Electronic Supplementary Material (ESI) for Nanoscale.

Intrinsic Hydrophilic Nature of Epitaxial Thin-film of Rare-earth Oxide Grown by Pulsed Laser Deposition

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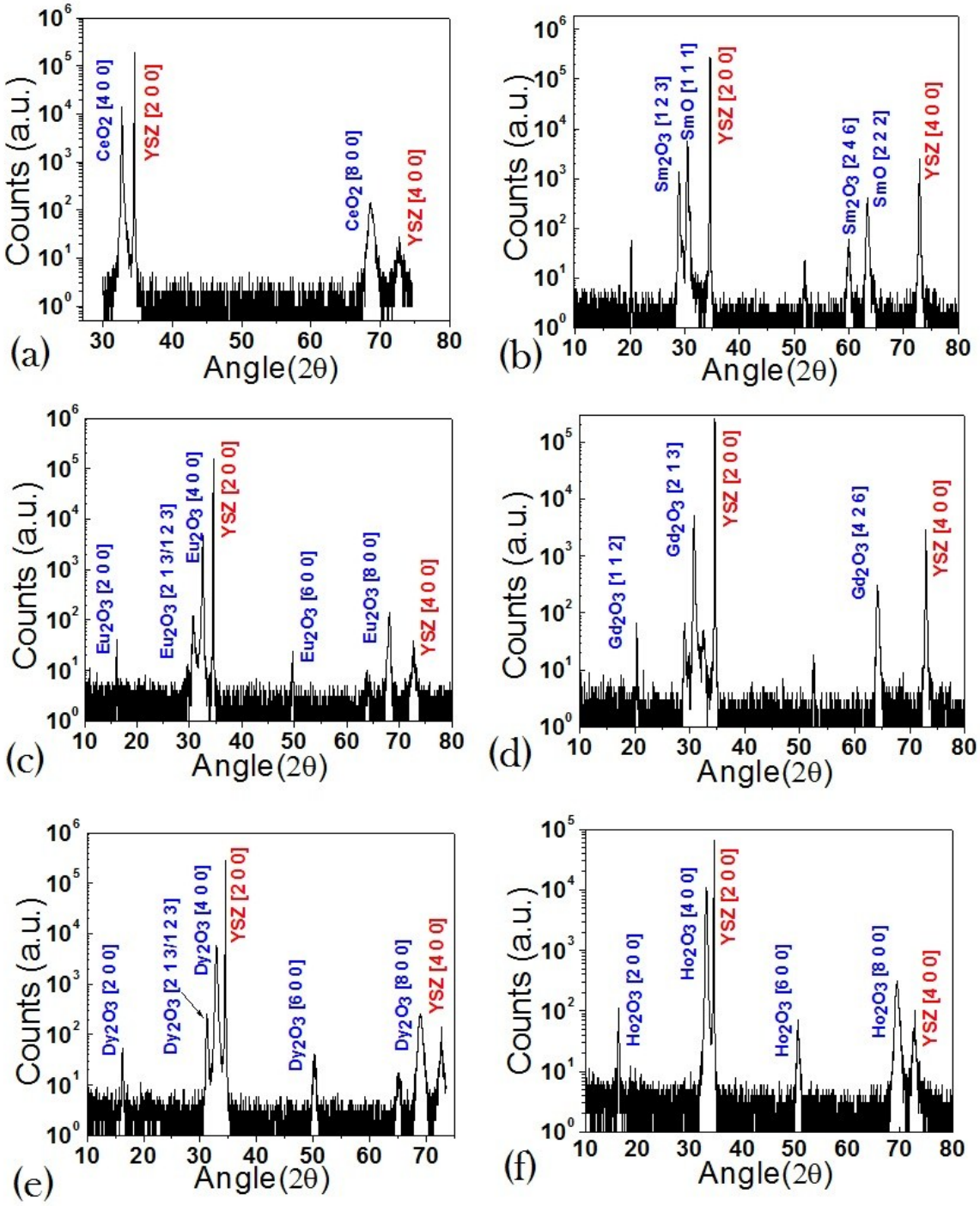

Figures:

Fig S1: XRD scans of PLD grown thin-film samples of (a)CeO_2; (b)Sm_2O_3; (c)Eu_2O_3; (d)Gd_2O_3; (e)Dy_2O_3; (f)Ho_2O_3. (g)Er_2O_3; (h)Tm_2O_3; (i)Yb_2O_3; (j)Lu_2O_3.

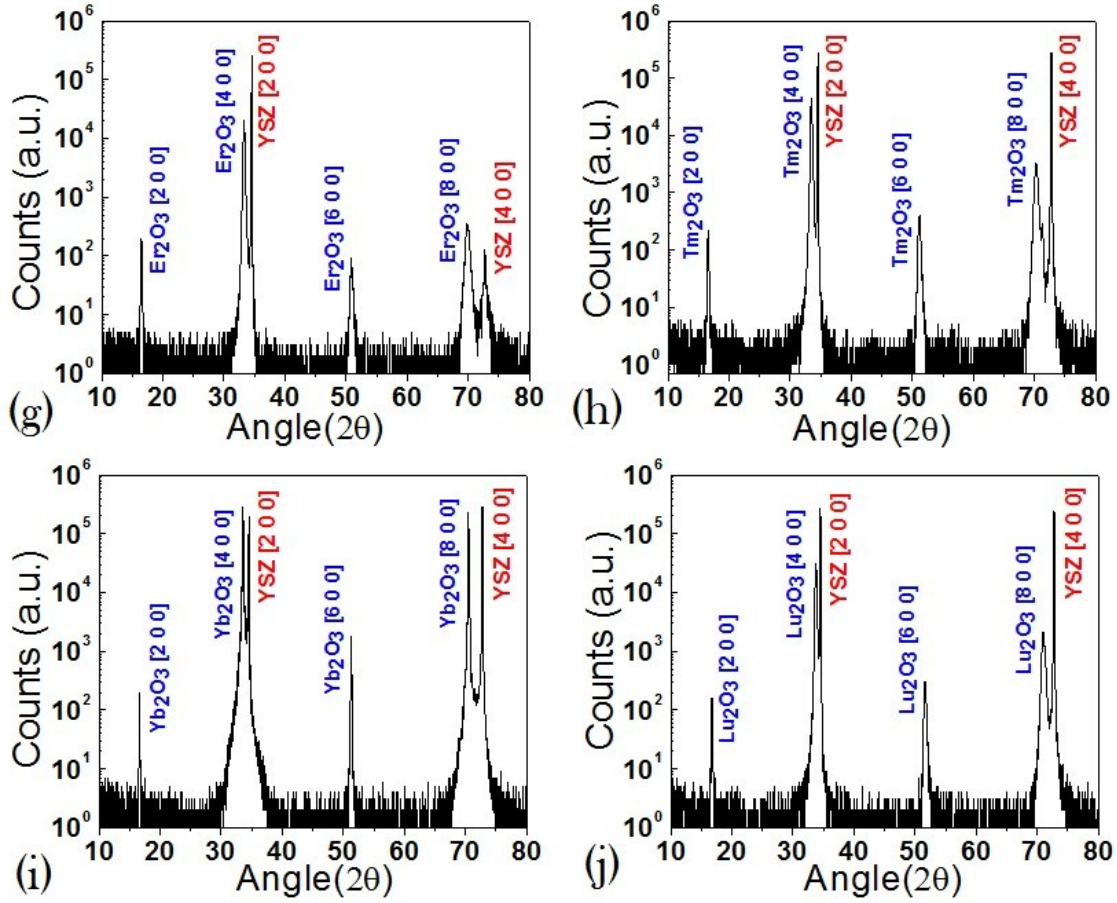

Fig S1-Cont.: XRD scans of PLD grown thin-film samples of (a)CeO_2; (b)Sm_2O_3; (c)Eu_2O_3; (d)Gd_2O_3; (e)Dy_2O_3; (f)Ho_2O_3. (g)Er_2O_3; (h)Tm_2O_3; (i)Yb_2O_3; (j)Lu_2O_3.

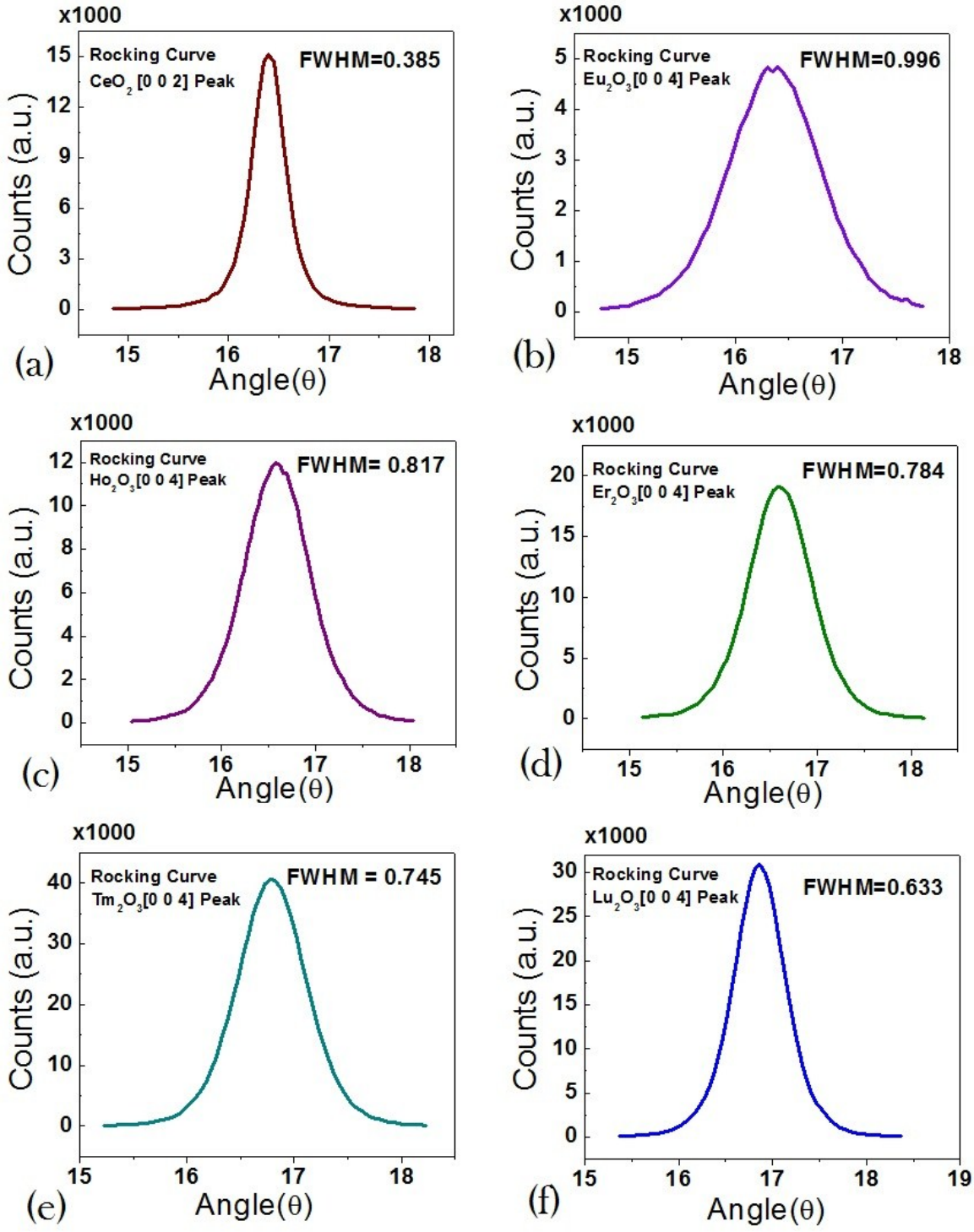

Fig S2: Rocking curve data of six different REO thin-film samples (a) (a)CeO_2; (b) Eu_2O_3; (c) Ho_2O_3; (d)Er_2O_3; (e)Tm_2O_3; (f)Lu_2O_3.

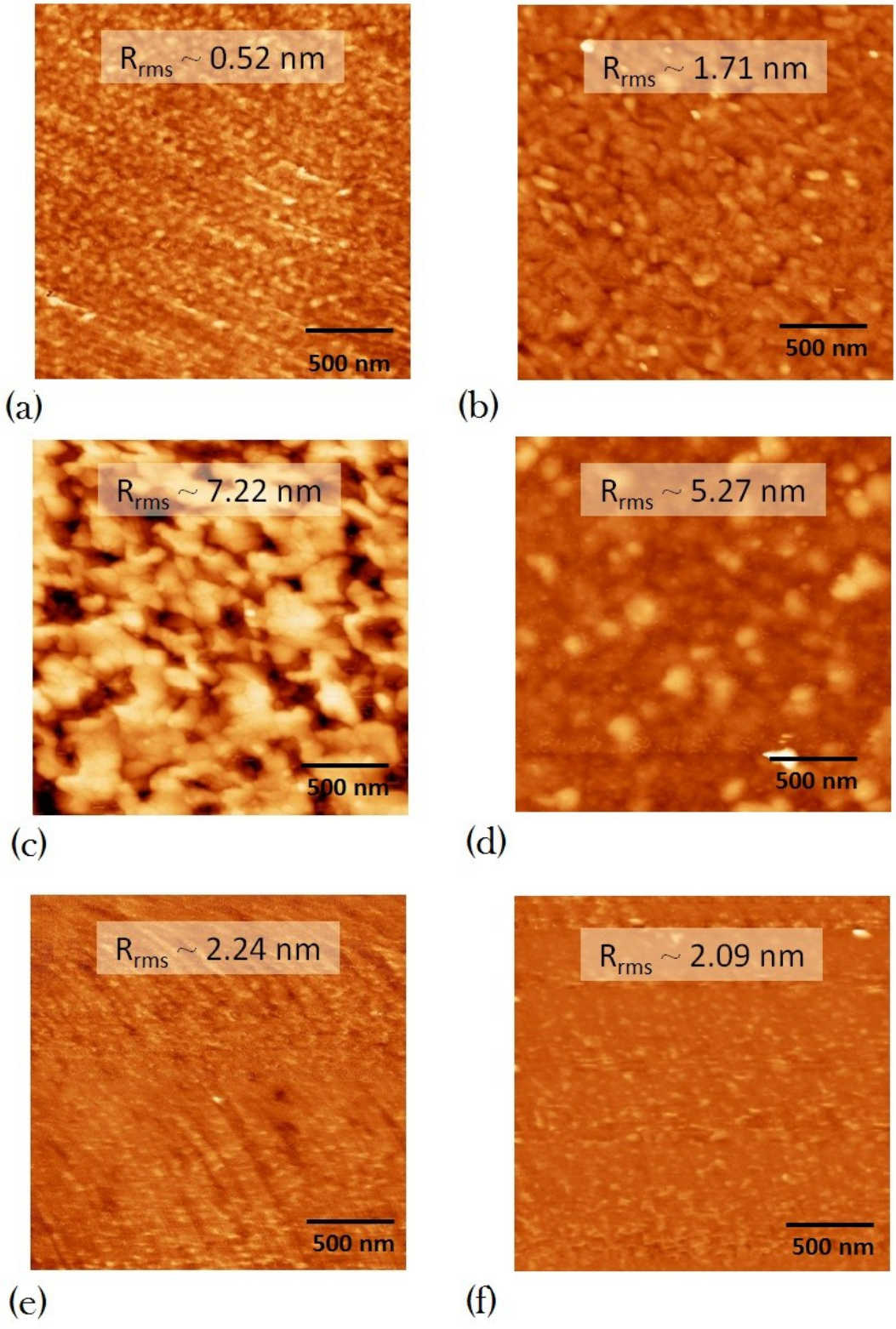

Fig S3: AFM images of PLD grown thin-film samples of (a)CeO_2; (b)Sm_2O_3; (c)Eu_2O_3; (d)Gd_2O_3; (e)Dy_2O_3; (f)Ho_2O_3 (g)Er_2O_3; (h)Tm_2O_3; (i)Yb_2O_3; (j)Lu_2O_3. The R.M.S. roughness is shown within the images.

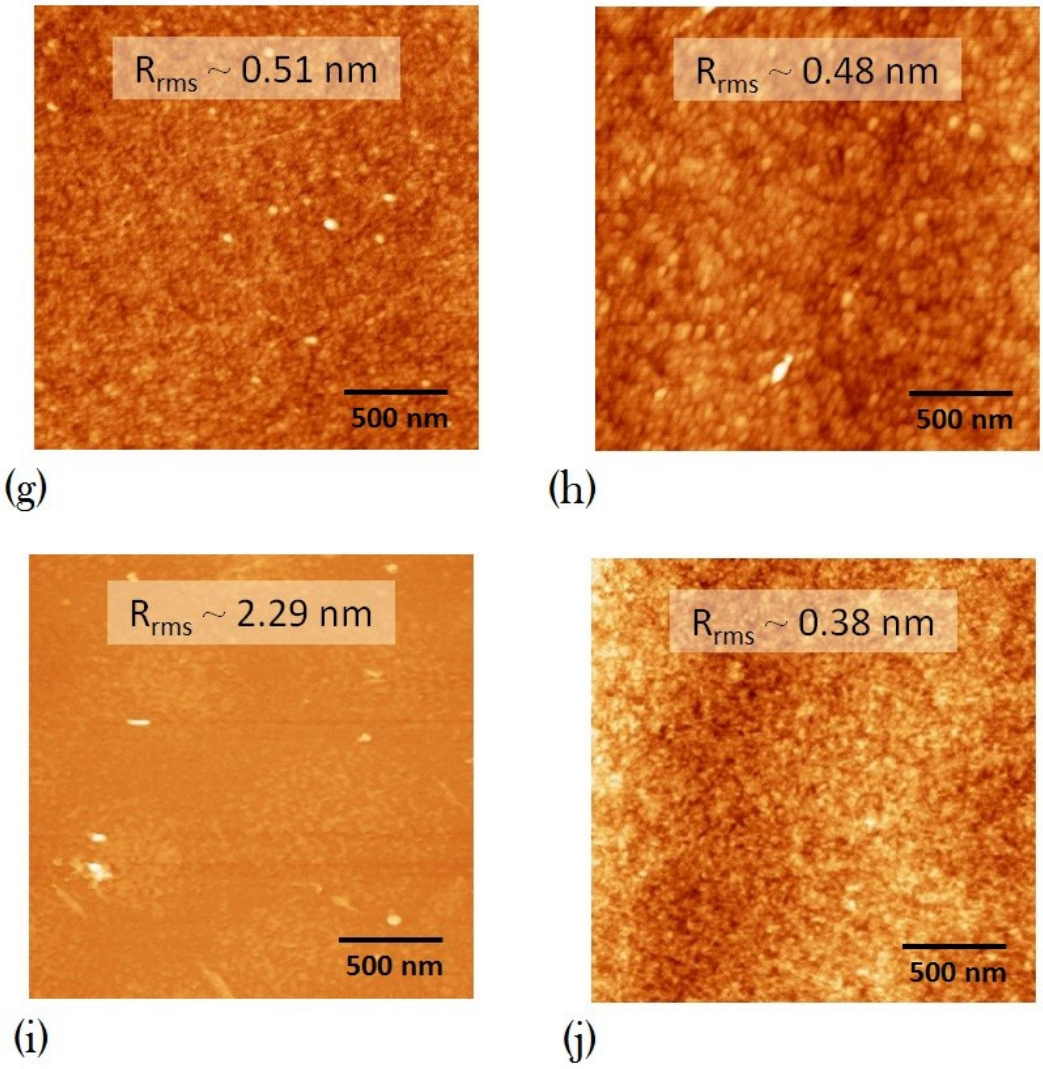

Fig S3 Cont.: AFM images of PLD grown thin-film samples of (a)CeO_2; (b)Sm_2O_3; (c)Eu_2O_3; (d)Gd_2O_3; (e)Dy_2O_3; (f)Ho_2O_3 (g)Er_2O_3; (h)Tm_2O_3; (i)Yb_2O_3; (j)Lu_2O_3. The R.M.S. roughness is shown within the images.

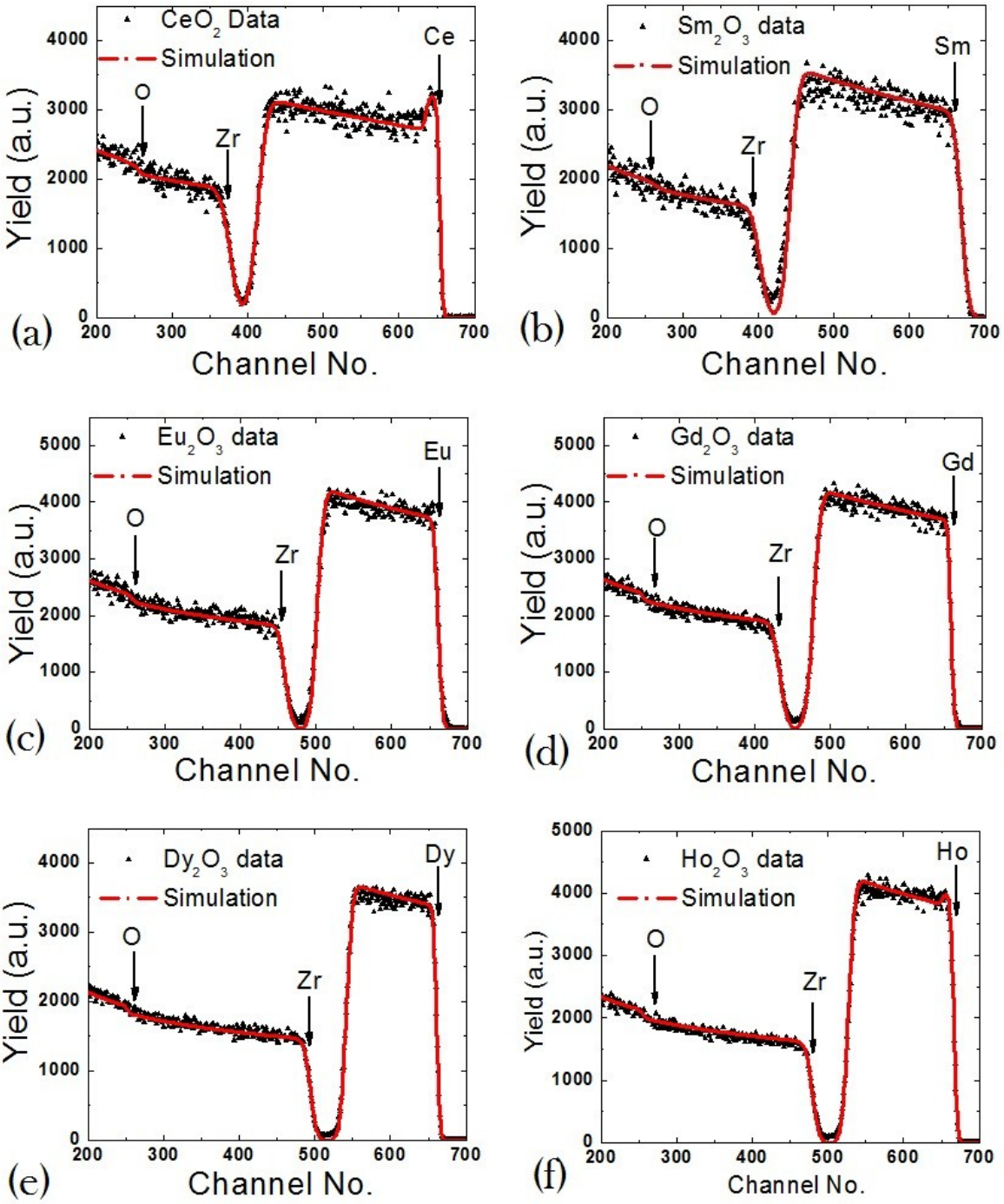

Fig S4: RBS study on thin-films of (a)CeO_2; (b)Sm_2O_3; (c)Eu_2O_3; (d)Gd_2O_3; (e)Dy_2O_3; (f)Ho_2O_3 (g) Er_2O_3; (h)Tm_2O_3; (i)Yb_2O_3; (j)Lu_2O_3 grown on YSZ [1 0 0]. The simulation is for the stoichiometric composition of the compound showing excellent fit.

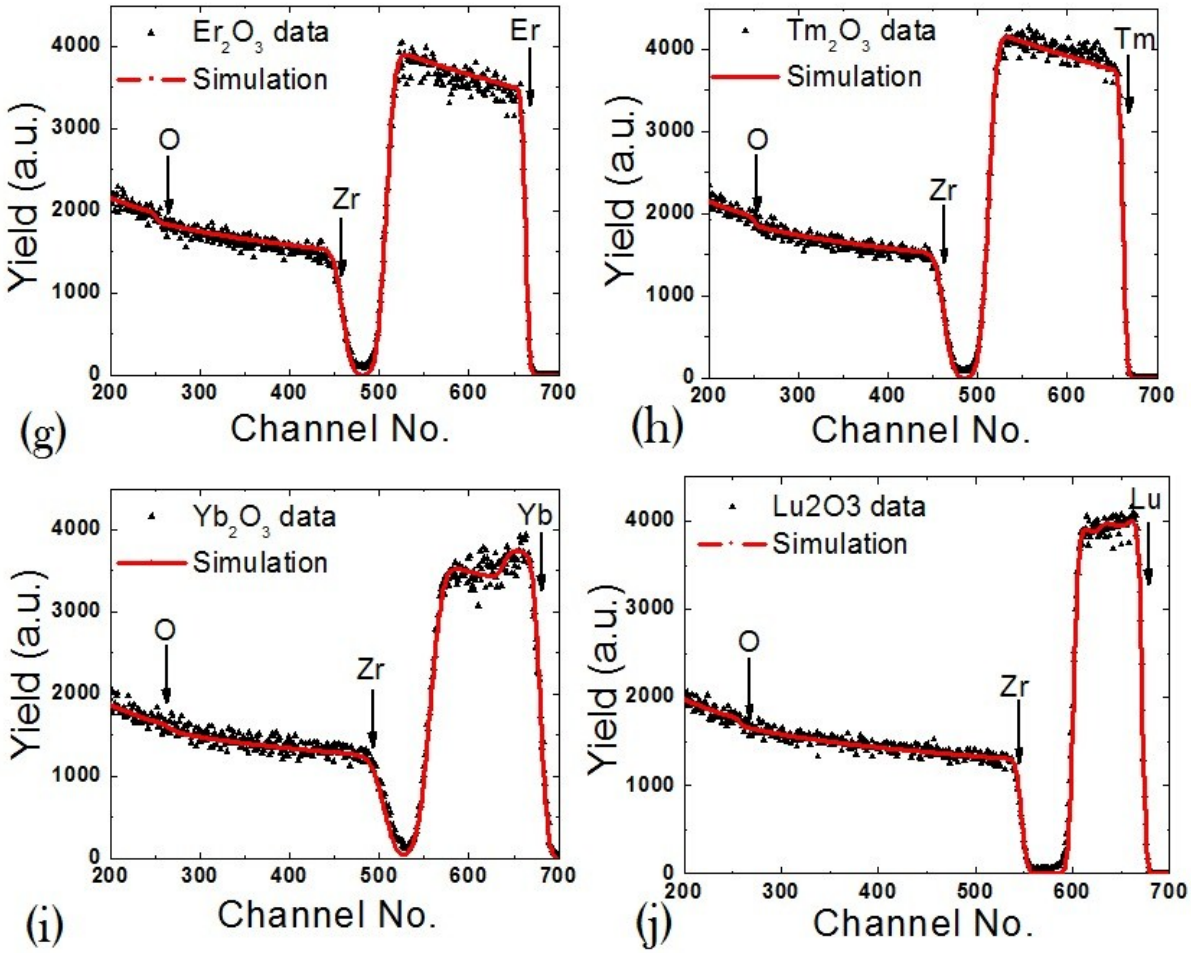

Fig S4 Cont.: RBS study on thin-films of (a)CeO_2; (b)Sm_2O_3; (c)Eu_2O_3; (d)Gd_2O_3; (e)Dy_2O_3; (f)Ho_2O_3 (g) Er_2O_3; (h)Tm_2O_3; (i)Yb_2O_3; (j)Lu_2O_3 grown on YSZ [1 0 0]. The simulation is for the stoichiometric composition of the compound showing excellent fit.

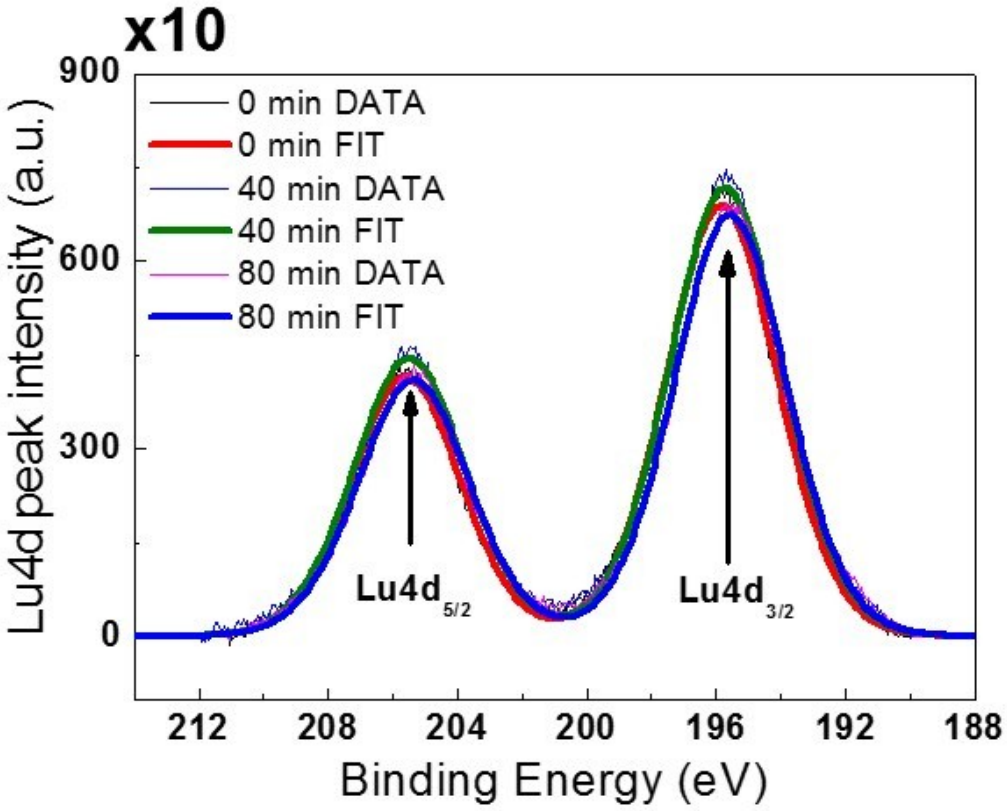

Fig S5: Full XPS spectra showing twin peaks of $Lu4d_{5/2}$ and $Lu4d_{3/2}$. No change in the spectra but a gradual reduction of the intensity with time is seen.

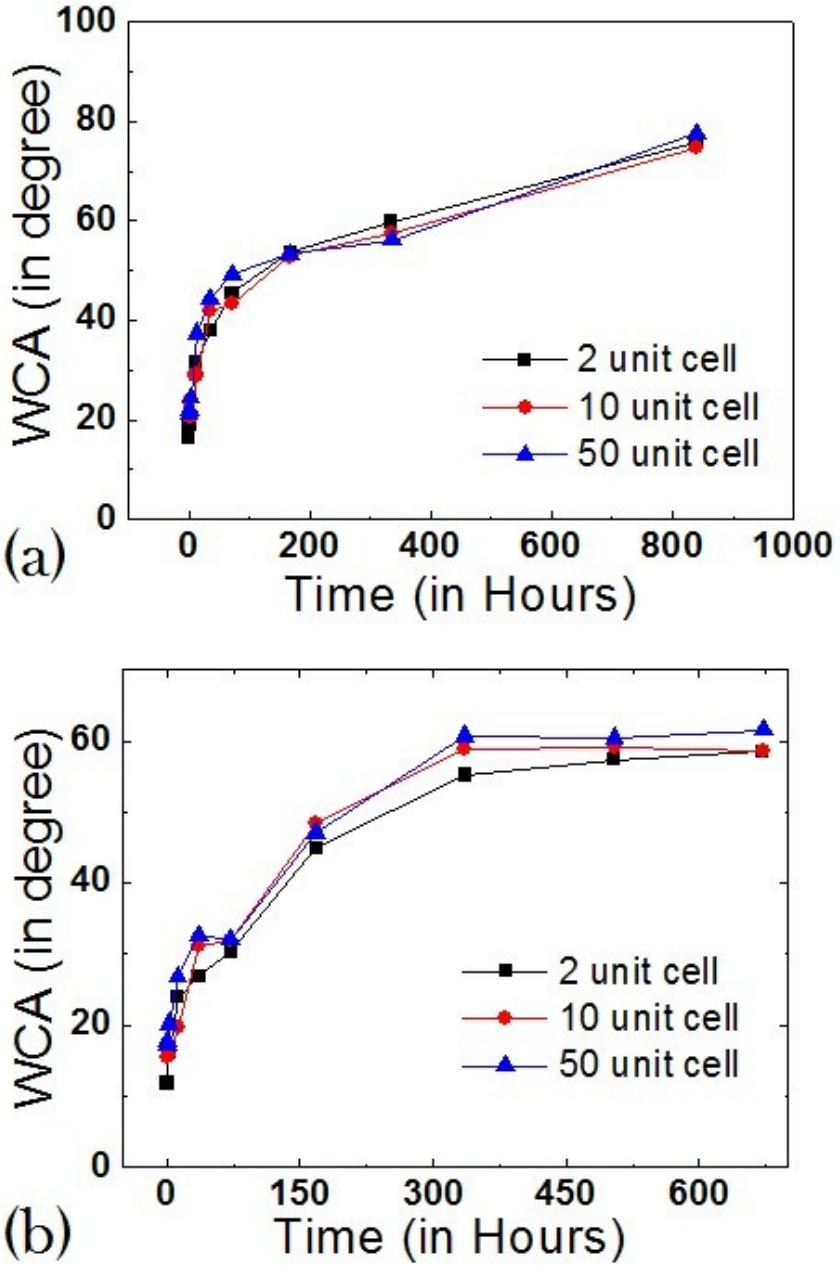

Fig S6: Temporal evolution of WCA of (a) Lu2O3 and (b) Er2O3 thin-film samples.

We notice the near identical behaviour of the WCA change with time for all different thicknesses.

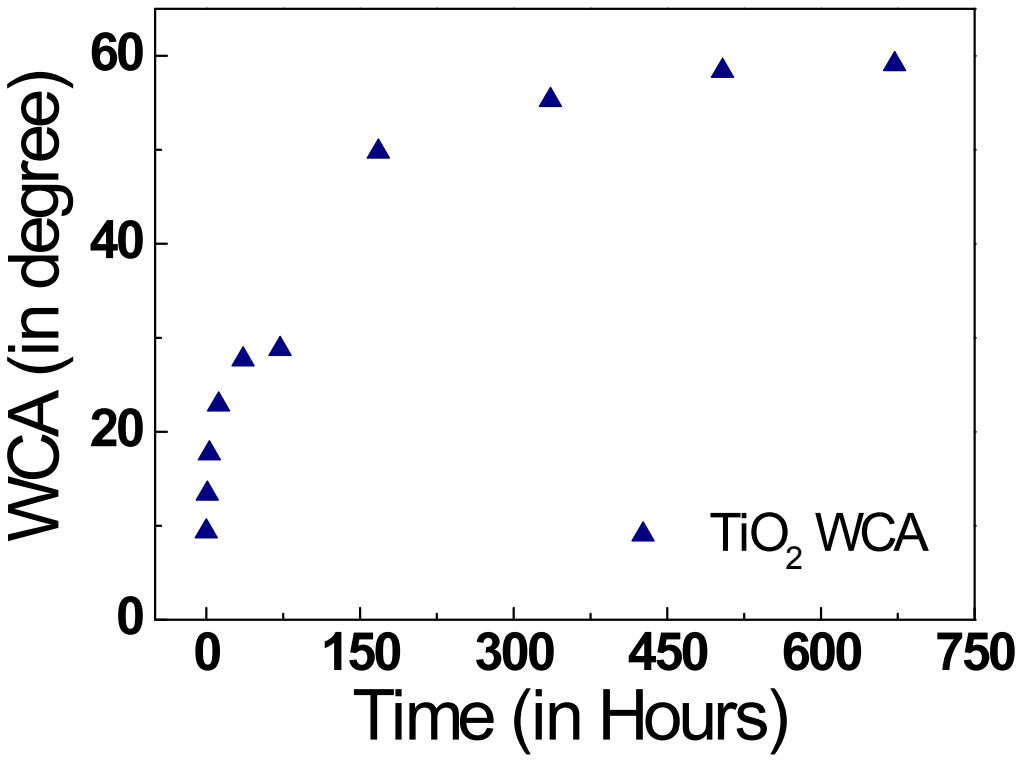

Fig S7: Temporal evolution of WCA of 50 unit-cell thick TiO_2 thin-films grown by PLD. The WCA of 3d based transition metal oxide (TMO) thin-film also shows similar behaviour like REO thin-films except that the saturation value is lower than REO samples at (65°) which again, is consistent with reported values.

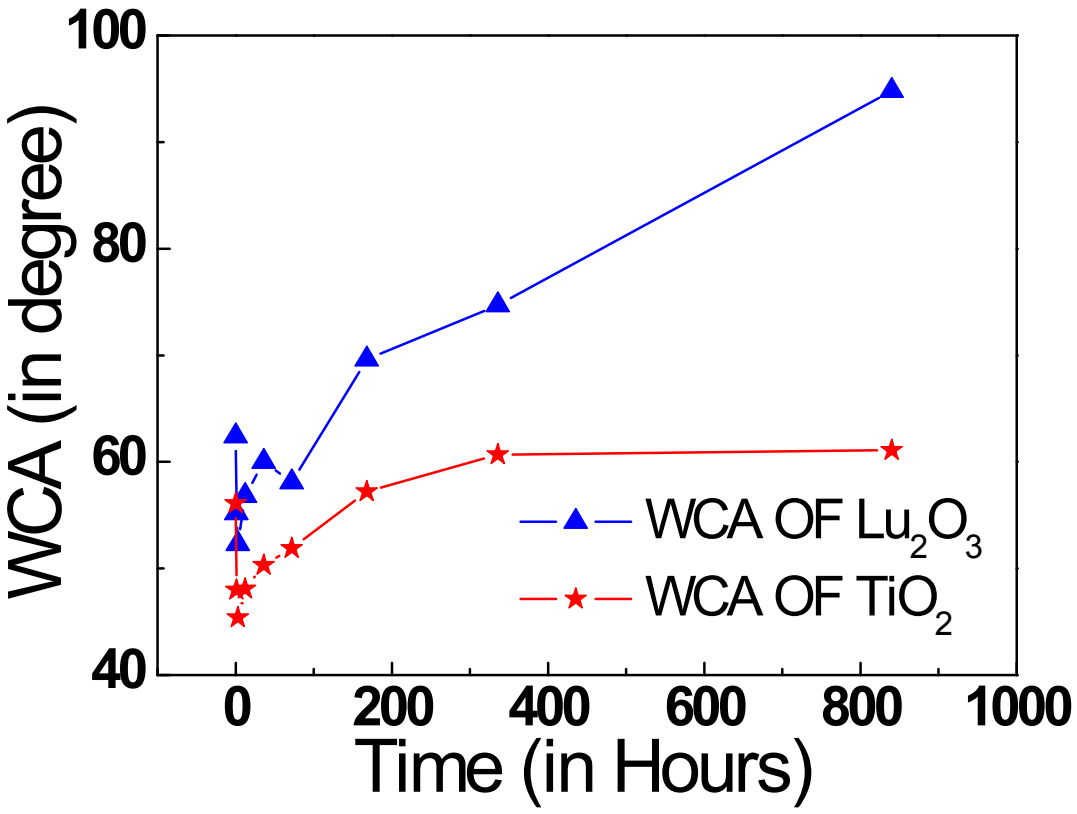

Fig S8: Temporal evolution of WCA of 50 unit-cell thick TiO_2 (001) [on STO (001)] and Lu_2O_3 (001) [on YSZ (001)] thin-films grown by PLD where the samples were kept in vacuum chamber for 5 days and then exposed to atmosphere and then WCA was measured over time.

In this case the initial WCA comes out to be significantly high and over initial atmospheric exposure we see a slight decrease of WCA and then eventually WCA increases to the environmentally stabilized value.

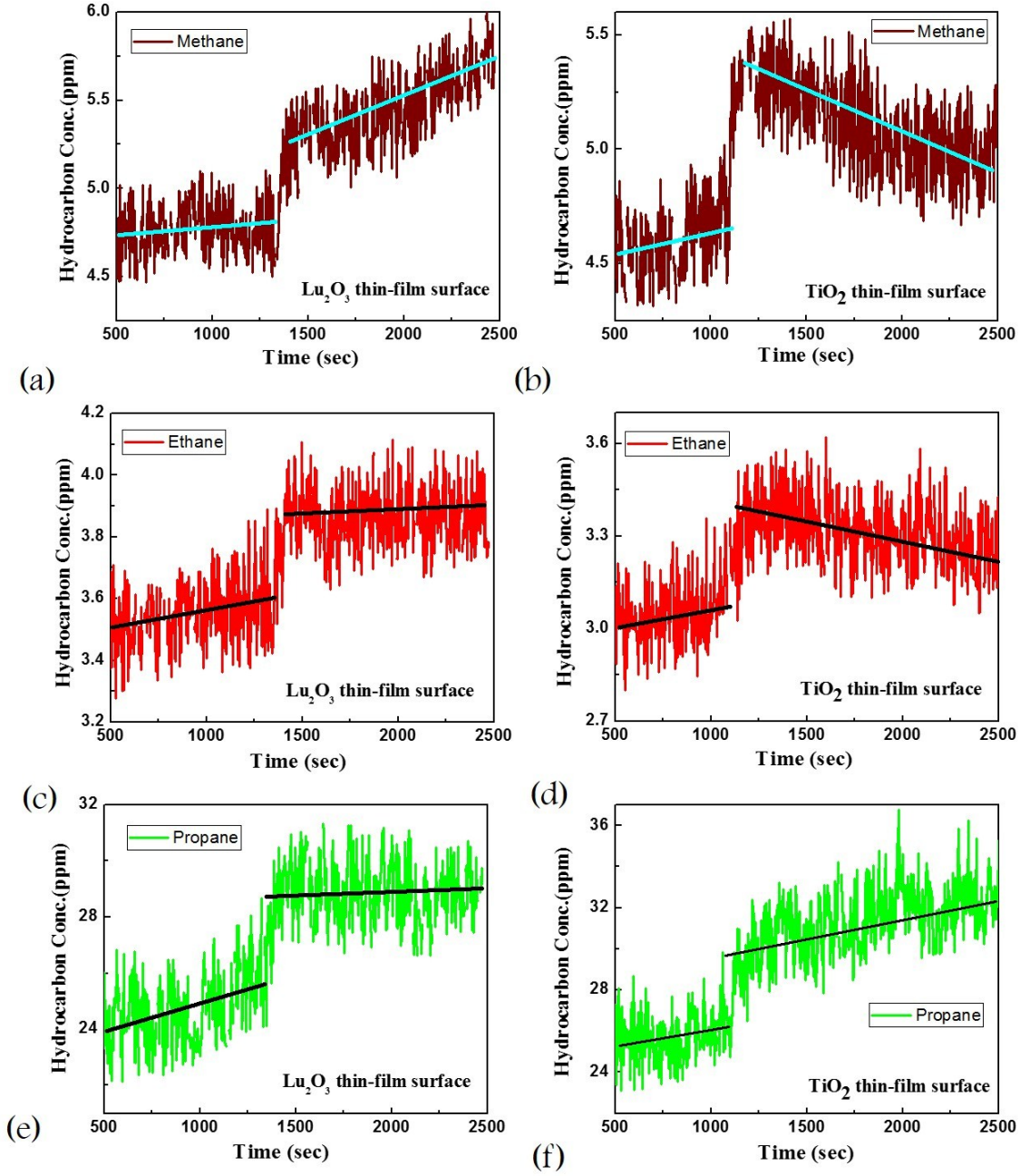

Fig S9: SIFT-MS analysis showing hydrocarbon emission from (a), (c), (e) Lu_2O_3 thin film and (b), (d), (f) TiO_2 thin-film surface.

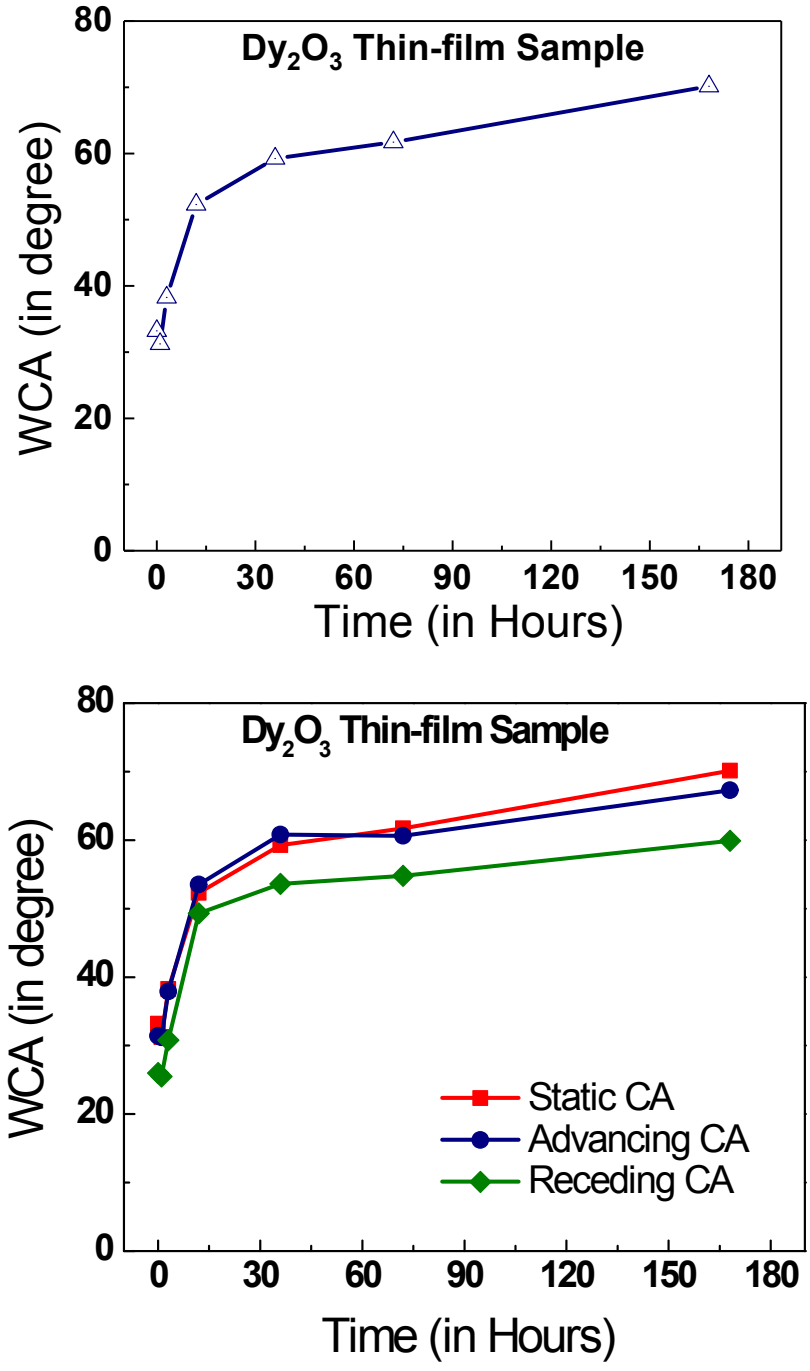

Fig S10: Temporal evolution of WCA of Dy2O3 thin-film surfaces (a) static contact-angle and (b) static as well as advancing & receding contact angle.

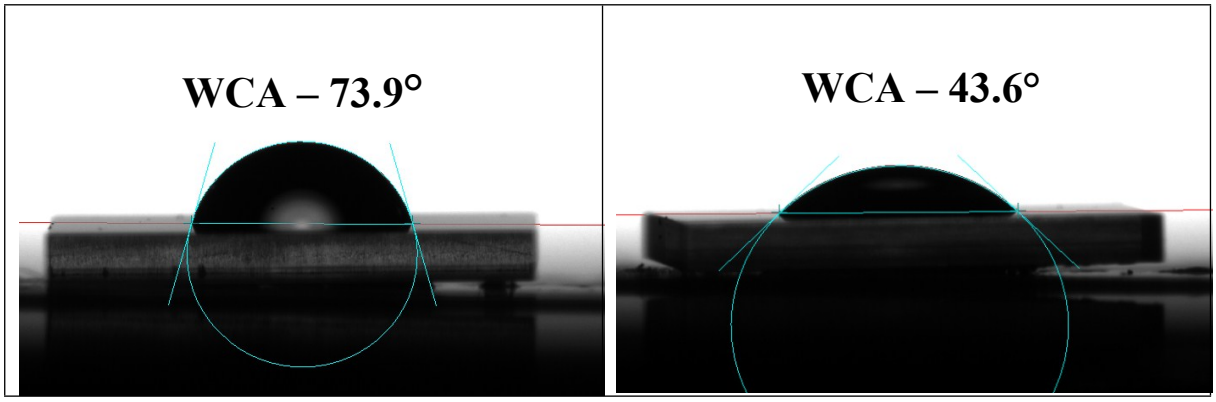

Fig S11: WCA of Lu_2O_3 thin-film changes from 73.9° (left) to 43.6° (right) upon annealing at 300°C.

Table S1. Calculation of roughness factor for all REO thin-film surfaces

Sample Details	Projected Surface Area (A_p) μm^2	Actual Surface Area (A_a) μm^2	Roughness Factor A_a/A_p
Lu_2O_3	4	4.0068	1.0017
Yb_2O_3	4	4.1335	1.03375
Tm_2O_3	4	4.0069	1.001725
Er_2O_3	4	4.0318	1.00795
Ho_2O_3	4	4.1246	1.03115
Dy_2O_3	4	4.7746	1.19365
CeO_2	4	4.0073	1.001825
Gd_2O_3	4	4.0949	1.023725
Eu_2O_3	4	4.1379	1.034475
Sm_2O_3	4	4.0339	1.008475