Table S1. Conditions of the hydrothermal treatment

Molality in vessel (mol/L)		Water density (kg/L)	Molality in water (mol/kg)		Temperature (°C)	Water Pressure (MPa)	Treatment time (min)
CeO_2	Decanoic acid		CeO_2	Decanoic acid			
0.05	0.000	0.50	0.10	0	400	38	10, 60
0.05	0.0025	0.50	0.10	0.005	400	38	10
0.05	0.010	0.50	0.10	0.02	400	38	10
0.05	0.015	0.50	0.10	0.03	400	38	10
0.05	0.030	0.50	0.10	0.06	400	38	10
0.05	0.045	0.50	0.10	0.09	400	38	10
0.05	0.135	0.50	0.10	0.27	400	38	7, 10, 30, 60
0.05	0.27	0.50	0.10	0.54	400	38	10
0.05	0.80	0.50	0.10	1.6	400	38	10
0.06	0.16	0.59	0.10	0.27	380	38	10
0.06	0.16	0.40	0.15	0.39	380	24	10
0.06	0.16	0.20	0.29	0.79	380	23	10
0.06	0.16	0.10	0.58	1.6	380	18	10
0.06	0.16	0.05	1.2	3.2	380	12	10
0.06	0.16	0.02	2.9	7.9	380	5.5	10
0.06	0.16	0.002	29	79	380	0.6	10
0.08	0.00	0.76	0.10	0	300	38	10, 60
0.08	0.21	0.76	0.10	0.27	300	38	7, 10, 30, 60
0.07	0.00	0.69	0.10	0	340	38	10, 60
0.07	0.19	0.69	0.10	0.27	340	38	7, 10, 30, 60

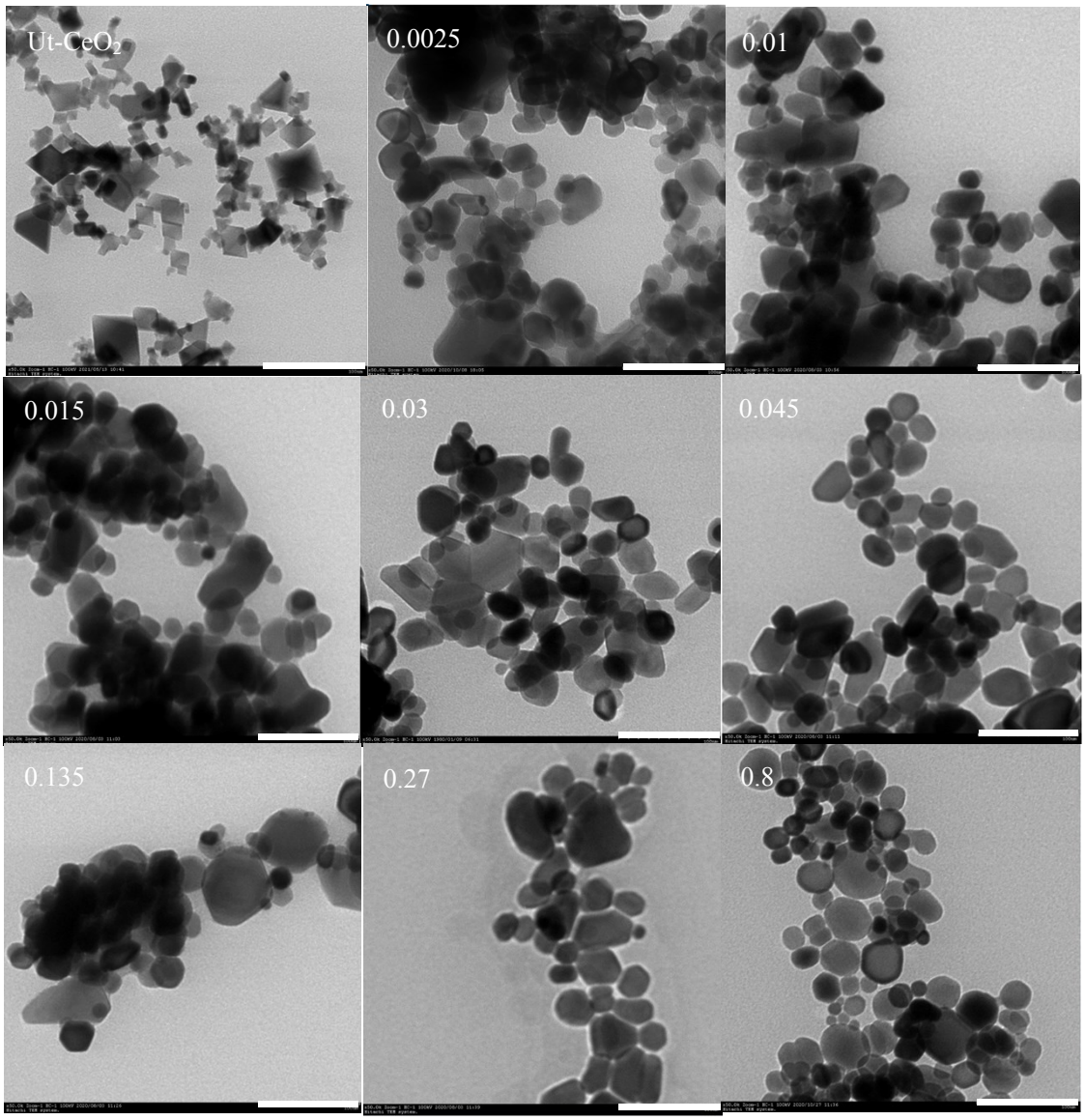

Figure S1. TEM images of the products. Untreated CeO_2 (Ut-CeO_2), 0.0025, 0.01, 0.015, 0.03, 0.045, 0.135, 0.27, and 0.8 mol/L DA concentrations.
0.05 mol/L CeO_2, 400 °C, 38 MPa, and 0.5 kg/L water density for 10 min.
Scale bars represent 100 nm.

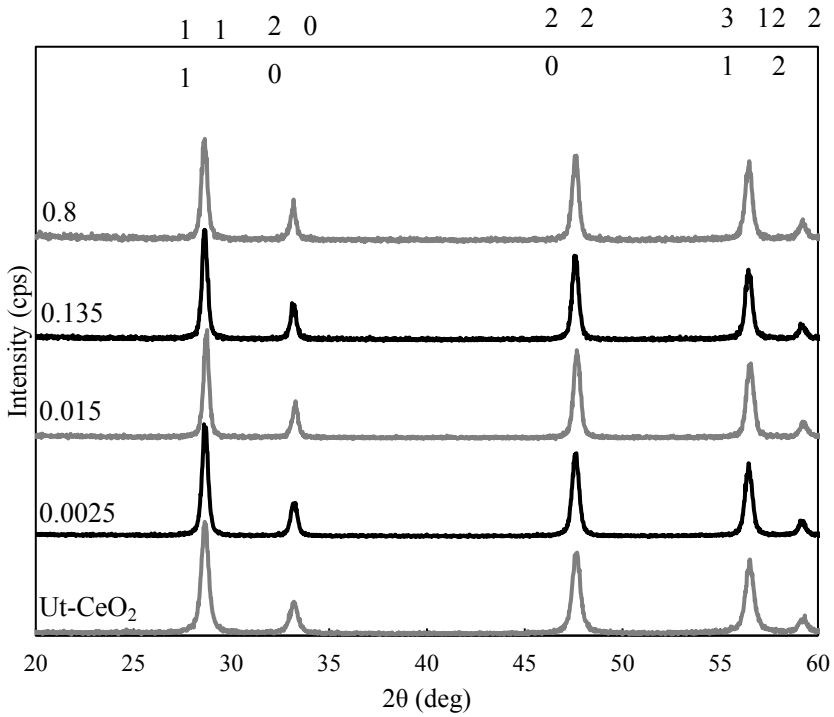

Figure S2. XRD patterns of the products. Untreated CeO_2 (Ut-CeO_2), 0.0025, 0.015, 0.135 and 0.8 mol/L DA concentration in water.
0.05 mol/L CeO_2, 400 °C, and 0.5 kg/L water density for 10 min.

Table S2. Atomic compositions (%) of cerium (III) decanoate and extracted chemicals.

Samples	C 1s	O 1s	Ce 3d
Cerium (III) decanoate	80.8	16.0	3.2
Extracted chemicals	80.9	16.1	3.0

Table S3. Oxygen storage capacity (OSC μmol-O/g, 500 °C) of CeO_2.

Untreated	340 °C 7 min	340 °C 360 min
38	67	91

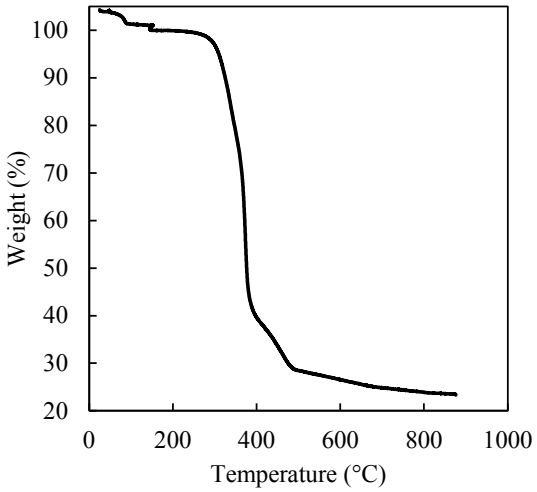

Figure S3. TGA curve of the Ce (III) decanoate synthesized by metathesis reaction.