Supplementary information

Figure S1: FTIR-ATR spectrum of the \( \text{Ce(OPr)}_4 \) concentrate in the range 4000 - 400 cm\(^{-1}\).

Figure S2: \( ^1H \) (a) & \( ^{13}C \) (b) NMR spectra of the cerium(IV) isopropoxide concentrate.

Figure S3: Images of the ceria gel (a) corresponding to Triton X-100 and (b) the gel which has been obtained when the precursor compound \( \text{Ce(OPr)}_4 \) was hydrolyzed outside of the aqueous cores of the reverse micelles.
**Figure S4**: UV-Vis Absorption spectra of the three different ceria gels corresponding to Triton X-100, Triton X-114 and Triton X-45.

**Figure S5**: (a) TGA and (b) DSC profiles of the three different ceria gels corresponding to Triton X-100, Triton X-114 and Triton X-45 reverse micelles.

**Figure S6**: X-Ray Diffractograms of the ceria solids corresponding to the three different Triton-X reverse micelles after calcination at 300°C for 2 h.
**Figure S7:** DFT pore size distributions of the ceria solids obtained from the three different Triton-X surfactants gels after calcination at 400°C for 2 h.

**Table S1:** FTIR-ATR data of the Ce(OPr)$_4$ precursor compound.$^{19-24}$

| functional group                                      | bibliographical characteristic absorption (cm$^{-1}$) | experimental characteristic absorption (cm$^{-1}$) |
|-------------------------------------------------------|------------------------------------------------------|--------------------------------------------------|
| stretching vibration of hydroxyl groups               | 3500                                                 | 3330                                             |
| -C-H elongation vibration                              | 2968                                                 | 2966                                             |
| anti-symmetric stretching vibration of -C-H            | 2930                                                 | 2923                                             |
| symmetric stretching vibration of -C-H                 | 2868                                                 | 2852                                             |
| bending vibration of -OH$^-$                           | 1600                                                 | 1633                                             |
| bending vibration of -C-H                              | 1480                                                 | 1462                                             |
| CH$_3$-C-CH$_3$ stretching modes of the isopropoxy group | 1350                                                 | 1360                                             |
| stretching conjugated vibration of -C=O               | 1050                                                 | 1041                                             |
| C-C stretching vibration within the isopropoxy group   | < 1000                                               | 835                                              |
| skeletal vibration of the isopropoxy group             | 841                                                  | 820                                              |
| symmetrical skeletal vibration of the isopropoxy group | 785                                                  | 727                                              |
| skeletal vibration of the isopropoxy group             | 566                                                  | 550                                              |
| stretching vibration of Ce-OR                          | 406                                                  | 407                                              |
**Table S2:** $^1$H and $^{13}$C NMR (ppm) experimental data of Ce(OiPr)$_4$ in CDCl$_3$ solvent.$^{25}$

|          | $^1$H NMR |          | $^{13}$C NMR |
|----------|-----------|----------|--------------|
|          | δ (ppm)   | compound | δ (ppm)      | compound |
| (1.201 & 1.213) doublet, 24 H |          | isopropoxide (CH$_3$) | 25.35, 8 C | isopropoxide (CH$_3$) |
| 1.423 single |          | water (OH) | 59.06 | DME (CH$_3$) |
| 3.392 single |          | DME (CH$_3$) | 64.43, 4 C | isopropoxide (CH) |
| 3.542 single |          | DME (CH$_3$) | 71.8 | DME (CH$_3$) |
| (3.988, 4, 4.012, 4.025, 4.037, 4.049 & 4.061) septet, 4 H | isopropoxide (CH) | (76.74, 77 & 77.25) | solvent (CDCl$_3$) signals |
| 7.26 |          | solvent (CDCl$_3$) | residual signals |          |

**Table S3:** TGA and DSC data of the three different ceria gels corresponding to Triton X-100, Triton X-114 and Triton X-45 reverse microemulsions.

|          | TGA - sample - CeO$_2$ | DSC - sample - CeO$_2$ |
|----------|-----------------------|------------------------|
|          | temperature range (°C) | max peak temperature (°C) | enthalpy (J/g) | combustion total enthalpy (J/g) |
|          | weight loss (%)*       |                         |              |                           |
| gel Triton X-100 | 34.1 - 143.3 | 133.2 | endo: 2.7 | exo: 414.8 |
|    | 145 - 187.6 | 170.5 | exo: 326 | |
|    | 192.8 - 320.7 | 196.4 | exo: 5.4 | |
|    | 324.1 - 385.5 | 302.3 | endo: 32.4 | |
| gel Triton X-114 | 30.7 - 127.9 | 111.7 | endo: 22.5 | exo: 304.9 |
|    | 131.3 - 179.1 | 173 | exo: 174.9 | |
|    | 182.5 - 325.8 | 195.2 | exo: 15.9 | |
|    | 329.2 - 586.8 | 243.2 | endo: 20 | |
|    | 598.7 - 765.9 | 363.1 | exo: 25.4 | |
| gel Triton X-45 | 40.9 - 131.3 | 173 | endo: 22.5 | | exo: 515.3 |
|    | 133.1 - 179.1 | 195.2 | exo: 48.4 | |
|    | 179.1 - 327.5 | 243.2 | endo: 44.4 | |
|    | 358.2 - 557.8 | 363.1 | exo: 47 | |

* The weight loss values are normalized.
Table S4: Experimental and literature FTIR data for the CeO$_2$ solids obtained from the three different Triton-X reversed micelles.$^{2,33,35-42}$

| functional group                                                                 | bibliographical characteristic absorption (cm$^{-1}$) | experimental characteristic absorption (cm$^{-1}$) |
|----------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------|
| stretching vibration of physisorbed H$_2$O or OH$^-$ stretching frequency of unidentate Ce-OH | 3440                                                   | 3437                                             |
| asymmetric stretch of CO$_2$                                                     | 2350                                                   | 2353                                             |
| stretching vibration of the hydrogen bonded C=O group                           | 1783                                                   | 1769                                             |
| bending vibration of -OH$^-$                                                      | 1620                                                   | 1640                                             |
| asymmetric stretching vibration of C-O-C at para-disub phenol or asymmetric stretching vibration of the RCOO$^-$ | 1540                                                   | 1548                                             |
| stretching vibration of COO & Ce-O-C or Ce-O-C                                  | 1380                                                   | 1391                                             |
| stretching vibration of Ce-O                                                      | 850                                                    | 835                                              |
| stretching vibration of the Ce-O-C                                               | 710                                                    | 671                                              |
| stretching vibration of the Ce-O                                                 | 500                                                    | 500                                              |
| $\delta$(Ce-O...O) stretching mode of vibration                                  | 534, 526 & 497                                        | 500-400                                          |