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Alternative method for the production of Carbon nanoparticles by a Laser-furnace technique

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Abstract – Carbon nanostructures were synthesized by the laser ablation of a heavy hydrocarbon using Helium heated with an electric furnace as inert atmosphere. The hydrocarbon was irradiated by a CO_2 laser in order to vaporize it and to produce the carbon soot that contains the nanostructures. The effect of the temperature of He on the type of carbon structures formed during the hydrocarbon vaporization was studied over the range of 25-700°C. The species were characterized by IR Spectroscopy, UV-Vis Spectroscopy and Scanning Electron Microscopy. A higher yield of nanostructures showing closed cage structure is obtained when high temperature is used.

The development and discovery of the first methods [1, 2] for producing carbon nanostructures in macroscopic quantities stimulated an intense scientific activity around alternative routes of production, isolation and separation of these materials, with the intention of exploring their potential applications. These nanostructures show a series of remarkable applications which include their use as superconductors, optical limiters, anti-AIDS drugs, catalysts and catalyst supports, photoconductors, precursors for synthetic diamonds, adsorbents, lubricant additives and plant growth regulators. In the field of alternative and renewable energy production these materials show a good performance as hydrogen storage mediums. Carbon nanostructures have been produced yet by a laser furnace technique using graphite as starting material [3]. In this work, carbon nanostructures were synthesized by the laser ablation of a heavy hydrocarbon under a Helium flow heated with an electric furnace. This heavy hydrocarbon was obtained from molecular distillation, so that high aggregate value may be produced from a residue stream. The hydrocarbon was irradiated by a continuum laser of CO_2 in order to vaporize it and to produce the carbon soot that contains the nanostructures. The effect of the temperature of He on the type of carbon structures formed during the hydrocarbon vaporization was studied over the range of 25-700°C. The carbon nanostructures were isolated from the soot using an organic solvent, in order to identify and characterize them by IR spectroscopy, UV-Vis spectroscopy and Scanning Electron Microscopy (SEM). The composition of the carbon soot is influenced by the carrier gas, showing a higher yield of nanostructures with specific characteristics when high temperature is used.

References

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