Nanotechnology Letters

Extended Abstract
Vol. 4, Iss. 4
2019

Nanoscience 2019 and Graphene 2019 : Fabrication, Characterizations, and Greatly Enhanced Dielectric Properties of Poly(vinylidene fluoride) Nanocomposites Using Silver-Based Hybrid Nanoparticles as Filler- Dr. Prasit Thongbai - Khon Kaen University, Thailand

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There is an increasing need for high–permittivity polymer–matrix composites (PMC) owing to the rapid development of the electronics industry. Unfortunately, the dielectric permittivity of PMC is still too low (□□ < 80). Moreover, the dielectric loss tangent is usually high (tan□ > 0.1) when the dielectric permittivity of PMC increased. In this research work, the dielectric properties of poly(vinylidene fluoride) (PVDF)–based nanocomposites can be significantly improved by incorporating with silver–BaTiO3 (Ag–BT) ceramic hybrid nanoparticles. The fabricated Ag–BT/PVDF nanocomposites are systematically characterized to explain the dielectric behavior in Ag–BT/PVDF nanocomposites. Interestingly, largely enhanced dielectric permittivity (□□>240) and suppressed loss tangent (tan□<0.08) over a wide frequency range (102 – 105 Hz) are obtained. Notably, the dielectric permittivity is slightly dependent on temperature. Composites are yet another powerful tool for the development of specific material according to our needs. Fusion of the above-mentioned two mighty tools results in birth of a whole new domain called nanocomposites. This unit provides details about different aspects of nanomaterials, composites, and their categories. This chapter talks thoroughly about the basics behind the various synthesis process involved along with optimization of various parameters related to fabrication of such nanocomposites. Among the pool of nanocomposites, silver nanoparticles and the composites based on these particles have harnessed much attention because of the striking properties of Ag nanoparticles like high electrical and thermal conductivity, chemical stability, catalytic activities, antimicrobial properties, nonlinear optical behavior, and surface-enhanced Raman scattering. Various type of metal nanoparticles have been prepared using advance techniques.

Nanoparticle modification with other nanoparticles is also an important research filed [18-24]. One of the method is reduction of metal ions to form protective colloids. Water-soluble polymers such as poly(vinyl alcohol), poly(N-vinylpyrrolidone), poly(methyl vinyl ether), etc. have been used for the preparation of metal particles. Among metal nanoparticles, silver nanocrystallites are predominantly fascinating due to exciting characteristics. Various reductants have been used to prepare colloidal silver in the presence of copolymers. Another successful method for the preparation of Ag nanoparticles is in the presence of UV irradiation and poly(N-vinylpyrrolidone). An important property of silver ions is bacteriostatic/ bactericidal nature. Therefore, silver nanoparticle (AgNP) have been used as antibacterial agent to increase bacterial resistance to conventional bactericides and antibiotics. The antimicrobial activity of silver nanoparticles combined with chitosan or cellulose have been rarely studied [25-33]. Moreover, cellulose/silver nanoparticle in polymer nanocomposite can be employed as biocompatible materials with enhanced antimicrobial activity.

This work is partly presented at Joint Event on EuroSciCon Conference on Nanoscience and Technology and EuroSciCon Conference on Graphene & Carbon Nanotechnology November 25-27, 2019 held at Tokyo, Japan