

Dielectric properties, preparation and characterization of lead-free ceramics from piezoelectric powders

Kateřina Zloužeová, Soňa Hříbalová, Vojtěch Nečina, and Willi Pabst

University of Chemistry and Technology Prague, Technická 5, 166 28 Prague 6, Czech Republic

Piezoelectric materials are widely used in electrotechnical devices as sensors, energy harvesters, actuators, transducers or as hydrophones. Usually, in the preparation of these materials, an effort is made to achieve the highest possible density, since, for example, the elastic, dielectric and piezoelectric properties decrease with increasing porosity. The decrease in relative permittivity with increasing pore volume fraction is then interesting, as it is related to the increase in the values of some figures of merit, which describe the response rate of the transducer. Porous ceramics then show a significant improvement in properties, for example for the application of hydrophones, even if, for example, piezoelectric, dielectric and elastic properties are worse than for their dense counterparts. This work deals with the preparation of lead-free piezoelectric ceramics - potassium sodium niobate (KNN) and barium titanate (BT) - from commercially available piezoelectric powders by conventional firing and spark plasma sintering (SPS) in order to prepare partially sintered (porous) ceramics. The relative permittivity is then measured by the impedance spectroscopy method in the range from 10 Hz to 1MHz. The aim of this work is to compare the properties of ceramic samples prepared by the SPS method and conventional firing and to discuss the effect of porosity on relative permittivity (or rather its real part).