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J Nanomed Nanotechnol 2018, Volume 9
DOI: 10.4172/2157-7439-C4-077

Novel hybrid Ga-SBA-3 nanostructured material: Synthesis, characterization and applications

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In this work we study the incorporation of gallium in the structure of the SBA-3 mesoporous material with the purpose of modifying the intrinsic acidity of the material using pyridine in order to determine the acidic sites that this material possesses. In addition, studies of adsorption/desorption of aniline and its subsequent polymerization on the mesoporous Ga-SBA-3 that gives the unique hybrids compound with conductive characteristics similar to those of an inorganic semiconductor. Si-SBA-3 was prepared using CTABr and TEOS, as surfactant and Si source, respectively. To obtain Ga-SBA-3 post-synthesis incorporation was employed. Ga-SBA-3 were dehydrated at 400 °C under vacuum and then were exposed to vapors of pyridine/liquid aniline depending on the studies to be performed (pyridine to determine the acid sites of the material and aniline for subsequent polymerization) at vacuum. The in situ polymerization of aniline was carried out to produce PANI/Ga-SBA-3. The final PANI/Ga-SBA-3 material was characterized by XRD, ICP, SEM-EDX, FTIR and BET. Direct current electrical conductivity measurements were performed using pellets and a four-probe technique, improving the contacts with a gold layer. Higher amount of poly-aniline in conductive emeraldine salt form was found in PANI/Ga-SBA-3 composite, with respect to other composites reported in the literature. At room temperature (273 K), the electrical conductivity of PANI/Ga-SBA-3 was $5.8x10^{-5}$ Scm^{-1}. To explain the semi-conductivity of the composite (nanowire of PANI within Ga-SBA^{-3}), we must consider the configuration of the nanostructured material and the type of PANI anchoring.

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