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J Material Sci Eng 2019, Volume 8
DOI: 10.4172/2169-0022-C1-126

17th International Conference on

Emerging Materials and Nanotechnolgy

March 07-08, 2019 | Berlin, Germany

Big return of the deceased ion-exchanger in the field of nanotechnology as a part of ternary nano-composite comprising of functionalised carbon nanotubes, pani and zirconium molybdate (ion-exchanger)

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In the last few decades, nano-composites have been the topic of interest. Carbon-nanotubes are of significant scientific importance due to their remarkable properties in almost every field, be it electronic, mechanical, thermoplastic, optical, electrical, biological, and environmental. The field of material science is currently undergoing a shift from developing traditional materials such as metals, ceramics, polymers and composites to a more revolutionary trend of developing nanostructures, which are functionalized, self-assisting and occasionally even self-healing. Albeit, these advances are potentially game-changing, excitement must be tempered somewhat as several bottlenecks exist. Nitric and Sulphuric acid (1:3 ratio) treated or functionalized MWCNT(A-CNT) were ultra-sonicated with PANI and ZrMo to obtain a ternary nano composite i.e.CNT/PANI/ZrMo. Inorganic part i.e. Zirconium Molybdate ion-exchanger is prepared by combining Ammonium Molybdate with Zirconium oxychloride. Since, the composite formed is ternary, PANI, the third component is added in all the three samples and in-situ polymerisation occurs. KPS or APS is used as polymerisation initiator or oxidising agent. Three composite samples prepared, one is ZrMo/PANI, the second one is ZrMo/PANI/(0.25g)MWCNT and the third one ZrMo/PANI/(0.75g)MWCNT. These samples are properly dispersed using ultra-sonicator and centrifuged for proper separation in the presence of SDS/DBSA/CTAB which acts as a surfactant. The composite when underwent various studies showed enhanced thermal conductivities, photocatalytic activity, antibacterial and anti-cancer properties as well. TEM and SEM analysis defined the morphology and excellent dispersion of CNTs in the composite where CNT appears as an axis over which PANI is surrounded like a uniform layer and ZrMo is filled in the inner cavities both giving backbone to the nano composite.

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Chemical nano metallurgy with structural and behavioral anisotropy

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Metallurgy is a quite cumbersome phenomenon, which involves reduction conditions at higher temperature that is usually more than thousand degrees centigrade. It involves, reduction of metal ores, calcination of their atoms, annealing of their atoms and surface electrochemistry simultaneously. It is unable to produce structural or behavioral anisotropy at any stage, and material produced is isomorphic and properties are from the average of each crystalline phase. This conventional metallurgy is not applicable for production of metal nanostructures which are close to the metal materials form. Therefore, beaker metallurgy may prove useful to produce structural anisotropy that can result into anisotropic behavioral outcome. The polyol reduction is a chemical metallurgy that is assigned the designation of beaker metallurgy and it works under comparatively quite less temperature or mild temperature conditions. It with in the presence of templates can refine metallic ore, and bears the potential to design different architectures. It can be applied to design 0, 2D and 1D including quantum dots. The materials produced by this strategy possess great structural anisotropy. The mechanism involves the hydride transfer for such metallurgy. It is applicable for the production of many metal oxides of low oxidation state nanostructures, like; ZnO and Iron Oxides. Furthermore, it can develop metal-metal hetrojunctions of different mode. The preferred modes are linear conjuction and core@ shell hetrojunctions. These modes were achieved for Ag and Pd nanostructures. The designed modes inhere, were aimed for the investigation of effect of one metal for other, particularly on catalytic properties. The material was characterized and monitored by UV-Vis Spectrophotometer, XRD, and SEM coupled with EDS. The catalytic properties were analyzed for carcinogenic dyes and pure oxidation reduction organic reactions. The substrate included azo dyes, carbazole based materials and organic nitro groups. The catalyst was used for more than three cycles and close reproducibility was observed at each time. Therefore, such designed nano modes were found unique nano designs with excellent catalytic outcomes.

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