Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting information for:

Antiferroelectric-to-ferroelectric phase transition in hexagonal rare-earth iron oxides

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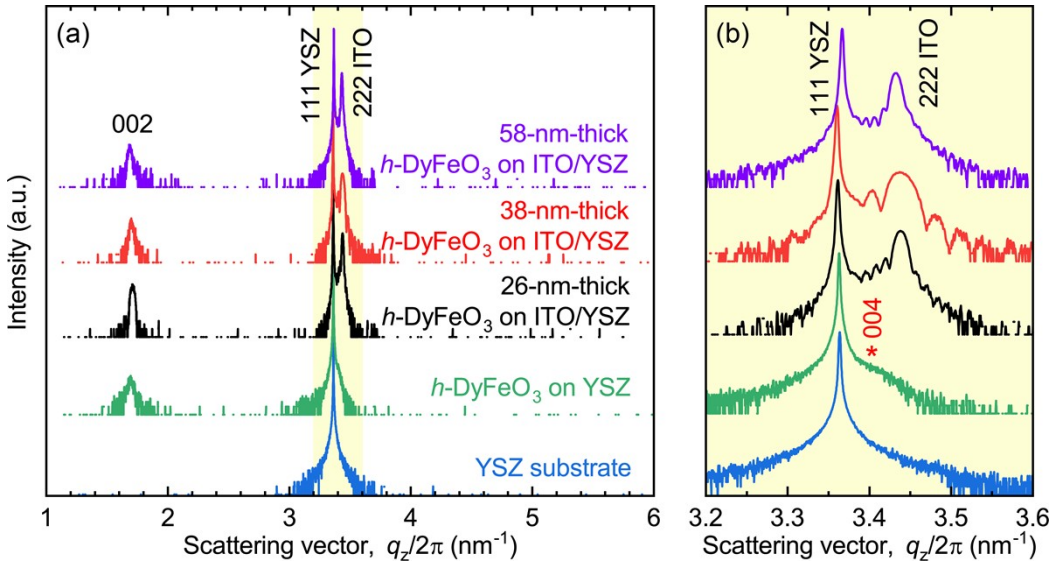

Figure S1. (a) Out-of-plane XRD patterns of the *h*-$DyFeO_3$ films fabricated on ITO/YSZ and YSZ substrates. (b) The magnified patterns of (a). For the *h*-$DyFeO_3$ films grown on ITO/YSZ, 004 diffraction peak of *h*-$DyFeO_3$ ($q_z/2\pi$ = 3.4 nm^{-1}) was hardly observed because the peak is overlapped with 111 YSZ ($q_z/2\pi$ = 3.36 nm^{-1}) and 222 ITO ($q_z/2\pi$ = 3.44 nm^{-1}). The 004 *h*-$DyFeO_3$ is detected by comparing it to the magnified patterns of *h*-$DyFeO_3$/YSZ film and YSZ substrate.

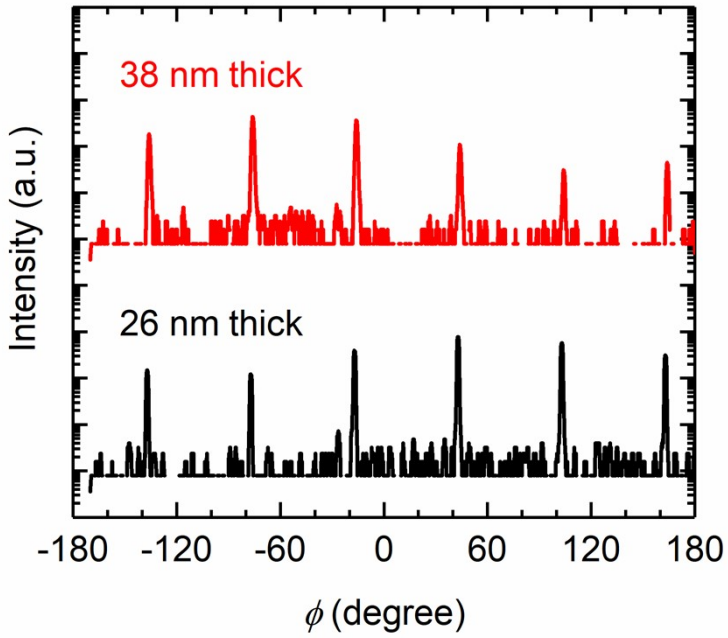

Figure S2. ϕ-scan pattern of the *h*-$DyFeO_3$ films as a function of thickness around the 110 *h*-$DyFeO_3$ diffraction peaks.

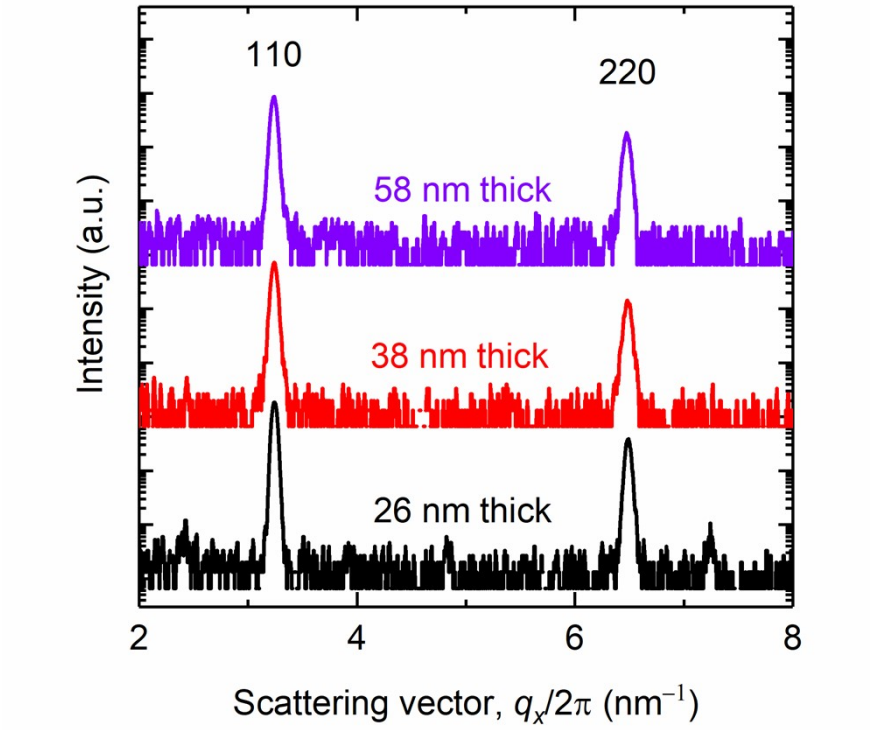

Figure S3. In-plane XRD patterns along the [11-2] YSZ direction for the *h*-$DyFeO_3$ films with varied thickness.

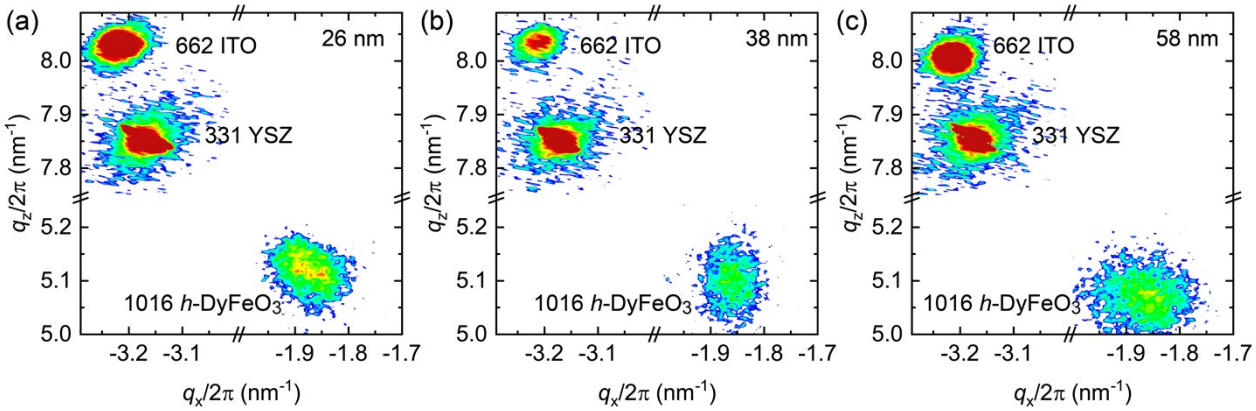

Figure S4. RSMs of the *h*-$DyFeO_3$ films. (a) 26 nm, (b) 38 nm, and (c) 58 nm.

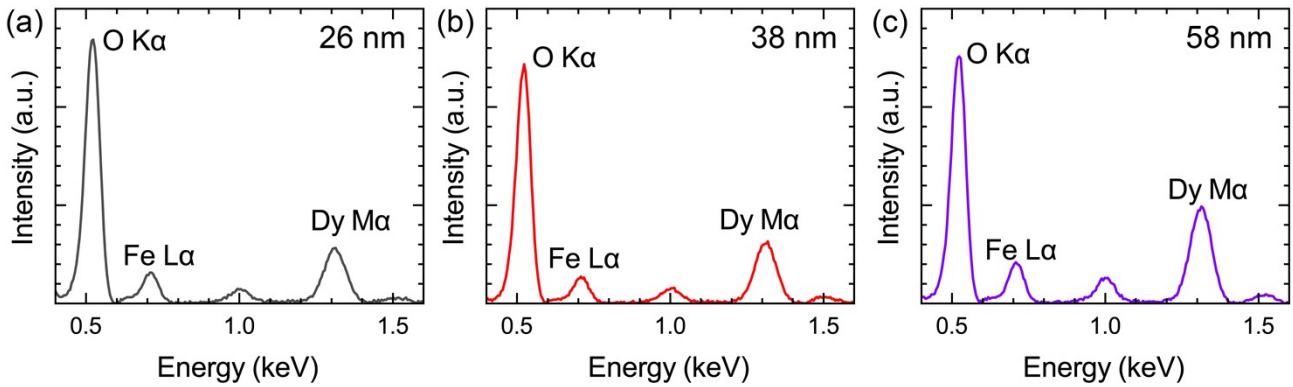

Figure S5. EDS spectra of the *h*-$DyFeO_3$ films. (a) 26 nm, (b) 38 nm, and (c) 58 nm.

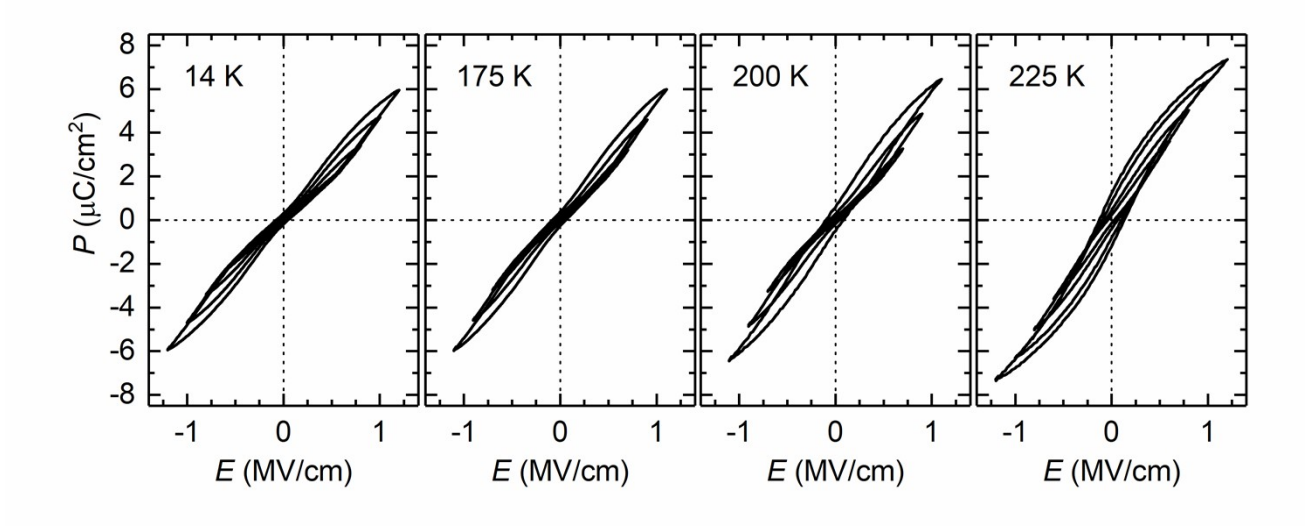

Figure S6. *P*–*E* curves for the 38-nm-thick *h*-$DyFeO_3$ film at 14, 175, 200 and 225 K at 10 kHz.

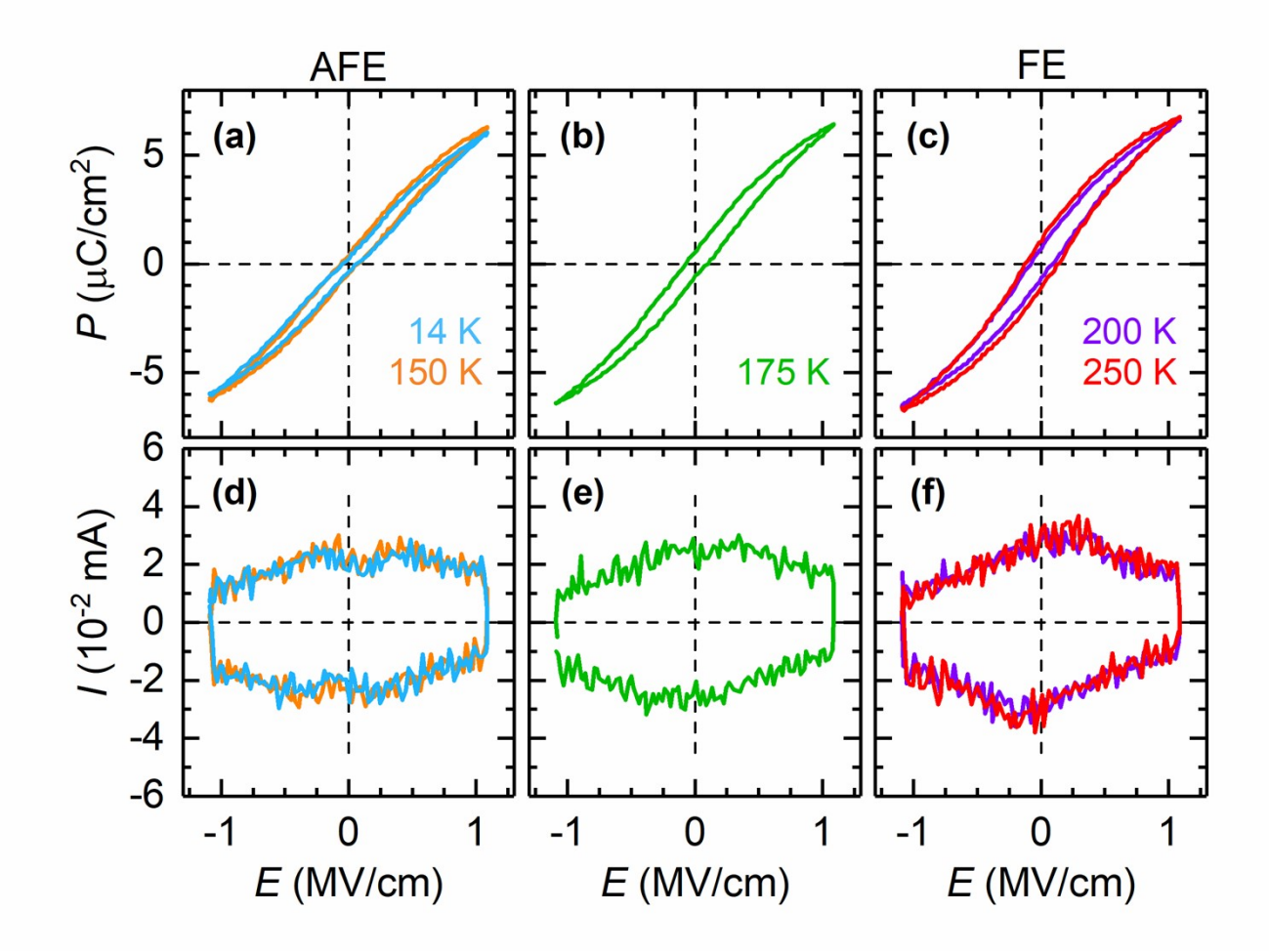

Figure S7. (a-c) *P*–*E* and (d-f) *I*–*E* curves for the 58-nm-thick *h*-$DyFeO_3$ film at (a, d) 14, 150, (b, e) 175, (c, f) 200 and 250 K at 10 kHz.

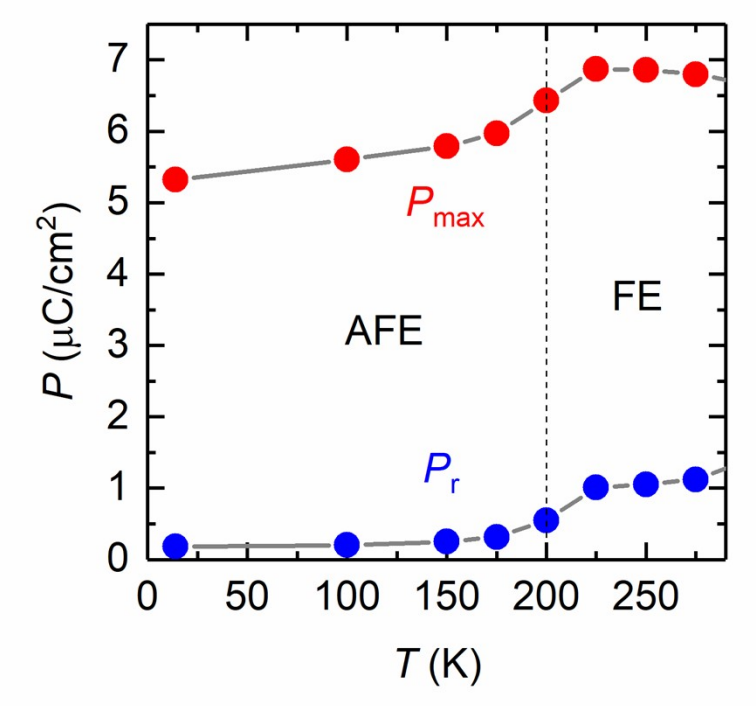

Figure S8. *T*-dependence of P_r and P_{max} values for the 38-nm-thick film at 10 kHz with maximum applied *E* of 1.1 MV/cm.

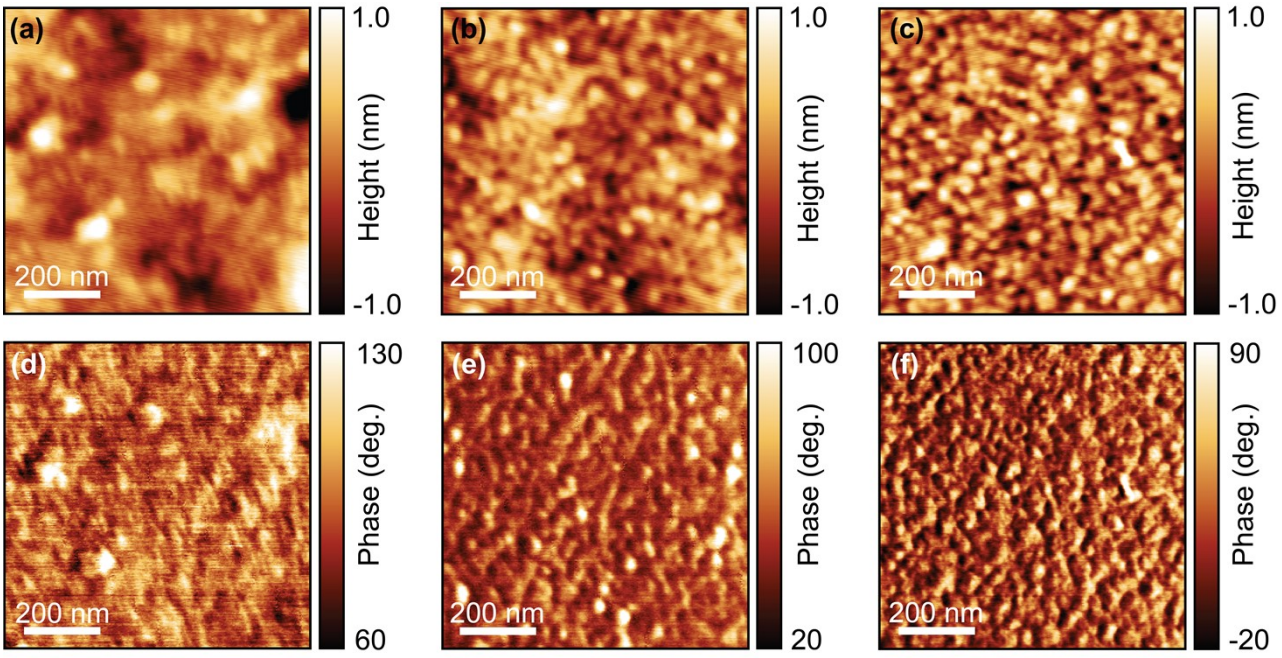

Figure S9. Piezoresponse force microscopy topography (Upper) and phase (Lower) images of the (a, d) 26-, (b, e) 38-, and (c, f) 58-nm-thick *h*-$DyFeO_3$ films.