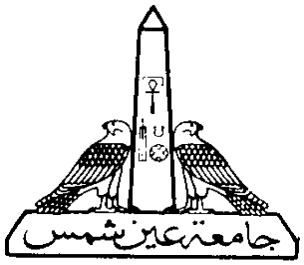

Faculty of Science
Ain Shams University

Physico-Chemical Properties of Polymer Nanocomposites

By

Islam Ali Elsayed Ali

A Thesis submitted to the

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In Partial Fulfillment of the Requirements for the

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In

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Cairo, Egypt

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Islam Ali Elsayed Ali ***2015***

Aim Of The Work

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Nanocomposites are of great interest in recent years because they are considered to be novel functional materials with a wide range of potential applications in bio and chemical sensors, electronics, catalysis and optics. A number of production techniques have been reported for preparation of metallic colloids using metal salts as starting materials, such as chemical, photochemical, electrochemical, radiolytic, and sonochemical reduction. Due to its unique advantages, the irradiation-based strategy, as a wrathful tool, has been extensively used to prepare nanoscale particles and materials.

In this thesis, we have developed a novel approach to synthesize silver / polystyrene/polyvinylpyrrolidone (Ag/PS/PVP) nanocomposite hybrid material which is based on the seeded growth of Ag nanoparticles within PS/PVP matrix. In this synthetic strategy, we use gamma-irradiation, to utilize the reorganized seed points, or nucleation sites, to initiate the growth of Ag nanoparticles directly on the polymer backbone. Gamma irradiation of Ag/PS/PVP nanocomposite can reduce metal ions to zero valent metal particles, avoiding the use of additional reducing agents and the consequent side reactions. Furthermore, the amount of zero valent nuclei can be controlled by varying the irradiation dose. Homogeneous formation of silver nanoparticles (AgNPs) is favorable as it results in uniformly dispersed nanoparticles. Through this process we are assured of successful producing of PS polymer filled with high monodispersed silver nanoparticles (AgNPs). Polystyrene (PS), which is a water insoluble polymer, has important advantages of good

mechanical and acoustic optical properties, where this parameter determines the photo induced response in the newly suggested composite. In our experiment, polyvinylpyrrolidone (PVP) was used as a polymer capping reagent, utilizing the interactions of silver ions with aminogroup in the poly vinyl pyrrolidone molecules.

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