

Calorimetric and dielectric studies of PLZT-P(VDF/TrFE) cposite

**Boris Vodopivec, Zdravko Kutnjak, Vid Bobnar, Adrijan Levstik, Marija Kosec,
Bozena Hilczer**

Institute of Molecular Physics - POLAND - EUROPE

Abstract

Calorimetric and dielectric response in lead lanthanum zirconate titanate-poly(vinylidene fluoride / trifluoro ethylene), PLZT-P(VDF/TrFE), ceramics-copolymer composite has been studied by ac and relaxation calorimetry and temperature and frequency-dependent linear and third-order nonlinear dielectric spectroscopy. Results were compared to those obtained in the pure poly(vinylidene fluoride / trifluoro ethylene), P(VDF/TrFE) (50/50), copolymer.

A paraelectric-to-ferroelectric phase transition in the crystalline region and a dielectric relaxation, which is a dynamic manifestation of the glassy-to-rubbery state transition in the amorphous phase of the system, were detected. The nature of the paraelectric-to-ferroelectric phase transition has been studied in detail by high-resolution ac calorimetry and nonlinear dielectric measurements. The dielectric dynamic processes in the composite are dominated by those of the copolymer matrix, while the dielectric constant of the composite was found to be much larger due to the high dielectric constant of PLZT ceramics. In addition, heat capacity measurements reveal that excess enthalpy decreases with increasing concentration of 9.5/65/35 PLZT ceramics, which itself does not exhibit paraelectric to ferroelectric phase transition and also that the excess enthalpy increases under bias electric field which induces ferroelectric phase in relaxor PLZT ceramics. Dielectric response of this piezoactive composite can thus be easily tuned by simply changing the PLZT/copolymer ratio or by applied bias electric field. This feature, together with the fact that it can easily be prepared in a variety of shapes, makes PLZT-P(VDF/TrFE) composite a very promising material for numerous applications.