Supplementary Data

This supplementary data is a part of the paper entitled "Synthesis and Certification of Lanthanum Oxide Extracted from Monazite Sand".

Supplement 1 (S-1). Homogeneity test of macroelement (La concentration) in the ten lanthanum oxide subsamples

La-Oxide Sub-sample	Test Results of La (%) A	B	Xt	Xt-Xr	$(Xt-Xr)^2$	Wt	Wt^2
1	77.016	77.116	77.0660	-0.9867	0.9736	0.1000	0.0100
2	78.706	78.082	78.3940	0.3413	0.1165	0.6240	0.3894
3	76.636	75.622	76.1290	-1.9237	3.7006	1.0140	1.0282
4	76.890	75.958	76.4240	-1.6287	2.6527	-0.9320	0.8686
5	81.372	78.846	80.1090	2.0563	4.2284	2.5260	6.3807
6	79.810	78.232	79.0210	0.9683	0.9376	1.5780	2.4901
7	80.316	79.118	79.7170	1.6643	2.7699	-1.1980	1.4352
8	79.676	77.718	78.6970	0.6443	0.4151	1.9580	3.8338
9	76.220	77.738	76.9790	-1.0737	1.1528	1.5180	2.3043
10	79.070	76.912	77.9910	-0.0617	0.0038	2.1580	4.6569
		Xr	**78.0527**				
			Total		16.9510		23.3972
				Sx	0.9417	Sw	0.5849
				Sx^2	0.8868	Sw^2	0.3421
						$Sw^2/2$	0.1711
						$Sx^2 - (Sw^2/2)$	0.7158
						Ss	**0.3579**

In Supplement 1, La concentration measured of 78.0527% or 0.780527. Log 0.780527 = -0.106, then 1 - 0.5 log 0.780527 = -1.0538. The value of σ = 2.0760, so the value of 0.3 σ = 0.6228. The value of Ss = 0.3579. The concentration of La has been homogeneous, because of Ss < 0.3 σ.

Supplement 2 (S-2). Homogeneity test of microelement (Sm concentration) in the ten lanthanum oxide subsamples

La-Oxide Sub-sample	Test Results of Sm (%) A	B	Xt	Xt-Xr	$(Xt-Xr)^2$	Wt	Wt^2
1	0.116	0.110	0.1130	-0.01015	0.0001	-0.0060	3.60×10^{-5}
2	0.104	0.116	0.1100	-0.01315	0.0002	-0.0120	1.44×10^{-4}
3	0.128	0.126	0.1270	0.00385	1.5×10^{-5}	0.0020	4.00×10^{-6}
4	0.125	0.119	0.1220	-0.00115	1.3×10^{-6}	-0.0060	3.60×10^{-5}
5	0.113	0.125	0.1190	-0.00415	1.7×10^{-5}	-0.0120	1.44×10^{-4}
6	0.137	0.136	0.1365	0.01335	0.0002	0.0010	1.00×10^{-6}
7	0.132	0.129	0.1305	0.00735	5.4×10^{-5}	-0.0030	9.00×10^{-6}
8	0.145	0.132	0.1385	0.01535	0.0002	0.0130	1.69×10^{-4}
9	0.119	0.118	0.1185	-0.00465	2.2×10^{-5}	-0.0010	1.00×10^{-6}
10	0.117	0.116	0.1165	-0.00665	4.4×10^{-5}	0.0010	1.00×10^{-6}
		Xr	**0.12315**				
			Total		0.0008		5.45×10^{-4}
				Sx	4.7×10^{-5}	Sw	1.36×10^{-5}
				Sx^2	2.2×10^{-9}	Sw^2	1.86×10^{-10}
						$Sw^2/2$	9.28×10^{-11}
						$Sx^2 - (Sw^2/2)$	2.10×10^{-9}
						Ss	$\mathbf{1.05 \times 10^{-9}}$

In Supplement 2, the Sm concentration measured of 0.123% or 0.00123. Log 0.00123 = -2.9096. The value of σ = 5.4823, so the value of 0.3 σ = 1.6447. The value of Ss = 1.05×10^{-9}. The concentration of Sm has been homogenous, because of Ss < 0.3 σ.

Supplement 3 (S-3). Homogeneity test of microelement (Y concentration) in the ten lanthanum oxide subsamples

La-Oxide Sub-sample	Test results of Y (%)		Xt	Xt-Xr	$(Xt-Xr)^2$	Wt	Wt^2
	A	B					
1.	0.101	0.099	0.1000	-0.00165	2.7×10^{-6}	-0.002	4.0×10^{-6}
2.	0.096	0.101	0.0985	-0.00315	9.9×10^{-6}	-0.005	2.5×10^{-4}
3.	0.106	0.103	0.1045	0.00285	8.1×10^{-6}	0.003	9.0×10^{-6}
4.	0.100	0.103	0.1015	-0.00015	2.2×10^{-8}	0.003	9.0×10^{-6}
5.	0.105	0.125	0.1150	0.01335	1.8×10^{-4}	-0.020	4.0×10^{-4}
6.	0.095	0.100	0.0975	-0.00415	1.7×10^{-5}	-0.005	2.5×10^{-5}
7.	0.099	0.097	0.0980	-0.00365	1.3×10^{-5}	-0.002	4.0×10^{-6}
8.	0.094	0.099	0.0965	-0.00515	2.6×10^{-5}	-0.005	2.5×10^{-5}
9.	0.104	0.103	0.1035	0.00185	3.4×10^{-6}	-0.001	1.0×10^{-6}
10.	0.102	0.101	0.1015	-0.00015	2.2×10^{-8}	0.001	1.0×10^{-6}
		Xr	**0.10165**				
			Total		2.6×10^{-4}		5.0×10^{-4}
				Sx	1.4×10^{-5}	Sw	1.2×10^{-5}
				Sx^2	2.1×10^{-10}	Sw^2	1.6×10^{-10}
						$Sw^2/2$	7.9×10^{-11}
						$Sx^2 - (Sw^2/2)$	1.3×10^{-10}
						Ss	6.4×10^{-11}

In Supplement 3, the Y concentration measured of 0.10165% or 0.0010165. The value of σ = 5.6429, so the value of 0.3 σ =1.6929. The value of Ss = 6.4×10^{-11}. The concentration of Y has been homogenous, because of Ss < 0.3 σ.

Supplement 4 (S-4). Stability test of macroelement (La concentration) in the three lanthanum oxide subsamples

La-Oxide Sub-sample	The concentration of La after 6 months (%)		Y_T (%)
	Y_A	Y_B	
1	77.066	79.980	78.957
4	76.424	79.160	77.792
9	76.979	78.330	77.655
	Yr (%)		**78.135**

In Supplement 1 (S-1) the concentration of La was obtained Xr = 78.0527% and in supplement 4 (S-4) the stability test data of La was obtained Yr = 78.1350%, the value of |Xr – Yr| = 0.0828**,** the value of 0.3 σ = 0.6228, so the concentration of La in lanthanum oxide is stable, because of |Xr – Yr| ≤ 0.3 σ namely 0.0828 < 0.6228.

Supplement 5 (S-5). Stability test of microelement (Sm concentration) in the three lanthanum oxide subsamples

La-oxide Sub-sample	The concentration of Sm after 6 months (%)		**Y_T (%)**
	Y_A	Y_B	
1	0.113	0.127	0.120
2	0.110	0.119	0.115
7	0.131	0.126	0.129
	Yr (%)		**0.121**

In Supplement 2 (S-2) the Sm concentration was obtained, Xr = 0.123% and on the stability test data in Supplement 5 (S-5) the Sm concentration was obtained Yr = 0.121%, the value of |Xr - Yr| = 0.002, and the value of 0.3 σ = 1.6447, so the concentration of Sm in lanthanum oxide was stable because of |Xr - Yr| ≤ 0.3 σ namely 0.002 < 1.6447.

Supplement 6 (S-6). Stability test of microelement (Y concentration) in the three lanthanum oxide subsamples

La-oxide Sub-samples	The concentration of Y after 6 months (%)		Y_T (%)
	Y_A	Y_B	
3	0.105	0.101	0.103
7	0.098	0.100	0.099
4	0.101	0.099	0.100
	Yr (%)		**0.1007**

In the Supplement 3 (S-3) the Y concentration was obtained, Xr = 0.10165% and on the stability test data, in Supplement 6 (S-6) the Y concentration was obtained Yr = 0.1007%, the value of |Xr – Yr| = 0.0095, and the value of 0.3 σ = 1.6919, so the concentration of Y in lanthanum oxide was stable because of |Xr - Yr| ≤ 0.3 σ namely 0.0095 < 1.6919.