Dielektrinės $BaTiO_3$ pagrindu pagamintų kompozitų savybės

Dielectric Properties Of $BaTiO_3$ Based Composites

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For the past 40-50 years, lead based perovskite $Pb(Zr_xTi_{1-x})O_3$ (PZT) piezoelectric ceramics have dominated the commercial market of piezoelectric devices due to their remarkable dielectric and piezoelectric properties and ability to operate in wide temperature range. But due to environmental concerns the use of PZT in the European Union was limited.

In our presentation broadband dielectric properties of $BaTiO_3$ (BT) based composites with core-shell superstructure will be presented. The composites were prepared in two steps. BT, $BiFeO_3$ (BF), $BaTiO_3$-$Bi(Mg_{0.5},Ti_{0.5})O_3$ (BT-BMT) and $BaTiO_3$-$Bi(Mg_{0.5},Ti_{0.5})$ O_3-$BiFeO_3$ (BT-BMT-BF) nanoparticles were compressed into low density pellets and head treated to create a necking structure. Then using solvothermal reaction method the epitaxial layer of BT was deposited around BT, BF, BT-BMT and BT-BMT-BF particles. In such systems cores are stressed by barium titanate shell creating similar conditions as inmorphotropic phase boundary (MPB), thus increasing dielectric and piezoelectric constants.

Dielectric measurements were performed in 120 – 500 K temperature and 10^1 – 10^9 Hz frequency range. The specimen was polished and washed in acetone bath then parallel electrodes were made using silver paste. In frequency range from 10^1 to 10^6 Hz the complex impedance was measured using HP 4284A precision LCR meter. To obtain highest frequencies (10^6-10^9Hz) the coaxial line was terminated by a flat capacitor - reflection and phase were measured using Agilent 8714ET RF network analyser. All measurements were performed during cooling cycle at 1 K/min rate. We have investigated 4 different composite systems where core is a good dielectric, a relaxor, a ferroelectric and a non-ferroelectric material. In figure 1 we show temperature dependence of a composite: $BaTiO_3$-$Bi(Mg_{0.5},Ti_{0.5})O_3$ relaxor core with $BaTiO_3$ ferroelectric shell. We have observed an anomaly at 1MHz at 382K temperature. The temperature of an anomaly coincides with an anomaly of a relaxor part found in a paper written by Xiong [1].

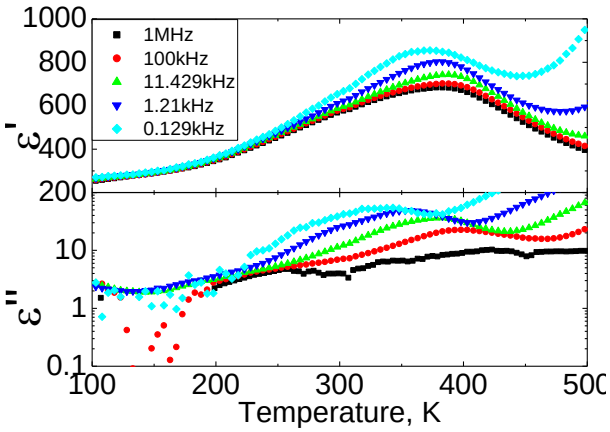

Fig. 1. Temperature dependence of BT/BT-BMT composite at different temperature

Key words: Dilectric permmitivity, Barium titanate, temperature dependance, phase transitions.

Literature

[1] B. Xiong, H. Hao, S. Zhang, H. Liu, and M. Cao, "Structure, Dielectric Properties and Temperature Stability of BaTiO3–Bi(Mg1/2Ti1/2)O3 Perovskite Solid Solutions," *J. Am. Ceram. Soc.*, vol. 94, no. 10, pp. 3412–3417, Oct. 2011.