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Direct observation of the formation of polar nanoregions in $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$ using neutron pair distribution function analysis¹ IL-KYOUNG JEONG, TIM DARLING, J.K. LEE, THOMAS PROFFEN, ROBERT HEFFNER, Los Alamos National Laboratory, J.S. PARK, K.S. HONG, Seoul National University, WOJTEK DMOWSKI, University of Tennessee, TAKESHI EGAMI, University of Tennessee & Oak Ridge National Laboratory — Using neutron pair distribution function (PDF) analysis over the temperature range from 1000 K to 15 K, we demonstrate the existence of local polarization and the formation of medium-range, rhombohedrally ordered polar nanoregions (PNRs) in a prototypical relaxor ferroelectric $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$. We estimate the volume fraction of the PNRs as a function of temperature and show that this fraction steadily increases from 0 % to a maximum of $\sim 30\%$ as the temperature decreases from 650 K to 15 K. Below $T \sim 200$ K the PNRs start to overlap as their volume fraction reaches the percolation threshold. We propose that percolating PNRs and their concomitant overlap play a significant role in the relaxor behavior of $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$.

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