SYNTHESIS OF CARBON NANOSTRUCTURES FROM NATURAL RUBBER

Jaime Abraham Guzmán Fuentes, José de Jesús Contreras Navarrete, Francisco Gabriel Granados Martínez, Jael Madaí Ambriz Torres, Carmen Judith Gutiérrez García, Diana Litzajaya García Ruiz, Ezequiel Huipé Nava, Yesenia Arredondo León, Orlando Hernández Cristobal, Lada Domratcheva Lyova

1Universidad Michoacana de San Nicolás de Hidalgo, Mechanical Engineering, Mexico. 2Universidad Michoacana de San Nicolás de Hidalgo, Electrical Engineering, Mexico. 3Universidad Michoacana de San Nicolás de Hidalgo, Language department, Mexico. 4Universidad Nacional Autónoma de México, ENES Unidad Morelia, Mexico. 5Universidad Michoacana de San Nicolás de Hidalgo, Wood Technology Engineering, Mexico.

Currently, carbon nanostructures have caused great interest in the scientific and technological field due to their excellent properties. However, due to the environment deterioration, it is necessary to look for alternatives that lead to environmental sustainability. The present research shows the results of the synthesis of carbon nanostructures obtained a natural rubber source by Chemical Vapor Deposition (CVD). Natural rubber was used as a carbon precursor and stainless steel bar AISI 304 as catalyst. The synthesis temperatures were 750, 800 and 850°C during 1 hour into a quartz tube reactor. It’s important to mention that the sample each experiment was divided in two parts: one obtained the steel bar and another the quartz tube internal surface. The obtained samples were characterized by Scanning Electron Microscopy (SEM), Raman and Fourier Transform Infrared Spectroscopy and Energy Dispersed Spectroscopy (EDS). The temperature variation and the catalyst surface influence in the carbon nanostructures shape. The samples obtained at 850°C the steel bar surface were Carbon Nanotubes (CNTs) with diameters between 250 and 300 nm. Decorated nanotubes (300-400 nm diameters) with semi-spherical particles (100-150 nm diameters) were obtained at the same temperature the quartz tube surface. At 800°C on the steel bar surface, spherical particles with diameters of 200-1200 nm were formed. Graphite was formed at the same temperature on the quartz tube surface. Spheres with diameters between 500-1500 nm were obtained at 750°C on the steel bar catalyst, while small particles with diameters between 15-20 nm were found in the quartz tube surface. EDS analysis showed that obtained nanostructures contain around 90% of carbon, about 9% of oxygen and 1% of iron and other elements traces. The research demonstrated that natural rubber is a promising precursor for the synthesis of CNTs, nano-spheres and decorated CNTs by the chemical vapor deposition.

Keywords: nanomaterials, rubber, CVD

Acknowledgment:

Authors are grateful to the Scientific Research Coordination of UMSNH and CONACyT for the financial support.

Presenting author’s email: ladamex@yahoo.es