

Ultrasonic Spectroscopy of Polymer Based PVDF-TrFE Composites with CNT Fillers

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Abstract : Ferroelectric polymers exhibit good flexibility, processability and low cost of production. Doping of ferroelectric polymers with nanofillers may modify its dielectric, elastic or piezoelectric properties. Carbon nanotubes are one of the ingredients that can improve the mechanical properties of polymer based composites. In this work, we report on both the ultrasonic and the dielectric properties of the copolymer polyvinylidene fluoride/tetrafluoroethylene (P(VDF-TrFE)) of the composition 70/30 mol% with various concentrations of carbon nanotubes (CNT). Experimental study of ultrasonic wave attenuation and velocity in these composites has been performed over wide temperature range (100 K - 410 K) using an ultrasonic automatic pulse-echo technique. The temperature dependences of ultrasonic velocity and attenuation showed anomalies attributed to the glass transition and paraelectric-ferroelectric phase transition. Our investigations showed mechanical losses to be dependent on the volume fraction of the CNTs within the composites. The existence of broad hysteresis of the ultrasonic wave attenuation and velocity within the nanocomposites is presented between cooling and heating cycles. By the means of dielectric spectroscopy, it is shown that the dielectric properties may be tuned by varying the volume fraction of the CNT fillers.

Keywords : carbon nanotubes, polymer composites, PVDF-TrFE, ultrasonic spectroscopy

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