were synthesized at high yields. MgO was dissolved from the synthesized CNTs using low concentration acid solutions, leaving the structural characteristics of CNTs intact.

Fe-Co and Co-Ni catalysts can be used to selectively produce single- or multi-wall carbon nanotubes at high yileds (more than 100%) by the catalytical decomposition of acetylene. At higher temparatures (more than 800 ^{o}C) and short reaction times (less than 30min) single-wall carbon nanotubes dominate. Despite of the conditions of the reaction, pyrolysis of acetylene over Fe-Ni catalysts results in the formation of MWCNT like strucutres.

Keywords: *Carbon Nanotubes, CCVD, MgO, Bimetallic Catalysts*