Supporting Information

Magnetic properties of epitaxial $TmFe_2O_4$ thin film with anomalous interface structure

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Table S1. The molar fractions of Tm and Fe analyzed by ICP-AES for $TmFe_2O_4$ polycrystals

prepared under various CO/CO_2 ratios. The compositions of the samples are almost stoichiometric although subtle deviations from the stoichiometry are observed. The values of concentration for Fe and Tm are averaged ones obtained by repeating the measurements three times. The experimental error is within 1 %.

CO/CO_2 molar ratio	Molality of Fe (mol/kg)	Molality of Tm (mol/kg)	Fe/Tm ratio
1	5.56	2.86	1.94
2/3	5.58	2.85	1.96
1/2	5.48	2.80	1.96
1/3	5.38	2.67	2.01
1/4	5.43	2.64	2.05

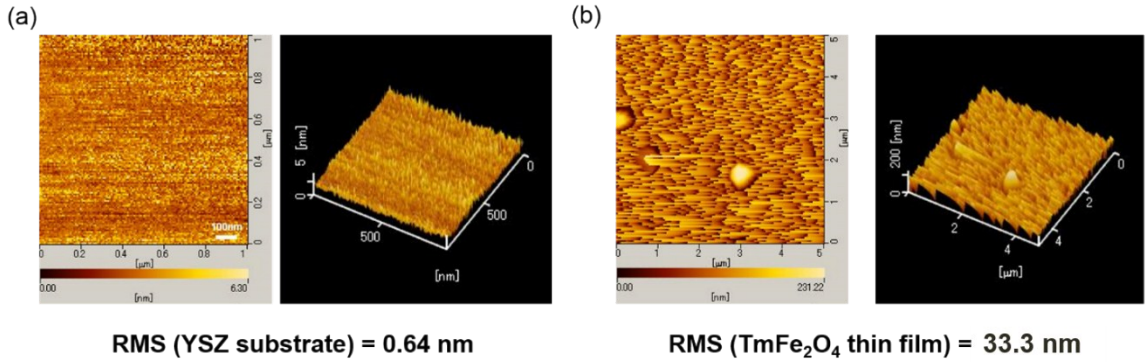

Figure S1. AFM images of YSZ substrate and $TmFe_2O_4$ thin film.

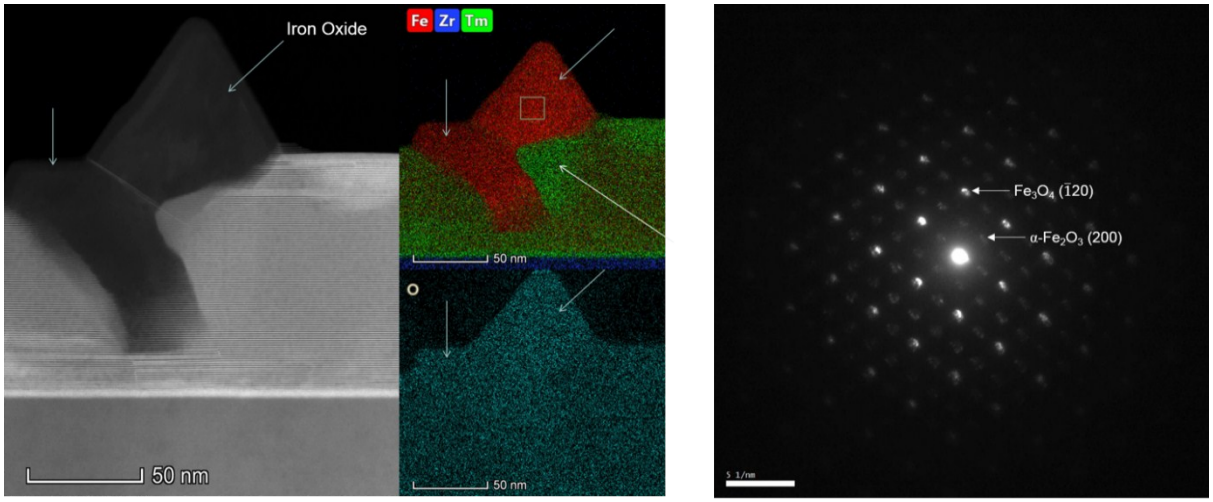

Figure S2. HAADF-STEM image, distribution of elements determined by EDX, and SAED pattern of impurity phases observed in a limited region of $TmFe_2O_4$ thin film. The SAED pattern indicates that the impurity phases are Fe_3O_4 and α-Fe_2O_3.

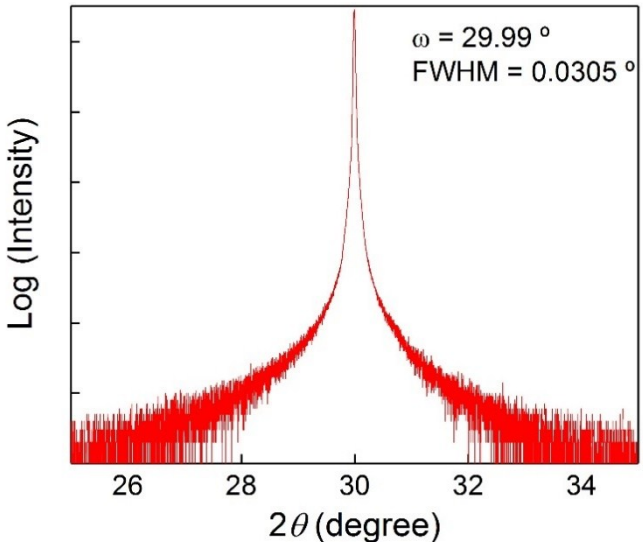

Figure S3. A rocking curve for YSZ (111) substrate. The full-width at half maximum obtained from the rocking curve is 0.0305°.