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Dielectric screening enhanced Hall mobility in doped ferroelectrics WOLTER SIEMONS, MICHAEL A. MCGUIRE, VALENTINO R. COOPER, MICHAEL D. BIEGALSKI, ILIA N. IVANOV, GERALD E. JELLISON, LYNN A. BOATNER, BRIAN C. SALES, HANS M. CHRISTEN, Oak Ridge National Laboratory — A low electron mobility is the key limitation that prevents widespread device applications of complex oxide materials. However, in some perovskites, for example $SrTiO_3$ and $KTaO_3$, high mobilities in excess of 10,000 cm^2 s^{-1} V^{-1} are measured. Together with this dramatic increase in mobility as temperature is lowered, their dielectric constants also increase from a few hundred at room temperature to near 20,000 at low temperatures, suggesting a correlation between the dielectric constant and the mobility. By using electron-doped ferroelectric crystals of composition $KTa_{1-x}Nb_xO_3$, where the ferroelectric transition temperature can be tuned by changing the Ta:Nb ratio, we demonstrate an enhancement of the Hall mobility by a factor of 2-3 at the Curie temperature up to room temperature. We conclude that the mobility in these doped ferroelectrics peaks at the Curie temperature due to the increased dielectric constant, which reduces charge carrier scattering by impurities. Enhanced mobility could result in faster oxide transistors, boost the performance of thermoelectric devices, and enable more efficient photovoltaic materials. Supported by ORNL's LDRD program (W.S., H.M.C., V.C., G.E.J.), U.S. DOE, BES, MSED (M.A.M., B.C.S.) and SUFD (M.D.B., I.N.I.).

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