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$\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3\text{-BaTiO}_3\text{-K}_{0.5}\text{Na}_{0.5}\text{NbO}_3\text{:ZnO}$ relaxor ferroelectric composites with high breakdown electric field and large energy storage properties

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$0.82[0.94\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3\text{-}0.06\text{BaTiO}_3]\text{-}0.18\text{K}_{0.5}\text{Na}_{0.5}\text{NbO}_3\text{:}x\text{ZnO}$ (BNT-BT-KNN: $x\text{ZnO}$, $x = 0\text{-}0.40$) relaxor composites were prepared and their electrical properties were investigated. The breakdown electric field increases with increasing ZnO content. For $x = 0$ and $x = 0.40$ samples, the maximum recoverable energy storage density is 0.74 J/cm^3 and 1.03 J/cm^3 while the maximum energy storage efficiency is 86.7% and 72.7% under the electric field of 9.0 kV/mm and 14.0 kV/mm , respectively. The recoverable energy storage density and efficiency of the composite vary less than 2.5% from 25°C to 125°C , which indicates temperature-insensitive energy storage performance. These results are discussed based on the ZnO-enhanced bulk resistivity and the ZnO-induced local electric field which suppresses the evolution of polar nanoregions.

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