Ferroelectric-thermoelectricity and Mott transition of ferroelectric oxides with high electronic conductivity

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Abstract: This paper reviews ferroelectric oxides in the unusual condition where the concentration of electronic carriers is close to a metal insulator transition; in certain structures and compositions these materials have properties of interest for oxide based thermoelectric applications. In relaxor ferroelectrics, nanopolar regions associated with intrinsic localized phonon modes provide glass-like phonon characteristics due to the large levels of phonon scattering. The (Sr1-xBax)Nb2O6-delta relaxor ferroelectric single crystals have a high thermoelectric power factor, S-2 sigma similar to 40 mu W/cm K-2 at 277 degrees C along the c-axis, which is competitive with the best thermoelectrics.
In the heavily reduced, nonstoichiometric n-type perovskite BaTiO3-delta and tungsten bronze (Sr1-xBax)Nb2O6-delta, it is shown that metallic-like conductivity occurs in the paraelectric phase and the onset of ferroelectricity stabilizes semiconducting character. Both the phase transition temperature dependence on the carrier concentration and evidence for polarization coupling to the conductivity mechanism will be discussed.

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