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Synthesis and Microscopic Characterization of Metal and Metal Alloy Nanoparticles Coated CNTs Hybrid Composites

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Microwave heating offers some advantages compared to conventional heating processes such as the use of a remote source, the relative speed of the process, and the volume and materials selectivity [1]. The polyol method is a low-temperature process that is environmentally friendly because the reactions are carried out under closed-system conditions. It was first introduced to produce submicron-sized metal powders. In this method, a suitable solid metal salt is suspended in a liquid polyol. The suspension is stirred and heated to a certain temperature, the reduction of the starting compound yields fine metal powders. The polyol itself acts not only as a solvent in the process but also as a stabilizer, limiting particle growth and prohibiting agglomeration. Recently, this method has also been extended to the preparation of metal oxides and metal chalcogenides [2]. Several researchers have demonstrated that in these reactions the temperature is a dominant factor in affecting the reactivity. They are: (a) the reduction potential of ethylene glycol, (b) the rupture, and creation of chemical bonds, and (c) diffusion [3-4]. All these three factors make microwave-heating techniques favorable for the fabrication of metal and metal oxides by using ethylene glycol as a solvent.

Metal and metal alloys nanoparticles in the presence and absence of Multiwalled Carbon Nanotubes (CNTs) have been synthesized by using microwave irradiation. Ag, Cu, Ag-Cu and Ag/CNTs, Cu/CNTs and Ag-Cu/CNTs nanoparticles of uniform size and shape are synthesized using dimethylformamide in case of Ag nanoparticles synthesis and ethylene glycol in case of Cu and Ag-Cu as reducing agent and as well as a solvent. X-ray diffraction and transmission electron microscopy are used to characterize both the nanoparticles and decorated CNTs. It is found that the morphology of the nanoparticles is controlled by the amount and type of the protecting agent used. The microwave assisted polyol process is found to be faster than the conventional-polyol process. The decorated CNTs are infused in polymer resin system to produce nanocomposites for various applications. These nanocomposites are characterized by thermal and mechanical properties and significant improvements are observed as compared to their neat counter parts.

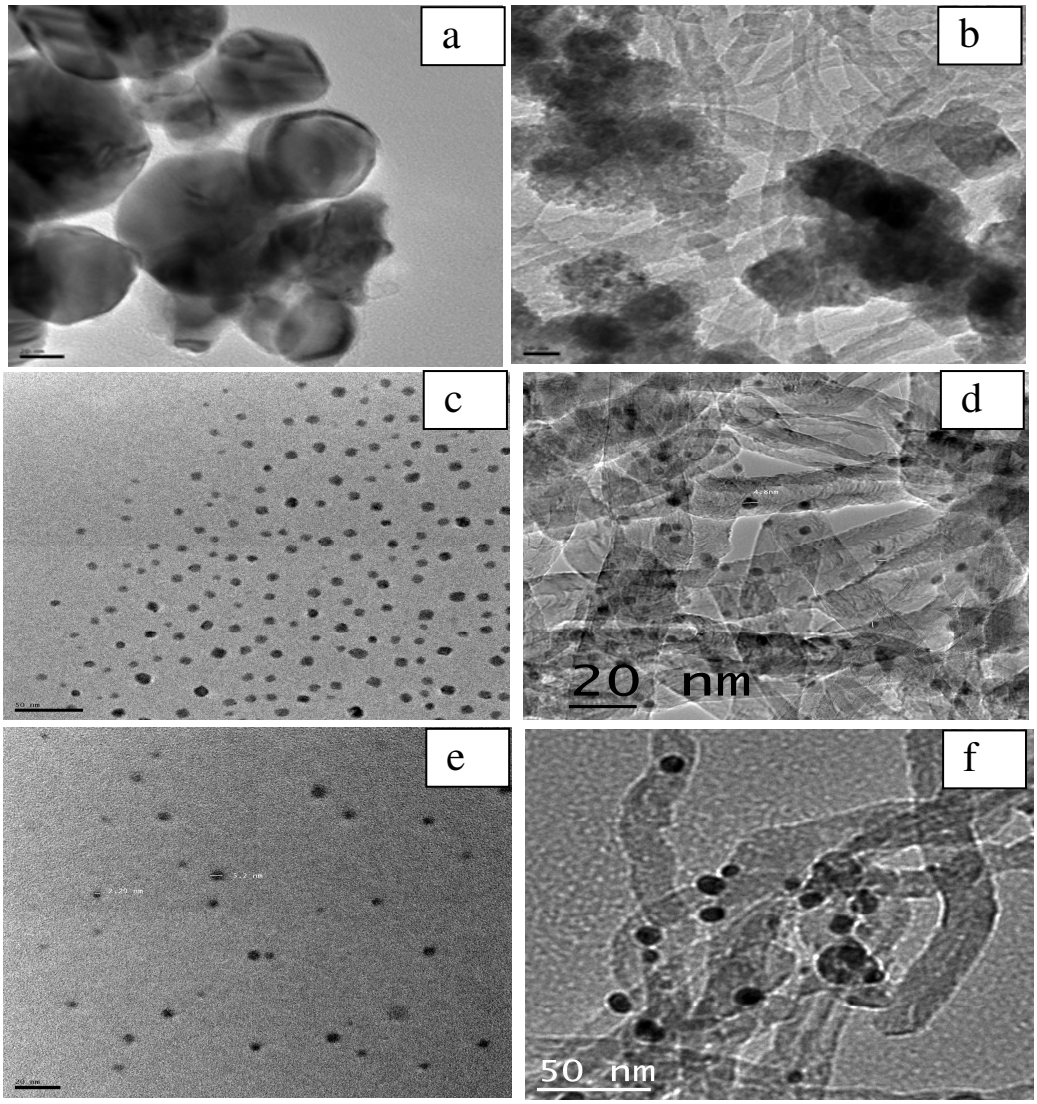

FIG 1. Transmission electron micrograph of as-prepared (a) Cu nanopartiale (b) Cu coated CNTs c) Ag nanoparticle (d) Ag coated CNTs (e) Au-Cu alloy nanoparticle (f) Au-Cu coated on CNTs

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