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Properties of Poly(carbonate) Containing Oxide Nanoparticles[1]
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— Nanocomposites composed of poly(carbonate) (PC) and oxide nanoparticles have been studied. For $BaTiO_3$ both as-received and surface-treated (3-aminopropyl-trimethoxysilane) nanoparticles were utilized. The complex relative permittivity, $\varepsilon^* = \varepsilon' - j\varepsilon''$, at audio frequencies from 5K to about 500K and the room temperature breakdown strength have been determined. Also, SEM, DSC and TGA studies have been carried out. ε' is 11 for PC containing 59 wt-% of untreated 50-70 nm diameter $BaTiO_3$ and ε' vs. nanoparticle content is larger than would be expected on the basis of the modified Hanai equation. Also, the breakdown strength is low and decreases as nanoparticle content increases. However, ε' is low and the breakdown strength is high for PC containing the surface-treated nanoparticles. The gamma relaxation (200K and 1000 Hz) does not change as nanoparticle content increases to 59 wt-%. Also, a low temperature relaxation region (in the vicinity of 20K) associated with the nanoparticles is found in the nanocomposites. Next, the breakdown strength increases as $BaTiO_3$ nanoparticle size increases from 50 nm to 500 nm.

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