

## Supplementary materials

# Erbium: Key to Simultaneously Achieving Superior Temperature-Stability and High Magnetic Properties in 2:17-type Permanent Magnets

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Tab. S1 Saturation magnetization intensity of RE<sub>2</sub>Co<sub>17</sub> phase with different rare earth elements

Compound	$\mu_0 M_s / T$
Sm <sub>2</sub> Co <sub>17</sub>	1.22
Gd <sub>2</sub> Co <sub>17</sub>	0.75
Tb <sub>2</sub> Co <sub>17</sub>	0.66
Dy <sub>2</sub> Co <sub>17</sub>	0.68
Ho <sub>2</sub> Co <sub>17</sub>	0.84
<b>Er<sub>2</sub>Co<sub>17</sub></b>	<b>0.91</b>
Tm <sub>2</sub> Co <sub>17</sub>	1.21

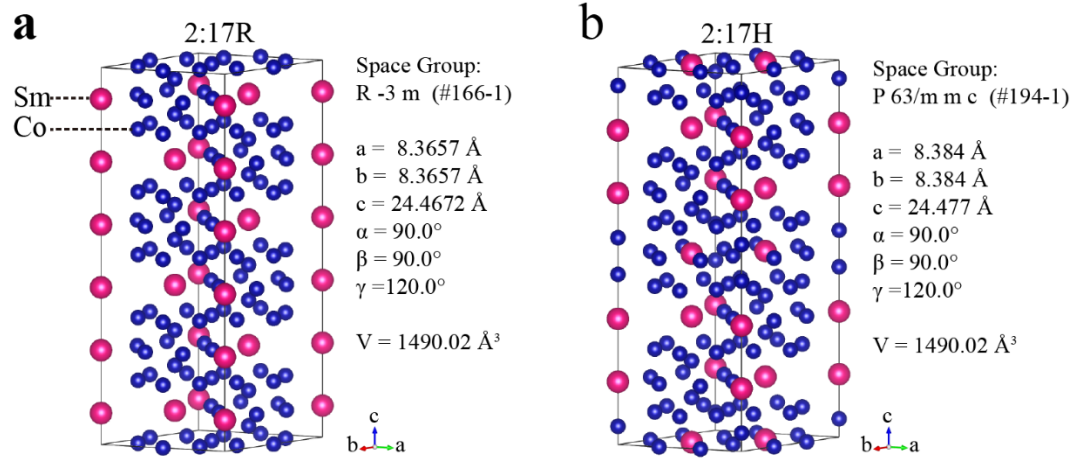


Fig. S1 2:17 phase supercell structure

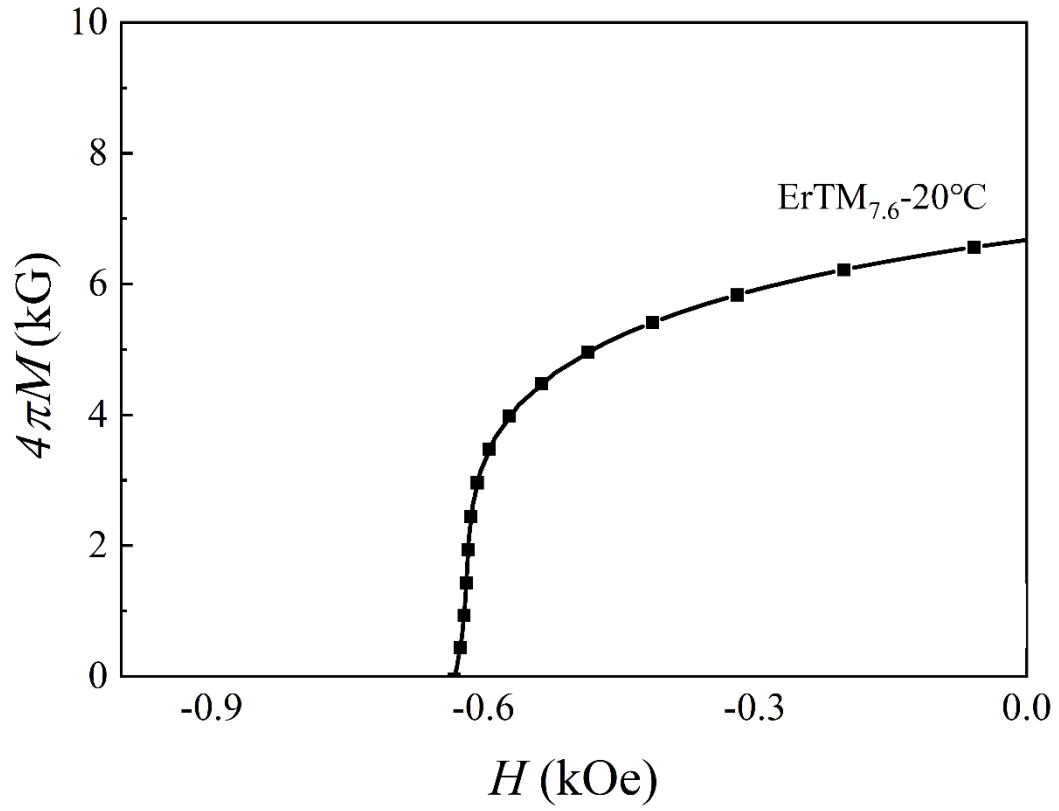


Fig. S2 Demagnetization curve of ErTM<sub>7.6</sub>(x=1) magnet.

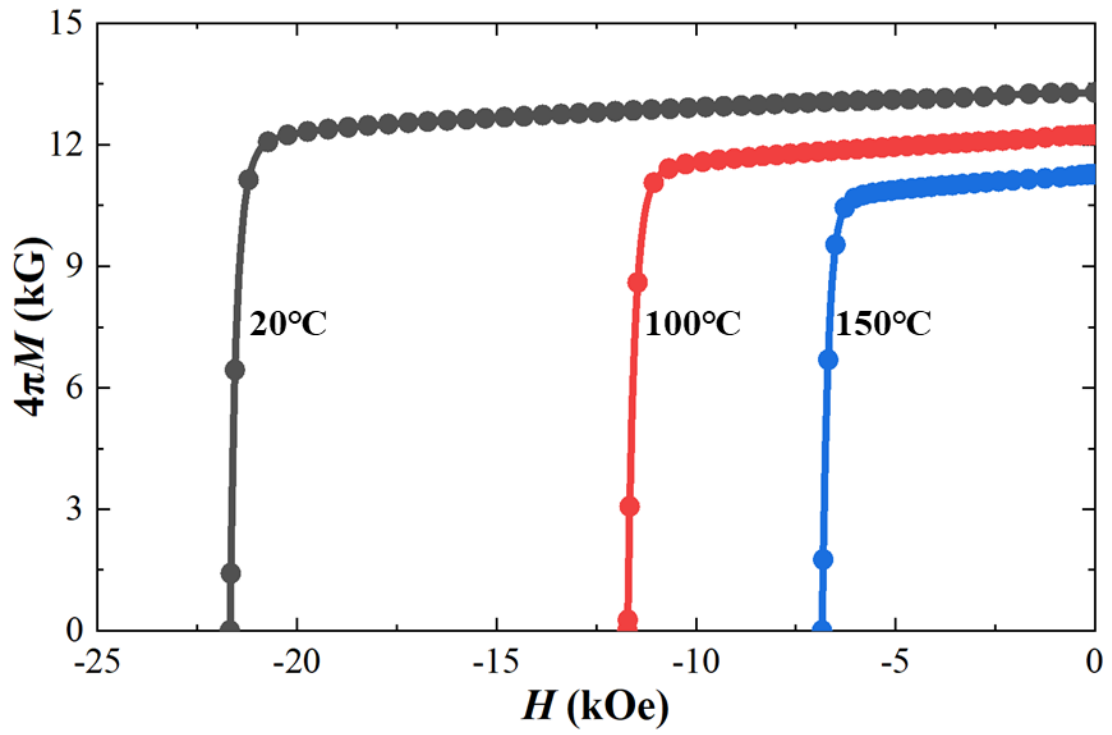


Fig. S3 Demagnetization curves at 20-150 °C of commercial Nd-Fe-B magnet obtained from Earth-Panda Advance Magnetic Material Co., Ltd.

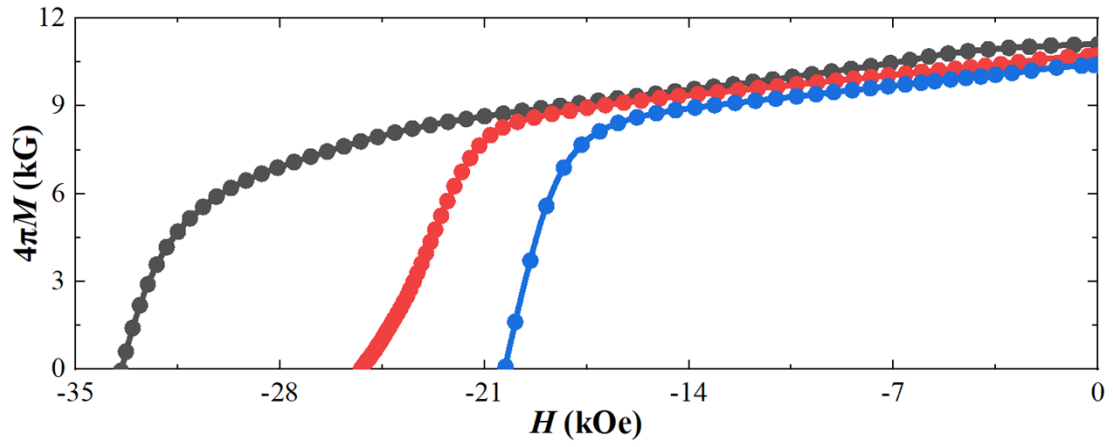


Fig. S4 Demagnetization curves at 20-150 °C of commercial Sm<sub>2</sub>Co<sub>17</sub>-type magnet purchased from Tianhe Magnetic Materials Technology Co., ltd.

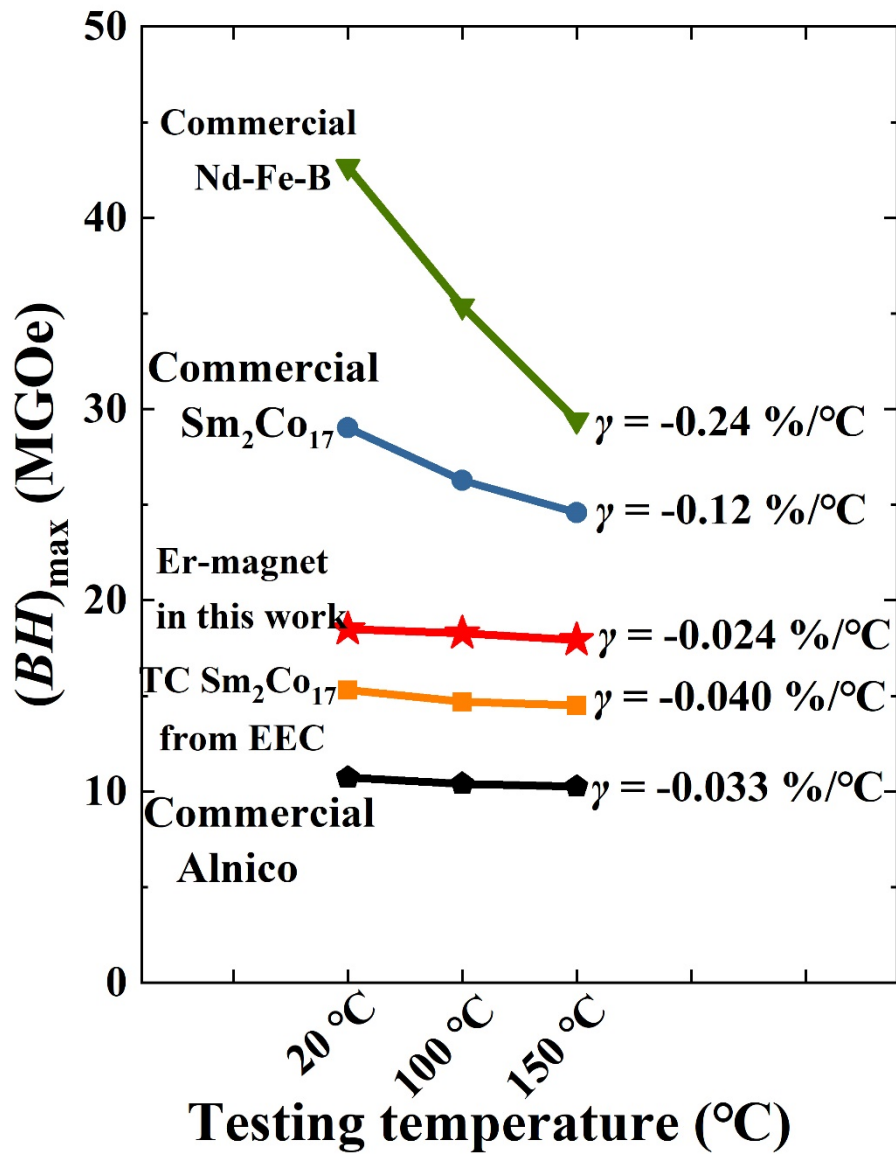


Fig. S5 The comparison of  $(BH)_{\max}$  at 20-150 °C of commercial Nd-Fe-B,  $\text{Sm}_2\text{Co}_{17}$ -type, TC  $\text{Sm}_2\text{Co}_{17}$ -type and Alnico magnets with the Er-magnet in this work, the corresponding  $\gamma_{20-150^\circ\text{C}}$ . The data of Alnico (brand CALNiCo80/12) magnet is from Hangzhou Kede Magnetic Components Co.,Ltd.

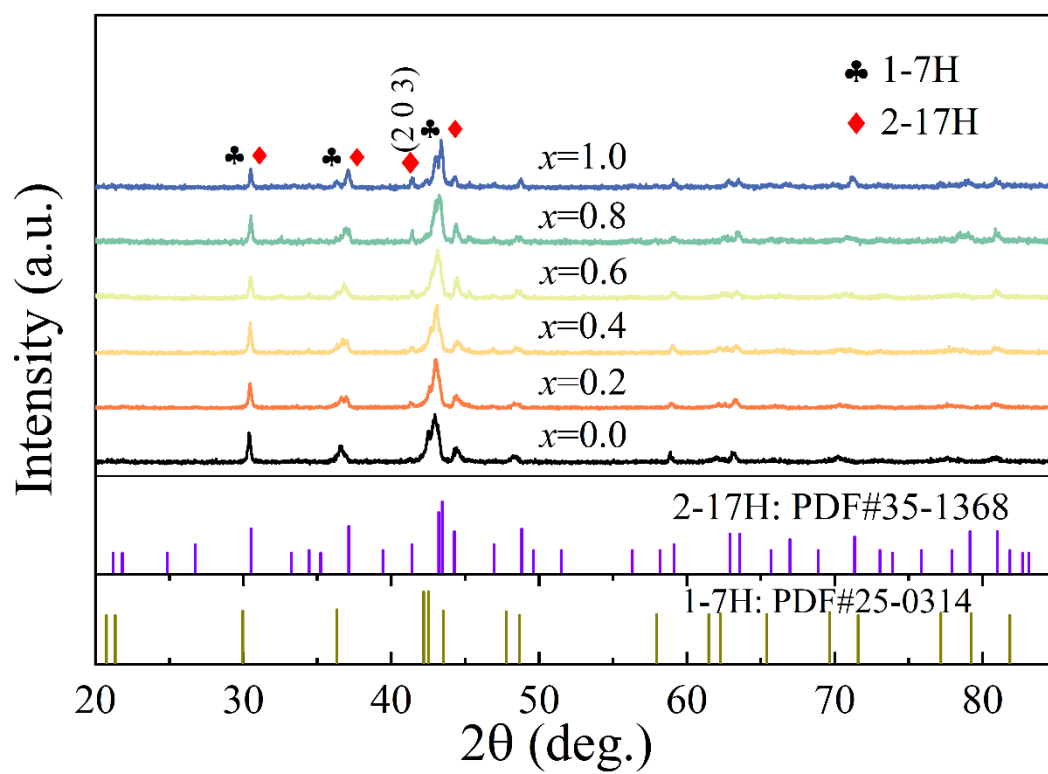


Fig. S6 XRD diffraction pattern of  $\text{Sm}_{1-x}\text{Er}_x\text{TM}_{7.6}$  ingots



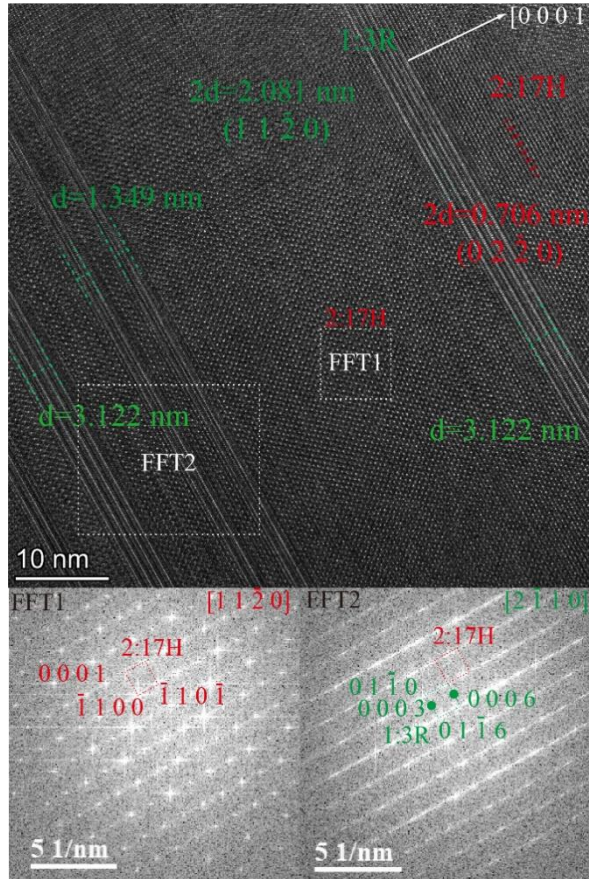


Fig. S7 HRTEM images of  $\text{ErTM}_{7.6}$  magnets and Fast Fourier Transform (FFT) patterns corresponding to the FFT1 and FFT2

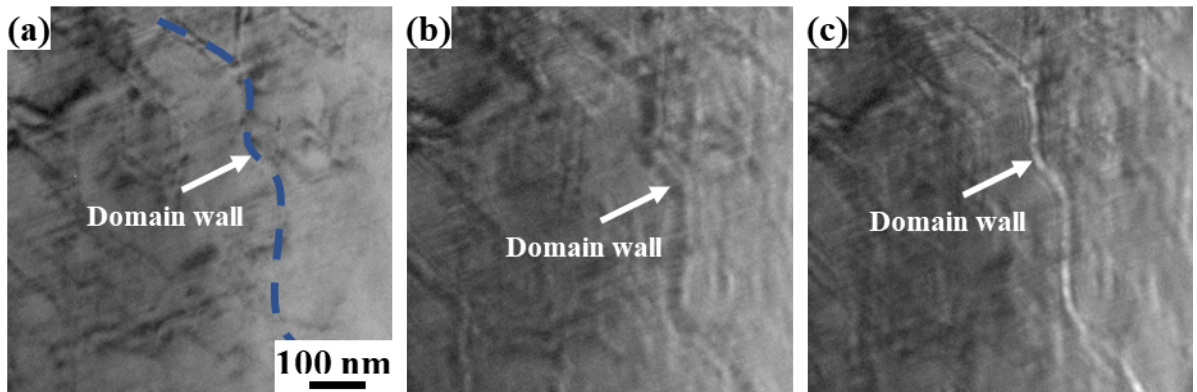


Fig. S8 LTEM images of  $\text{Sm}_{0.4}\text{Er}_{0.6}\text{TM}_{7.6}$  magnets. a-c are the bright field, over-focus, and under-focus images, respectively. The black and white traces in b and c indicate that this position is a magnetic domain wall, and the corresponding position is also marked with a dashed line in a.