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Enhanced energy storage density and discharge efficiency in the strontium sodium niobate-based glass-ceramics

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Abstract

The niobate-based glass-ceramics with a high energy storage density were prepared by using the controlled crystallization technology in the (Na_2O, SrO)-Nb_2O_5-SiO_2 glass-ceramics. The dielectric properties, energy storage density, and discharge properties were investigated with the variation of the Na/Sr molar ratio. By varying the Na/Sr ratio, the energy storage density raises up to a high value of 10.09J/cm^3. With the variation of the Na/Sr ratio, both dielectric breakdown strength and discharge efficiency have an opposite change trend with the activation energy that reflects the interface polarization of the glass-ceramics. In contrast, for Na/Sr=1/2, the glass-ceramic has the lower activation energy, which indicates that its interfacial polarization is weaker due to a fine microstructure. Thus, the glass-ceramics for Na/Sr=1/2 have the characteristics of the higher breakdown strength of 2074kV/cm and the higher discharge efficiency of 90.1%. Then it may contribute to the high energy storage density capacitor.

Key words: glass-ceramic; dielectric constant; breakdown strength; energy storage density; discharge efficiency

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