

ELECTRONIC SUPPORTING INFORMATION

Chemical heterogeneity and approaches to its control in $\text{BiFeO}_3\text{-BaTiO}_3$ lead-free ferroelectrics

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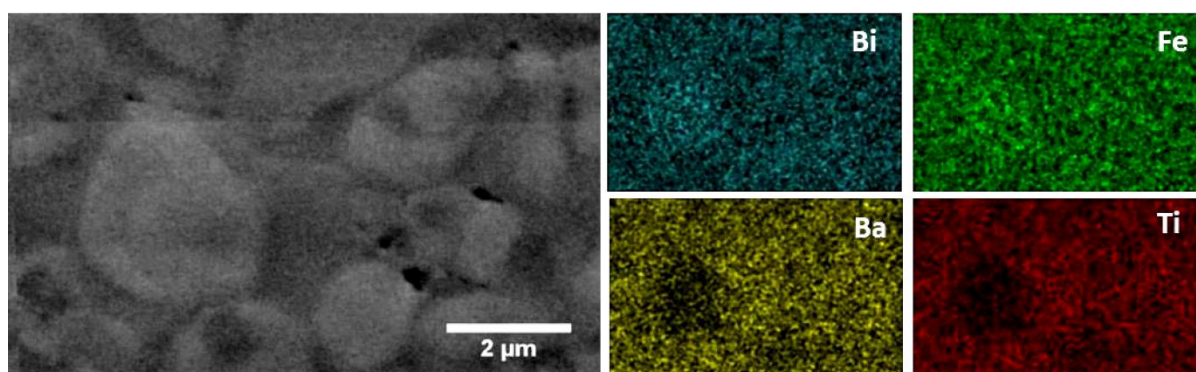


Figure S1. SEM-EDS elemental mapping results of air-quenched (15 min) Mn-AC ceramics. As-sintered Mn-AC was subjected to annealing at 750°C for 15 min, then directly quenched to room temperature. Brighter regions under SEM-backscattered electron mode are mostly associated with depletion of Ba and Ti elements which are prone to segregate in the shell.

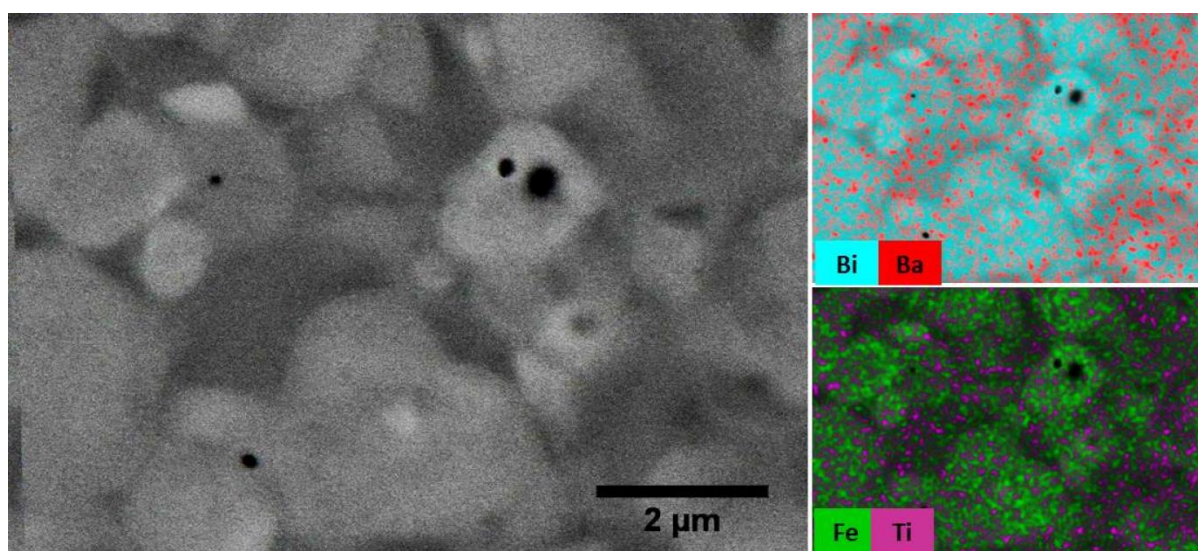


Figure S2. SEM-EDS elemental mapping results of air-quenched (21h) Mn-AC ceramics. As-sintered Mn-AC ceramic was annealed at 750°C for 21 h, then directly quenched to room temperature. The signals of Bi and Fe elements are prominently collected from the brighter regions under SEM-backscattered mode, which could be the evidence of persistent chemical heterogeneity in the air-quenched even after prolong annealing treatment.

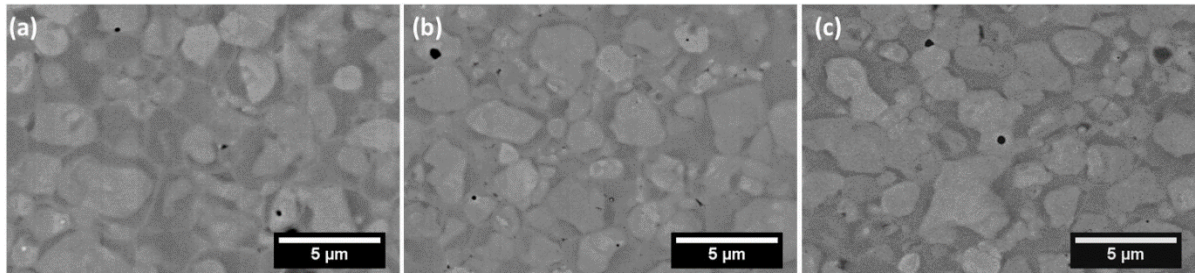


Figure S3. Microstructure of none-etched polished surfaces of **a)** as-sintered Mn-AC, **b)** air-quenched(15min) Mn-AC and **c)** air-quenched (21h) Mn-AC. All images were taken under SEM-backscattered mode.

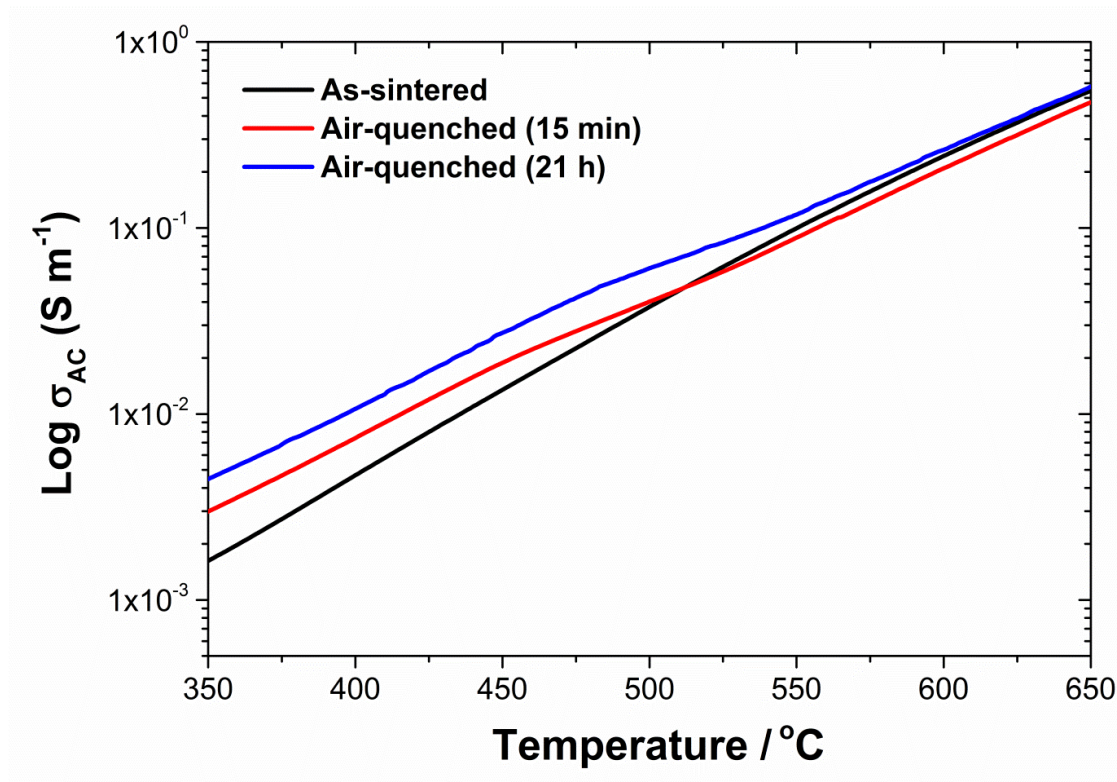


Figure S4. Temperature dependence of AC conductivity, σ_{AC} for as-sintered, air-quenched (annealed at 750°C for 15 min and 21 h) Mn-AC ceramics, measured at 100 kHz.

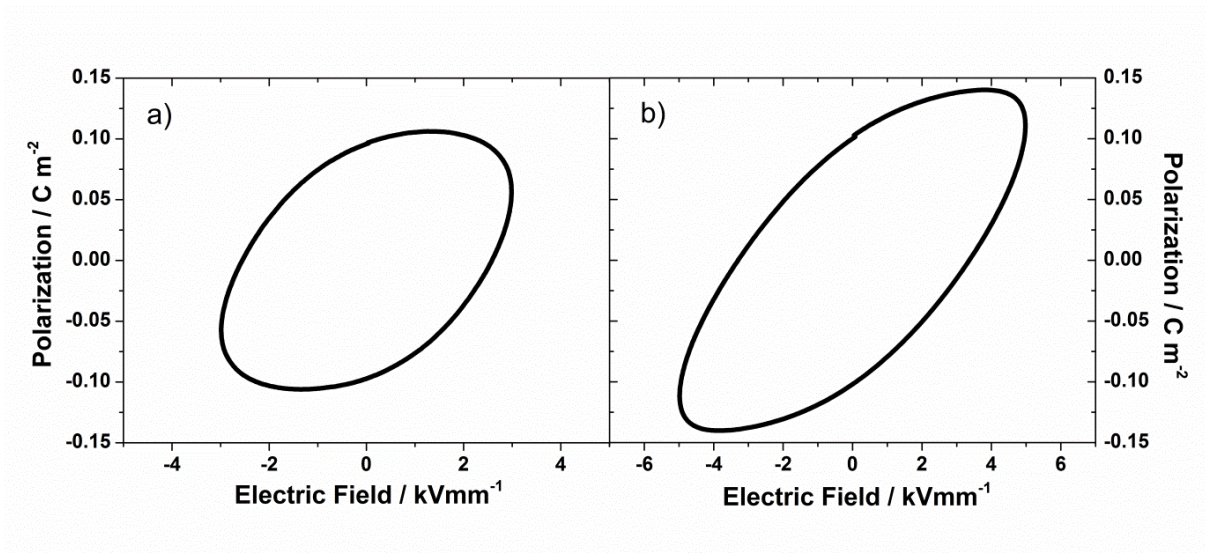


Figure S5. Ferroelectric P-E hysteresis loops of **a)** undoped 75BFBT and **b)** 3 mol% MnO₂ (BC). Observed rounded P-E loops indicate high conductivity without MnO₂ and with excessive MnO₂ addition in 75BFBT ceramics.

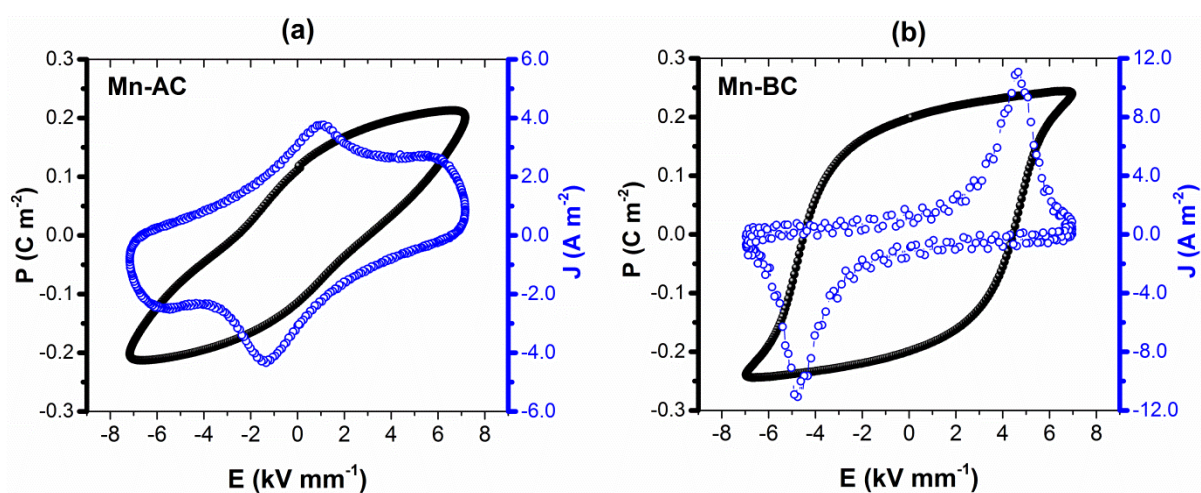


Figure S6. P-E and J-E loops of **a)** Mn-AC, and **b)** Mn-BC ceramics sintered at 1050°C for 2h.