

## Correlation between A-site Randomness and Magnetic Phase Transition in $\text{Pr}_{0.5}\text{Ba}_{0.5}\text{MnO}_3$

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The interplay between A-site randomness and magnetic phase transition in  $\text{Pr}_{0.5}\text{Ba}_{0.5}\text{MnO}_3$  (PBMO) was extensively investigated. A step-like transition in magnetization and resistivity with a sharp width of  $\Delta H/H \sim 10^{-3}$  was observed in the A-site partially ordered PBMO at 2 K, indicating that the metamagnetic transition is associated with a competition between randomly distributed short-range ferromagnetic and antiferromagnetic phases. It provides evidence that the A-site randomness not only suppresses A-type antiferromagnetism also moderately weakens long-range ferromagnetism. In addition, the  $H/M$  versus  $M^2$  isotherms show that the A-site ordered PBMO undergoes a second-order magnetic phase transition from paramagnetism to ferromagnetism, whereas the A-site disordered PBMO exhibits a fluctuation-driven first-order transition arising from a competing order phase *possibly* existing in the paramagnetic state.