Bario titanato, legiruoto Ce^{3+}, dielektrinės savybės

Dielectric Properties of Barium Titanate Doped with Ce^{3+}

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Ferroelectricity in barium titanate (BT) has already been studied for more than 70 years. Still this material attracts a lot of attention because some of its properties are not quite well understood. It is also important from the application point of view. This material has become one of the most important electroceramic materials [1] due to its dielectric, ferroelectric and piezoelectric properties. Ferroelectric properties and a high dielectric constant make BT useful in an array of applications such as multilayer ceramic capacitors, gate dielectrics, waveguide modulators, IR detectors and holographic memory [2].

Most of the recent studies are concentrated on the doping of barium titanate with various ions. A lot of studies are concentrated on the rare-earth metal ion doping. Such kind of lattice substitution can affect the properties of BT quite drastically. The addition of different ions can lead to very complex behaviour. One of the best examples is the mixtures between barium titanate and barium zirconate. This system shows very complicated crossover in the phase diagram between ferroelectric, relaxor and incipient ferroelectric phases. Among BT-based ferroelectric relaxors, Ce-doped $BaTiO_3$ received much attention, both due to fundamental and application interests [3].

This study is devoted to the investigation of broadband dielectric spectroscopy of barium titanate doped with different concentration of cerium ions. Ceramic samples of BT doped with Ce^{3+} were prepared by solid-state reaction in order to promote the incorporation of Ce ions into B sites. The investigation was carried in a broad temperature (50 – 500 K) and frequency range (5 mHz – 1 GHz).

The study shows that the increase of Cerium dopants in the B-site of perovskite lattice diminishes ferroelectric order and the relaxor behaviour is enhanced. It resembles barium zirconate titanate (BZT) system but the random fields supposed to be much stronger in the case of BT doped with Ce^{3+}. The evolution of temperature and frequency dependences of dielectric permittivity will be discussed in this contribution.

The temperature dependences of dielectric permittivity of $BaCe_{0.3}Ti_{0.7}O_3$ are depicted in Figure 1-2.

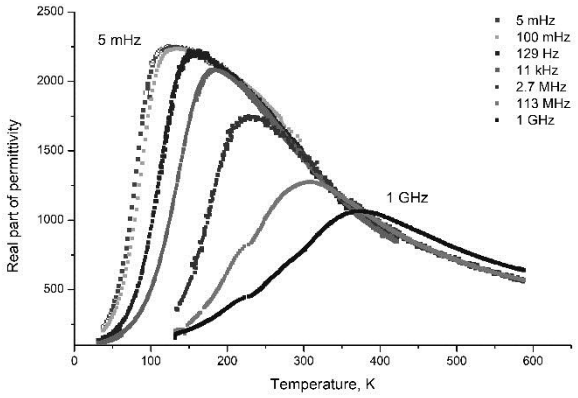

Fig 1. Temperature dependence of the real part of complex dielectric permittivity

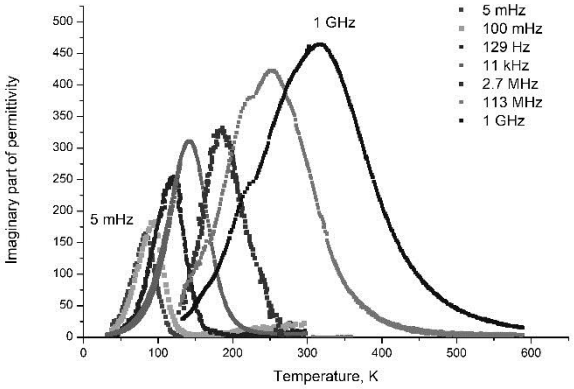

Fig 2. Temperature dependence of the imaginary part of complex dielectric permittivity.

Key words: dielectric spectroscopy, barium titanate, ferroelectric, relaxor.

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