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PVP-assisted interfacial engineering of PVC/B_4C nanocomposites: dielectric relaxation and charge transport

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Abstract
This paper examines the dielectric properties (dielectric constant, dielectric loss, and AC conductivity) of polyvinyl chloride (PVC) nanocomposites reinforced with boron carbide (B_4C) nanoparticles manufactured by the use of the solution-casting method and filler loads 0, 5, 10, 20, and 30 wt%. SEM of pure PVC, pristine B_4C and the composites established that filler had been incorporated successfully and morphology of dispersion depending on loading was as expected based on electrical response. The introduction of B_4C to the samples increased ε′ from 7.6 (pure PVC) to 22.4 at 30 wt% (at 1 kHz) due to the facilitation of interfacial polarization and semi-conductive pathways within the polymer structure. The loss tangent also decreased with frequency as a measure of lower interfacial polarization at the higher frequencies. AC conductivity showed a significant enhancement with B_4C loading because of the formation of interconnected charge transport channels. The results mentioned above demonstrate the high potential of PVC/B_4C nanocomposites in applications in high technology electronics, electromagnetic interference (EMI) shielding and high frequency insulation systems with better dielectric and AC conduction characteristics.

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