

Nanocomposites and nanomaterials

The effect of heating rate on the phase transformation of Ni(NiO)/BaTiO₃ multilayer thin films

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Ceramic capacitors are often used an element of any electronic structure. They are used wherever signals with varying polarity are required, good frequency characteristics, small losses, insignificant leakage currents, compact dimensions and low cost are required.

Barium titanate BaTiO₃ is one of the most common electroceramic materials used to make multilayer capacitors, sensors for gas sensors and water vapor, photocatalysts, catalyst carriers, and for other purposes.

In this work, samples of nanocomposites "Ni-BaTiO₃" were formed by the screen printing method. Screen printing pastes for dielectric and conductive layers were prepared with using a nanosized BaTiO₃ powder with a particle size of 20-25 nm and a Ni/NiO powder with a particle size of 8 nm. The assembly of the composite consisted of the sequential application of 8 layers of a suitable paste based on BaTiO₃ and subsequent application of the layer with a paste based on Ni/NiO by screen printing method.

The heat treatment of obtained samples was conducted in two stages. The first stage consisted in heating the samples to 450 °C in order to distil off the organic component of the pastes. The second stage was sintering. Sintering was performed in non-isothermal conditions in dilatometer at rates from 100 to 3000°C/hour. The resulting samples were examined by using a number of techniques: optical profilometry method, XRD, microscopy, and others.