

Effect of catalyst and substrate on growth characteristics of carbon nanofiber onto honeycomb monolith

ABSTRACT

Carbon nanofiber coated monolith with a homogeneous and consistent layer was prepared by catalytic decomposition of benzene on iron catalyst. A comparative study was carried out on carbon nanofiber growth onto bare monolith, acid modified monolith and wash-coat alumina monolith. The catalyst was prepared by dip-coating the monolith into an iron-salt solution with different concentrations (0.160.3 g/mL), dried, and calcined at 500 °C. It was found that the concentration of catalyst controlled Fe particles dispersion, which in turn was responsible for the catalytic activity. Lower iron concentration loaded monolith showed higher bulk density of nanofibers growth compared with higher concentration of iron solution used. The results demonstrated that after treatment with nitric acid, the surface area of cordierite monoliths could be increased to values as high as 30.6 m²/g. Intertwined bundles of carbon nanofibers grown by this pre-treatment formed of a wide range of diameter sizes with tree like morphology. In addition, wash-coat materials such as alumina, utilized to increase the specific surface area and to distribute the catalyst on the surface of the monolith. The deposition of alumina wash-coat layer caused the iron (Fe) to appear more homogeneously distributed after drying and calcination, indicating Fe-0.26Al₂O₃/monolith to be a superior support to grow CNFs compared to other substrates.

Keyword: Acid modified; Carbon nanofibres; Honeycomb monolith; Iron; Wash-coating alumina