

Core-shell structured BaTiO₃/PVDF nanocomposites prepared by RAFT and click chemistry for energy storage: structure and characterization

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Dielectric materials with high dielectric constants and low dielectric losses have attracted significant attention in the recent years due to their wide range of potential applications in telecommunications equipments, automotive and electronic devices such as multilayer, embedded, and high energy density capacitors.^[1,2] Therefore, the energy density can be enhanced either by increasing the dielectric constant or increasing the electric breakdown strength of the materials. The preparation of core-shell structured high dielectric constant nanoparticles by “grafting from” and “grafting to” techniques had received many interests.^[3]

Core-shell structured poly(vinylidene fluoride) / baryum titanate (BaTiO₃-g-PVDF) nanocomposites were prepared by surface-initiated reversible addition-fragmentation chain transfer (RAFT) of VDF from the surface of functionalized BaTiO₃ nanoparticles. The first step aimed to functionalize the surface of the BaTiO₃ as received to create initiating functions and sites for the RAFT polymerization using potassium ethyl xanthate as the salt to allow the formation of macrochain transfer agent. Then, grafting of VDF onto the surface of modified BaTiO₃ was achieved by RAFT polymerization using different amounts of BaTiO₃ starting from 3, 5, 10 and 20 wt % and the effect of the percentage on the properties of the nanocomposite was investigated. The resulting nanocomposites were characterized by FTIR and HRMAS ¹⁹F NMR spectroscopies, SEC, XRD, SEM (EDX), TEM, TGA and DSC. In addition, preliminary study of the preparation of BaTiO₃/PVDF nanocomposites via click chemistry was also studied. The first step is to functionalize BaTiO₃ decorated by propargyl bromide on its surface. Then, a click reaction (Huisgen) was performed to attach PVDF-CH₂-CH₂-N₃ onto such functionalized nanoparticles.

References

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