The effect of oxidative heat treatment on the preparation of stainless steel 304 and 316 as the effective catalytic substrate for carbon nanotube growth

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Abstrak

Stainless Steel (SS) is the potential substrate in Carbon Nanotube (CNT) synthesis; Iron (Fe) and Nickel (Ni) content make SS function doubly as substrate and catalyst. In this study, SS is prepared with chloride acid, HCl (37.8%) and oxidative heat treatment (OHT) at 850oC for 30 minutes. This study aims to identify the effect of OHT on SS in CNT's formation. The identification is done by using carbon sources of acetylene and camphor. The substrate of SS 304 is varied into foil, plate and wire mesh. The result of using acetylene for 20 minutes in respect of the three variations produces carbon loss of over 90%. This is due to an increase in the Cr percentage which inhibits the formation of the catalyst's nanoparticles. With the help of ferrocene foil substrate, plate, and wire mesh, the CNT produced are 0.0573 gram, 0.0701 gram, and 0.1246 gram along with a reduction in carbon loss to 30%. The use of the substrate of SS 316 with lower Cr content and additional time of synthesis to 60 minutes yields the mass of 0.6325 gram and carbon loss of 2.76%. By using camphor for 60 minutes, the identification results in an increase of CNT mass in SS 304 of 0.831 for foil, 1.856 for plate and 2.6305 for wire mesh. Scanning Electron Microscopy-Energy Dispersive X-Ray Spectroscopy (SEM-EDX) is used to identify the carbon form on the surface of the SS while Gas Chromatography Flame Ionization Detector (GC-FID) is used to identify the acetylene decomposition. Based on this experiment, SS 304 and 316 type along with the OHT preparation method can be used easily as an effective substrate to produce CNT.