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Synthesis and Adsorption Properties of Gold Nanoparticles within Pores of Surface-Functional Porous Polymer Microspheres

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Mesoporous polymer microspheres with gold (Au) nanoparticles inside their pores were prepared considering their surface functionality and porosity. The Au / polymer composite microspheres prepared were characterized by transmission electron microscope (TEM), X-ray diffraction (XRD), and Brunauer–Emmett–Teller (BET) techniques. The results showed that the adsorption of Au nanoparticles could be increased by imparting the pore structure and surface–functional groups into the supporting polymer microspheres (in this study, poly (ethylene glycol dimethacrylate–co–acrylonitrile), poly (EGDMA–co–AN) system). Above all, from this study, it was established that the porosity of the polymer microspheres is the most important factor that determines the distribution and adsorption amount of face-centered cubic (fcc) Au nanoparticles in the final products. Our study showed that the continuous adsorption of Au nanoparticles with the aid of the large surface area and surface interaction sites formed more favorably the Au/polymer composite microspheres. The BET measurements of Au / poly(EGDMA–co–AN) composite microspheres reveals that the adsorption of Au nanoparticles into the pores kept the pore structure intact and made it more porous.

Keywords: mesoporous polymer microspheres, adsorption, surface functionality, pore structure, poly (ethylene glycol dimethacrylate–co–acrylonitrile)

Charge transport of multiwalled carbon nanotube–poly(methyl methacrylate) composites and electrostatic application

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Thin films of multiwalled carbon nanotube (MWCNT)–poly (methyl methacrylate) (PMMA) composites were synthesized to study electrical properties of metal–insulator transition. MWCNTs were synthesized by conventional chemical vapor deposition method. MWCNTs of various weight concentration were dispersed in insulating PMMA matrix by high power sonication for 12 h. For charge transport properties of the composites, dc conductivity ($\sigma_{dc}$) and its temperature dependence [$\sigma_{dc}(T)$] were measured in the range of 0.3 K ~ 300 K. The $\sigma_{dc}$ at room temperature increased as MWCNT concentration increased, which shows typical percolation behavior. The $\sigma_{dc}(T)$ of the composites with high concentration of MWCNTs shows metallic behavior at low temperatures which originated from metallic property of one dimensional carbon nanotubes. We synthesized the spin-coated of composites at low concentrations of MWCNTs onto glass substrate to examine electrostatic application. AC dielectric constant of the composites was measured in the range of 10 Hz ~ 2MHz to study charge storage capability.

Keywords: 탄소나노튜브, 정전방지, 복합체