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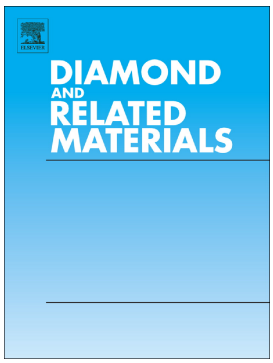

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Using benzene as growth precursor for the carbon nanostructure synthesis in an inverse diffusion flame reactor

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Abstract

The synthesis of carbon nanostructures, (CNS), with tubular-like morphology were carried out over Ni and NiFe catalysts introduced into different inverse diffusion flames environments fueled with ethylene, ethylene-benzene and benzene. In general, only the ethylene and benzene-doped ethylene flames could produce CNS since the pure benzene flame favored the soot formation path. Although the addition of benzene into the flame favored the CNS production in mass and particle dimensions, a loss of quality of the internal structure of the tube walls was seen particularly when the NiFe catalyst was used. Three types of tubular structures were obtained depending of flame and catalytic system. The multi-walled carbon nanotubes were only observed in the ethylene flame (800 K - 1400 K) over the Ni catalyst, while the hollowed and solid carbon nanofibers were observed in the ethylene-benzene flame (800 K - 1200 K) over both the Ni-based and NiFe catalysts. Also, a small amount of carbon nano-onions were seen at the tip of the ethylene-benzene flame where temperature was closer to 1400 K. In all cases, the base-growth model was the dominant mechanism for the tubular CNS found at the periphery of the flame, a place where the most important chemical species concentration (CO, C_2H_2 C_6H_6 and H_2) was higher enough for catalyst activation.

Keywords: Inverse diffusion flame; carbon nanotubes; carbon nanofibers synthesis; carbon nano-structures; benzene.

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