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A new perspective for harvesting solar energy on nanostructurated hybrid carbon-based materials - Polluted water, hydrogen photoproduction, solar and fuel cells applications

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Applications of nanostructured C-based materials are shown in this plenary. Nanocrystalline C-doped TiO_2 hybrid hollow spheres were prepared by solvothermal synthesis from mixtures of furfural, chitosan or saccharose with titanium isopropoxide. Origin of carbon influences texture, crystalline framework, optical and photo electrochemistry properties of TiO_2. The results indicate that the C-TiO_2 hybrid hollow spheres may be used as TiO_2-based film electrodes in solar cells with an enhancement of solar energy conversion. Au-supported on C-based materials were prepared and used for hydrogen photoproduction under visible light irradiation. Results showed 3 times higher photoactivity than a commercial photocatalysts attributed to an increase in the resonance plasmon of gold. Photoactivity of S-doped nanoporous carbons was tested using photocurrent generation, cyclic voltammetry and photodegradation of methylene blue (MB) under artificial solar irradiation. Results were compared against those on N-doped and on unmodified carbons and on a commercial TiO_2. An exposure to ambient light has a strong effect on an open circuit potential indicating the strong activity of S-doped carbons in oxidation reactions. The activity in the process of MB degradation was up to about 3 and 6 times higher in mixtures containing S-doped and N-doped carbons than that on a commercial TiO_2. The extent of photoactivity depends both on the composition of the activated carbon and on the sulfur and nitrogen content suggesting harvesting solar energy for environmental and green chemistry applications is possible. Finally, recent approaches of nanostructured Pd/C-based materials in fuel cells nanotechnology are discussed.

Biography

Juan Matos completed his doctorate in Physics and Chemistry of Surface at the Central School of Lyon (France) and the Venezuelan Institute for Scientific Research (IVIC, Venezuela) in 1999. He studied the influence of carbon in heterogeneous catalysis and photocatalytic reactions with different potential applications as solar nanotechnology by using membranes, nanomaterials, solar photoreactors and green chemistry approaches. He was the founder and head of the Department of Catalysis and Alternative Energies at IVIC. He currently has about 65 papers published in high impact journals, about 900 citations and h-factor 13.

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Application of nano cutting fluids to machining: An experimental investigation

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This paper deals with the performance assessment of nanofluids in machining. In order to combat the negative effects of conventional cutting fluids researchers have initiated the search for ecologically safe and user friendly alternatives to conventional cutting fluids. In this context, experiments are being carried out to assess the performance of vegetable oil based nano cutting fluids in machining. An attempt is made in this paper to present the performance of nano solid lubricant suspensions in vegetable oils in the turning of AISI1040 steel by minimum quantity lubrication (MQL).

At first in the present work characterization of nano particles is done by X-Ray Diffraction (XRD) to confirm their purity. In order to assure the nano size of the solid lubricant considered, particle size analyzer is used. After checking the primary properties of the solid lubricant, various samples of nano fluids are prepared by thoroughly mixing small proportions by weight of solid lubricant in vegetable oils. The samples thus prepared are used to assess their viability in machining, by evaluation of basic properties like thermal conductivity, specific heat and heat transfer coefficient from empirical relations. Variation of cutting tool temperatures, average tool flank wear and surface roughness of the machined surface with cutting speed and feed of the prepared nano cutting fluids are graphically analyzed. It has been observed that results are encouraging, and among all the oils used coconut oil based nano fluid has exhibited better performance.

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