$Sr_xBa_{1-x}Nb_2O_{6-\delta}$ Ferroelectric-thermoelectrics: Crystal anisotropy, conduction mechanism, and power factor

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Abstract: Nonstoichiometric tungsten bronze-structured ferroelectric $Sr_xBa_{1-x}Nb_2O_{6-\delta}$(SBN) single crystals were found to be a promising n-type thermoelectric oxide. Thermopower anomalies were observed at the phase transition temperatures, depending on the degree of reduction as well as crystal anisotropy. Above 500 K, heavily reduced SBN crystals show high thermoelectric power factors (similar to 20 mu W/cm K-2 at 516 K) with both thermopower and electrical conductivity higher parallel to the c-axis. It is noted that the power factor increases with temperature due to the semiconducting behavior with high carrier concentration. The carrier transport mechanism also varies with the degree of reduction and temperature.