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Supplementary materials

Nano and micro sized Eu^{3+} and Tb^{3+}-doped lanthanide hydroxycarbonates and oxycarbonates. The influence of glucose and fructose as stabilizing ligands.

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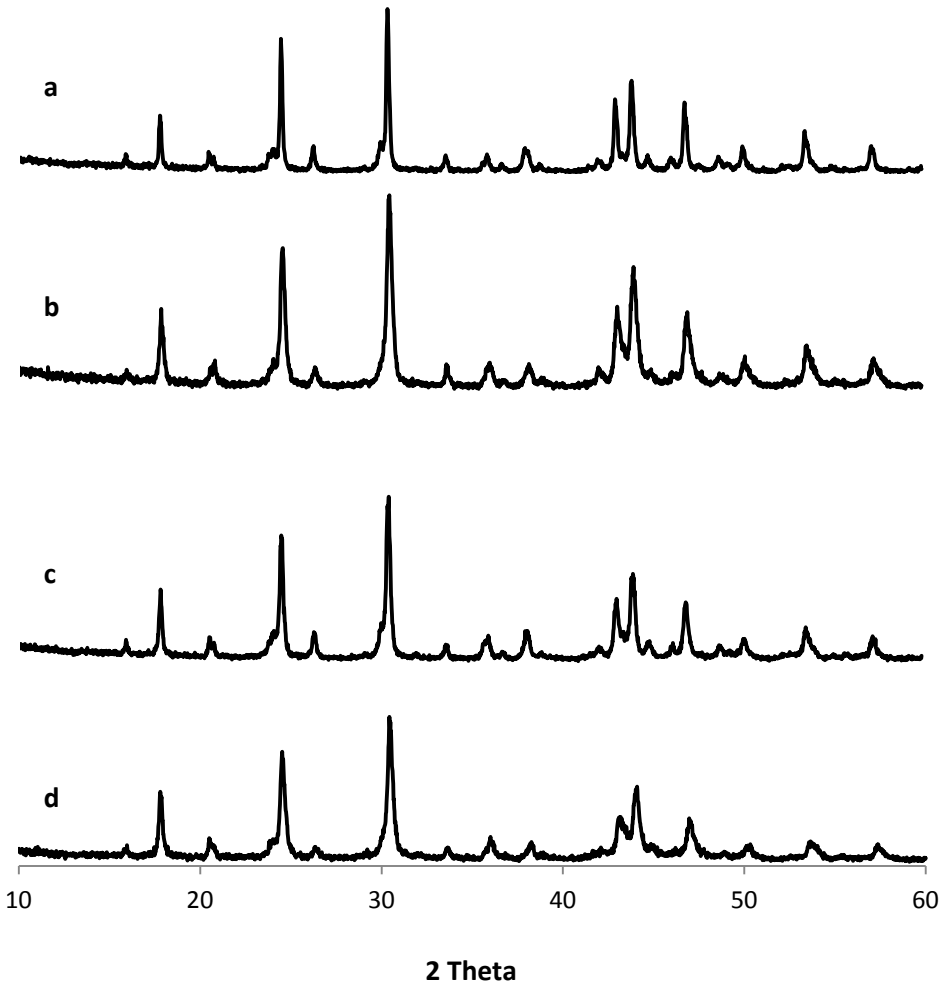

Fig. S1 Powder XRD pattern of (a) 2% , (b) 5%, (c) 10%, (d) 15% Tb: $LaOHCO_3$

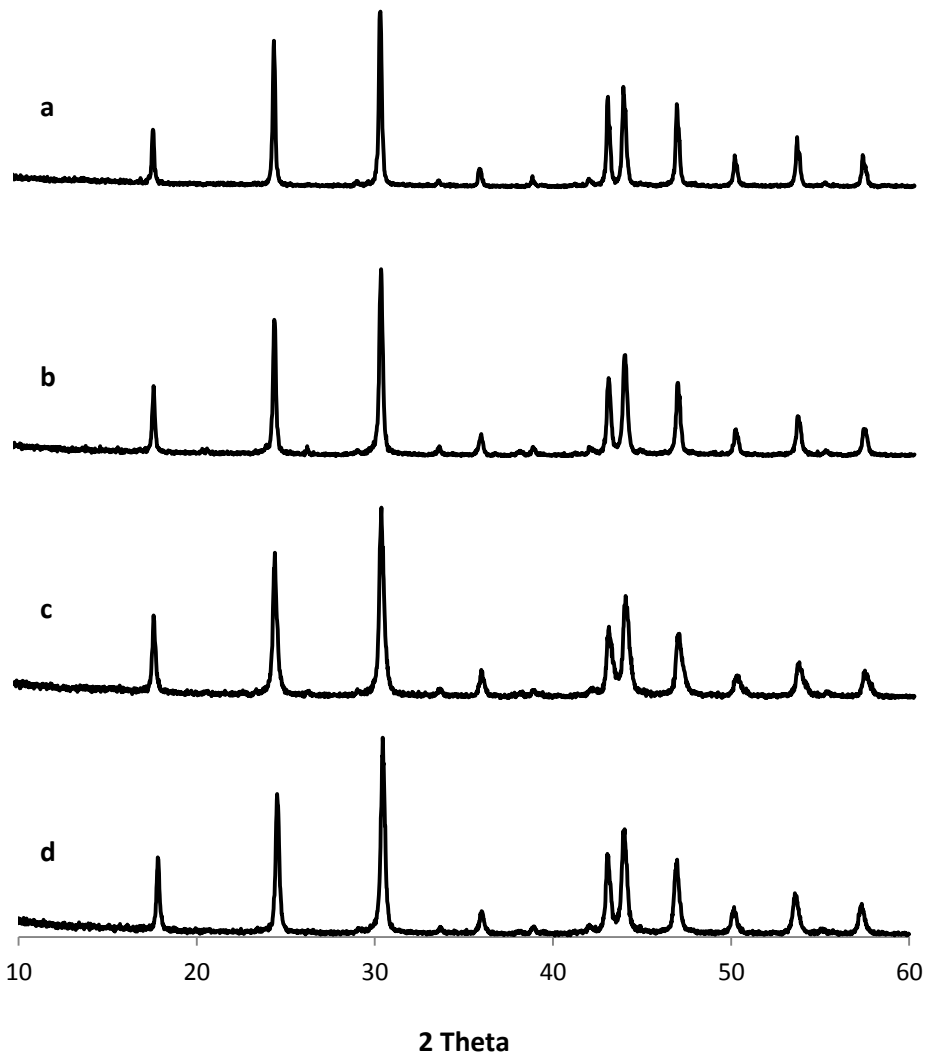

Fig. S2 Powder XRD pattern of (a) 2% , (b) 5%, (c) 10%, (d) 15% Eu: $LaOHCO_3$

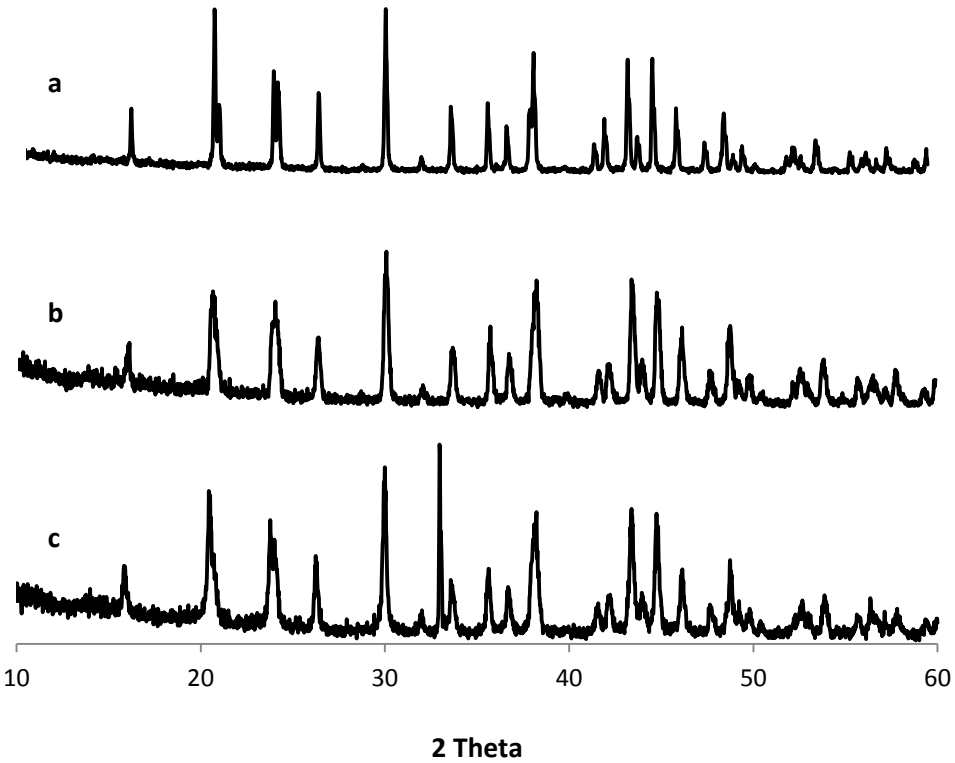

Fig. S3 Powder XRD pattern of (a) 5% Eu: $La_2O(CO_3)_2$, (b) 5% Tb: $La_2O(CO_3)_2$, (c) 5% Tb $La_2O(CO_3)_2$ stabilized with glucose

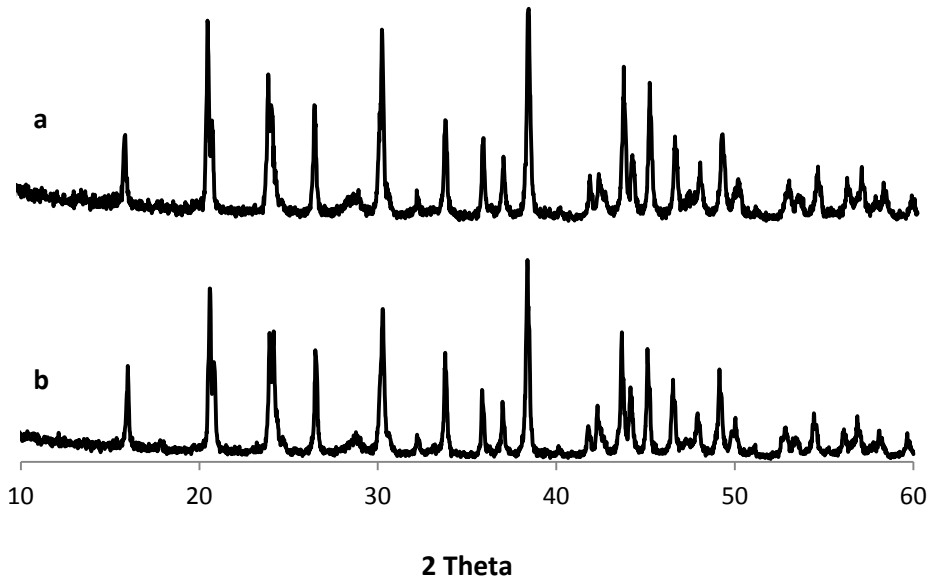

Fig. S4 Powder XRD pattern of (a) $Ce_2O(CO_3)_2$, (b) 5% Tb: $Ce_2O(CO_3)_2$

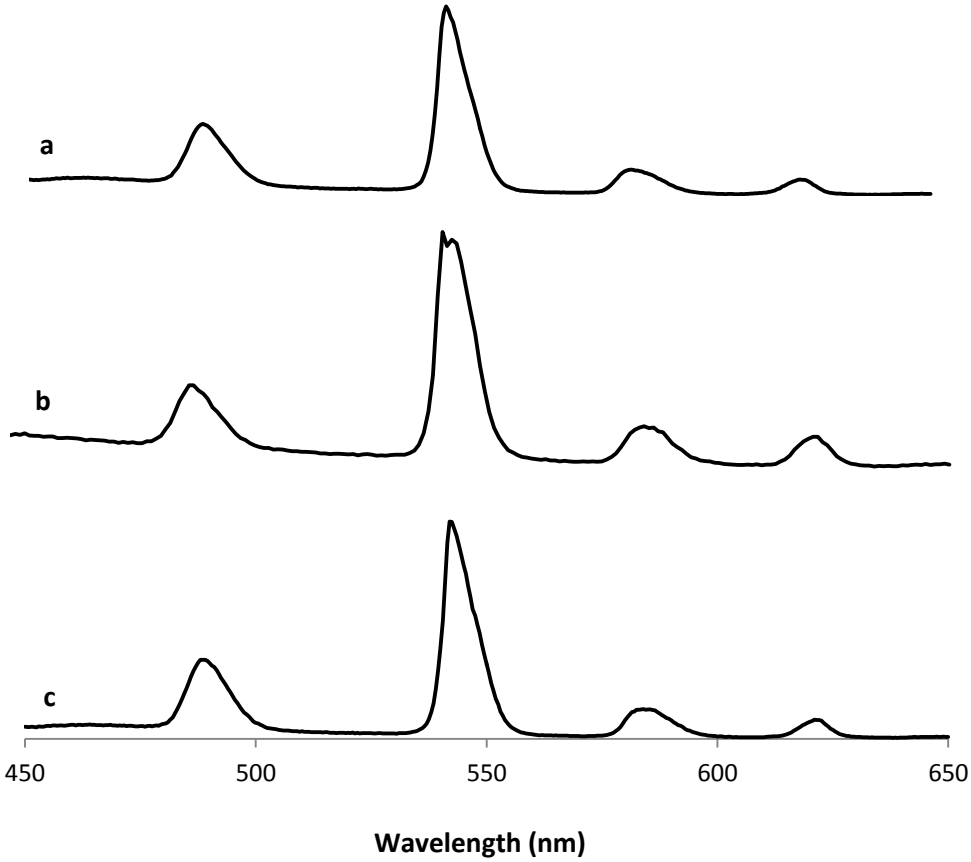

Fig. S5 Emission spectrum of (a) 2%, (b) 10%, (c) 15% Tb: $LaOHCO_3$ (powder sample) under 351 nm excitation

Table S1. $^5D_4$ luminescence lifetime values of Tb doped $LaOHCO_3$

Sample	Luminescence lifetime µs (powder)
2% Tb	1.42
5% Tb	1.93
10% Tb	1.79
15% Tb	1.74

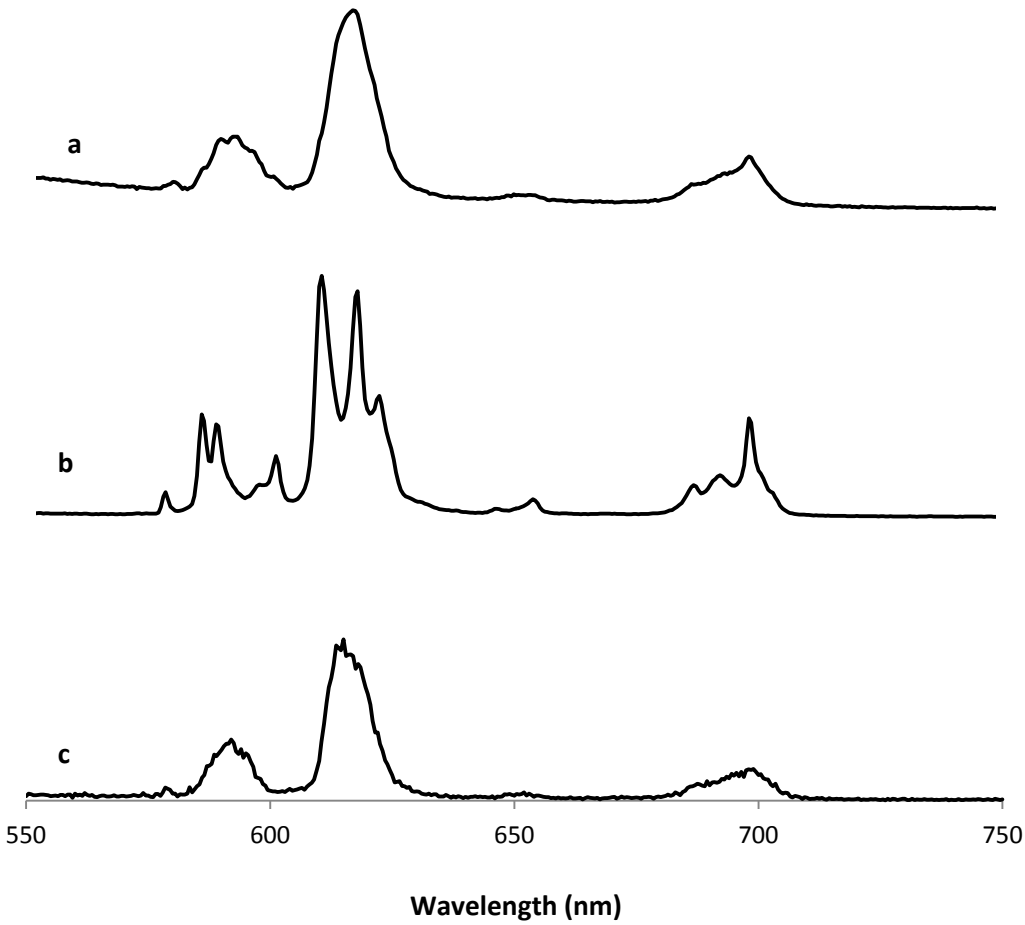

Fig. S6 Emission spectrum of (a) 2%, (b) 10%, (c) 15% Eu: $LaOHCO_3$ (powder sample) under 395 nm excitation

Table S2. $^5D_0$ luminescence lifetime values of Eu doped $LaOHCO_3$

Sample	Luminescence lifetime µs (powder)
2% Eu	0.63
5% Eu	0.70
10% Eu	0.57
15% Eu	0.57

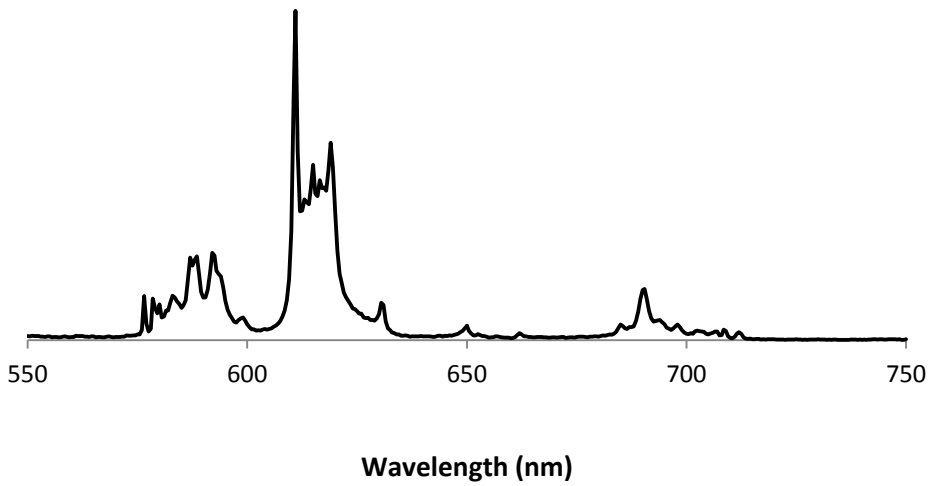

Fig. S7 Emission spectrum of 5% Eu: $La_2O(CO_3)_2$ (powder sample) under 395 nm excitation

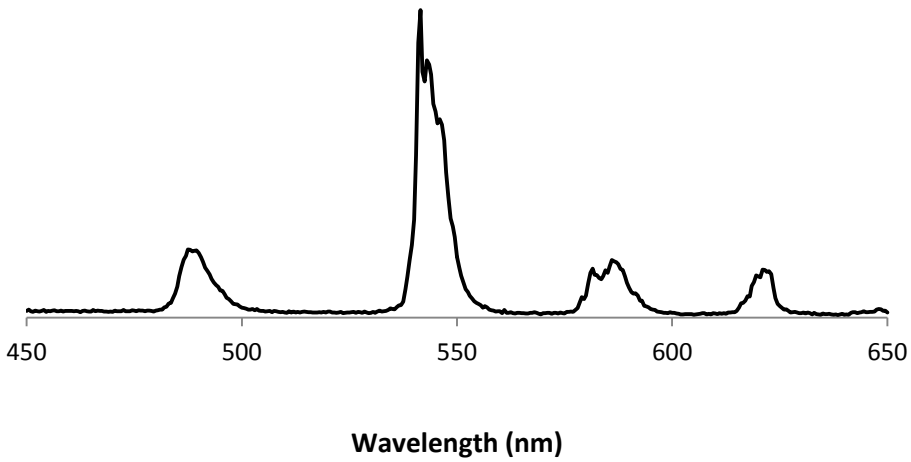

Fig. S8 Emission spectrum of 5% Tb: $La_2O(CO_3)_2$ (powder sample) under 351 nm excitation

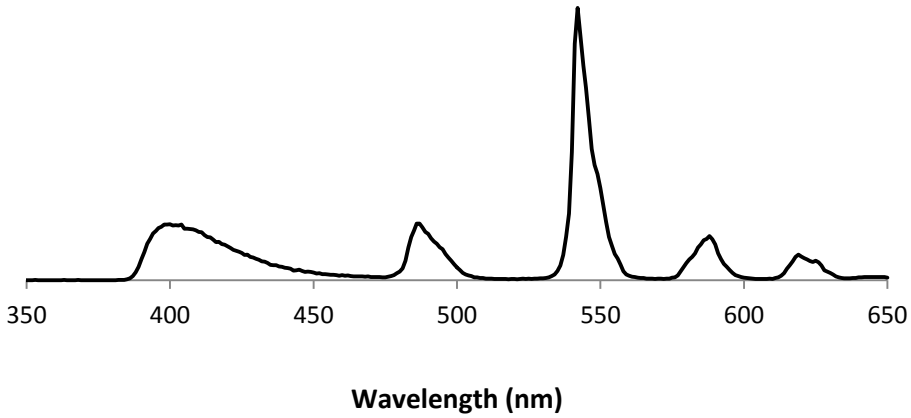

Fig. S9 Emission spectrum of 5% Tb: $Ce_2O(CO_3)_2$ (suspension) under 292 nm excitation

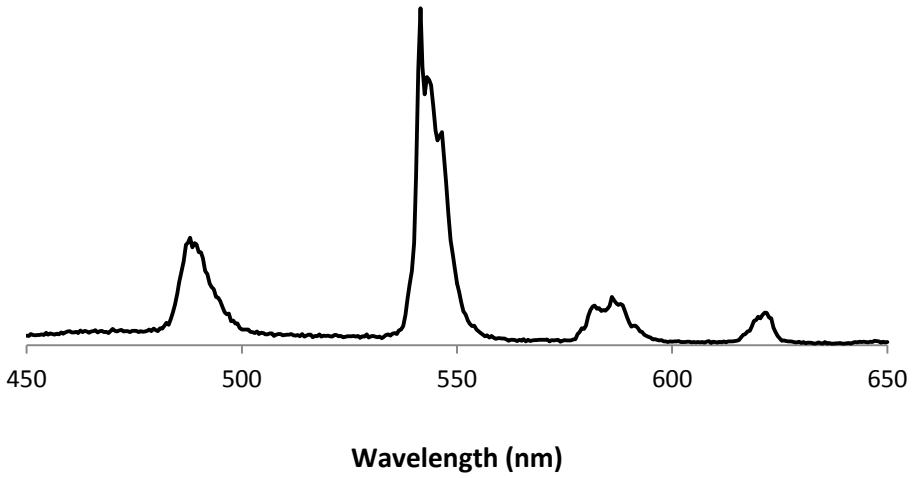

Fig. S10 Emission spectrum of 5% Tb: $La_2O(CO_3)_2$ stabilized with glucose (powder sample) under 351 nm excitation

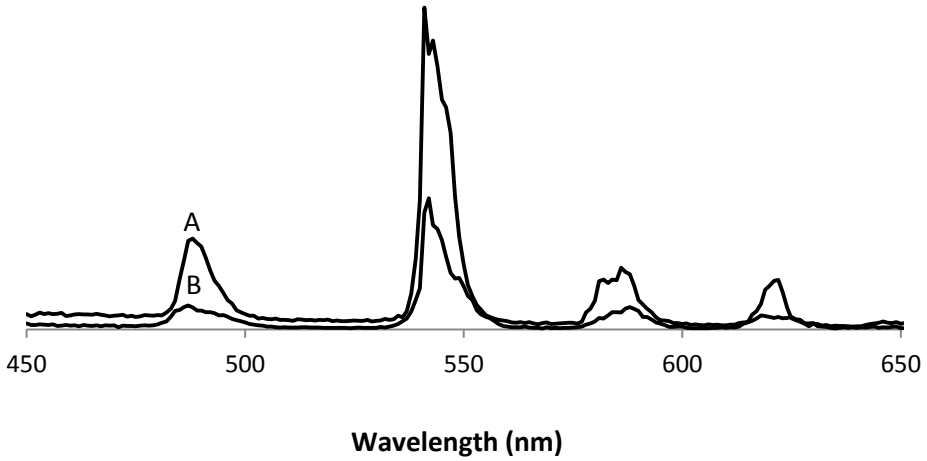

Fig. S11 Emission spectra of (A) 5% Tb: $La_2O(CO_3)_2$, (B) 5% Tb: $Ce_2O(CO_3)_2$ (powder samples) under 351 nm excitation

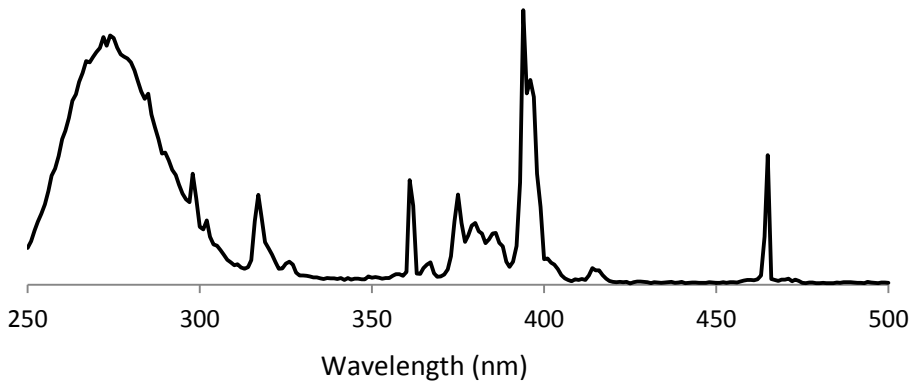

Fig. S12 Excitation spectrum of 5% Eu: $LaOHCO_3$ (powder samples), monitoring the emission at 617 nm

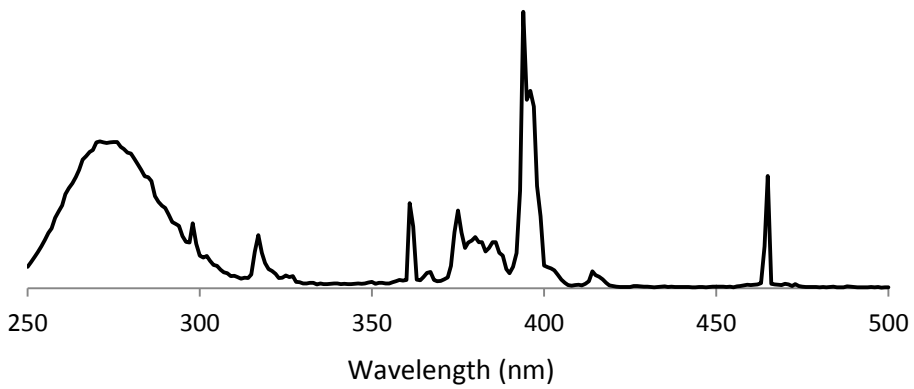

Fig. S13 Excitation spectrum of 5% Eu: $La_2O(CO_3)_2$ (powder samples), monitoring the emission at 617 nm

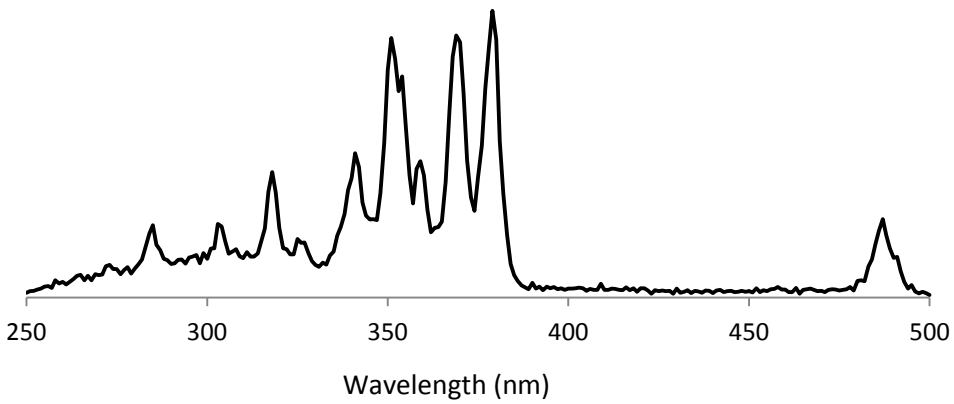

Fig. S14 Excitation spectrum of 5% Tb: $LaOHCO_3$ (powder samples), monitoring the emission at 540 nm

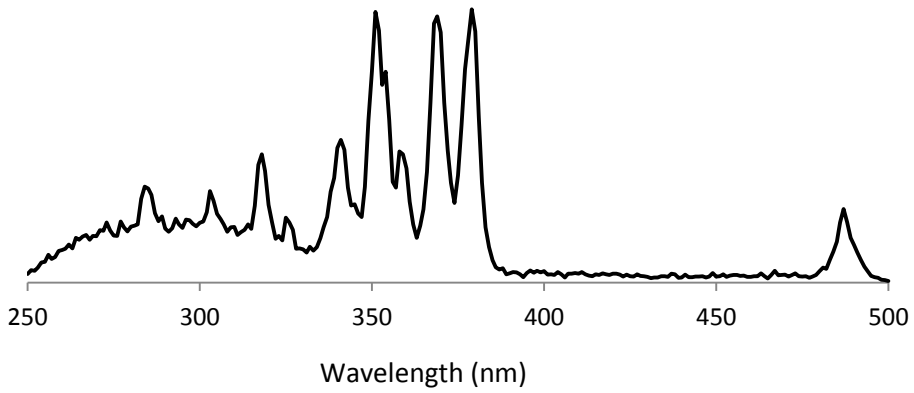

Fig. S15 Excitation spectrum of 5% Tb: $La_2O(CO_3)_2$ (powder samples), monitoring the emission at 540 nm

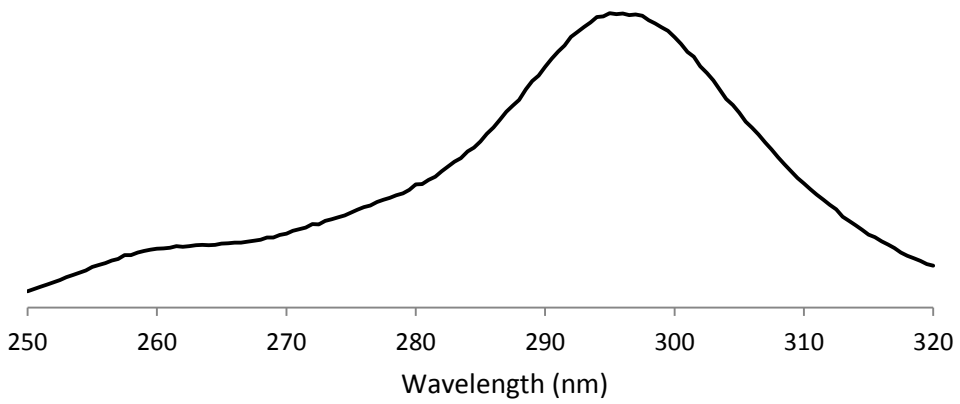

Fig. S16 Excitation spectrum of $Ce_2O(CO_3)_2$ (powder samples), monitoring the emission at 370 nm

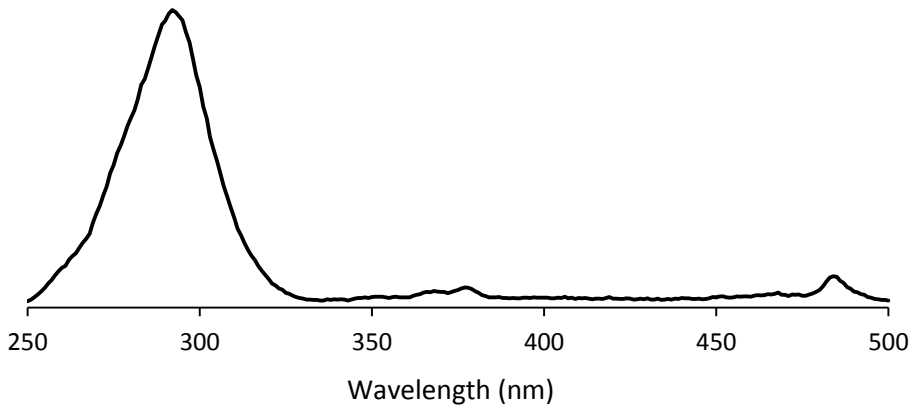

Fig. S17 Excitation spectrum of 5% Tb: $Ce_2O(CO_3)_2$ (powder samples), monitoring the emission at 540 nm

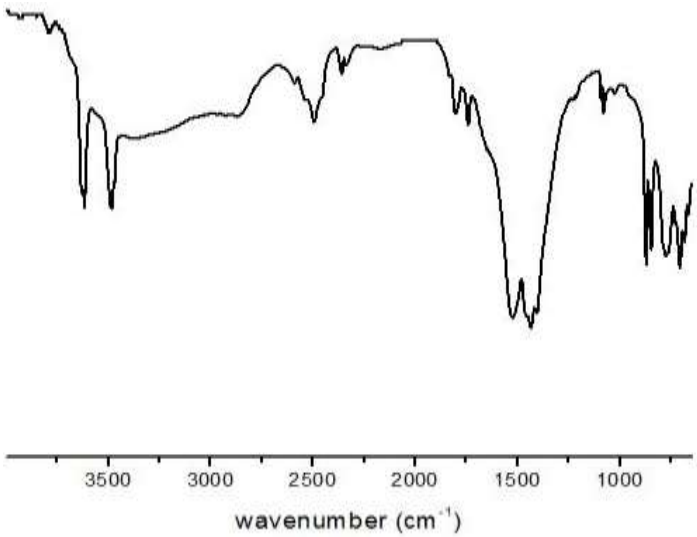

Fig. S18 Infrared spectrum of $LaOHCO_3$ NPs synthesized hydrothermally

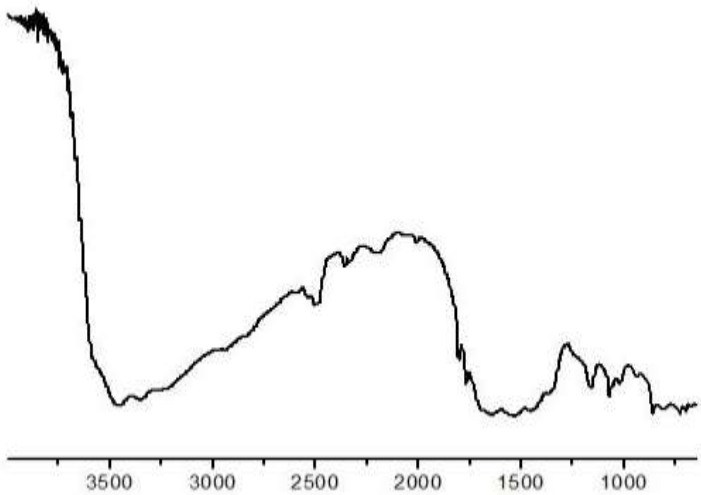

Fig. S19 Infrared spectrum of $La_2O(CO_3)_2$ NPs synthesized in the presence of glucose at 85-90ºC (from lanthanum acetate and urea)

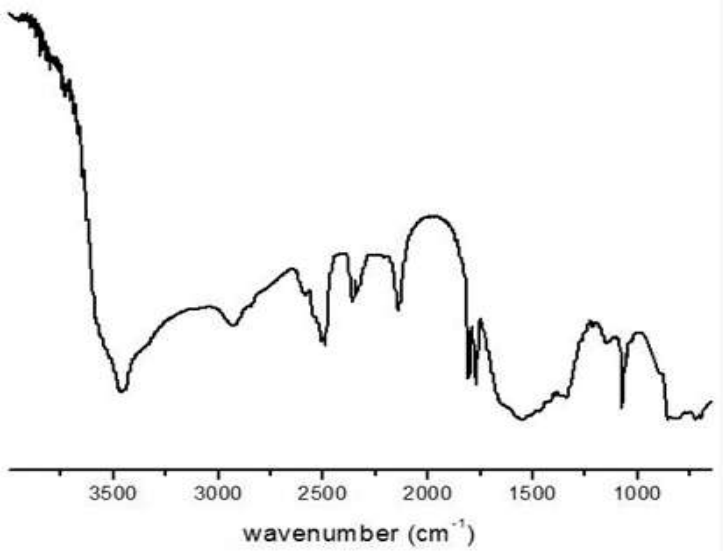

Fig. S20 Infrared spectrum of $Ce_2O(CO_3)_2$ NPs synthesized at 85-90ºC

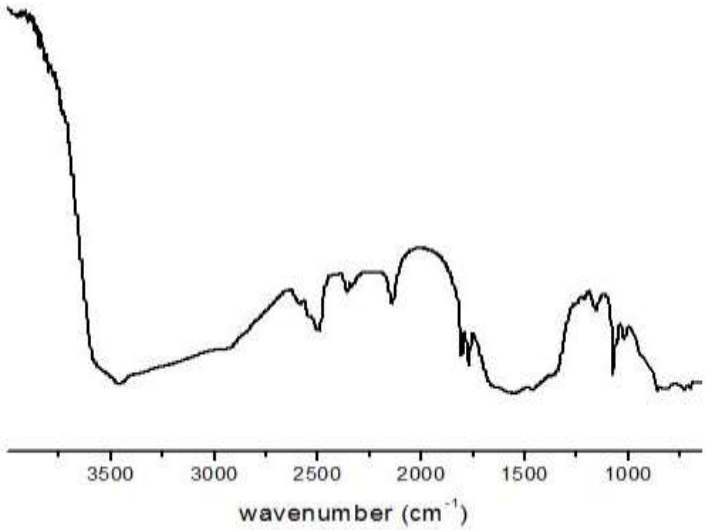

Fig. S21 Infrared spectrum of $Ce_2O(CO_3)_2$ synthesized in the presence of glucose at 85-90ºC

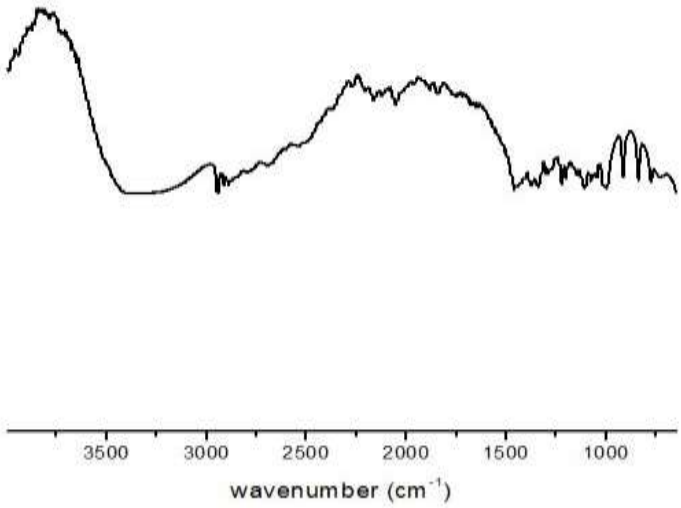

Fig. S22 Infrared spectrum of glucose

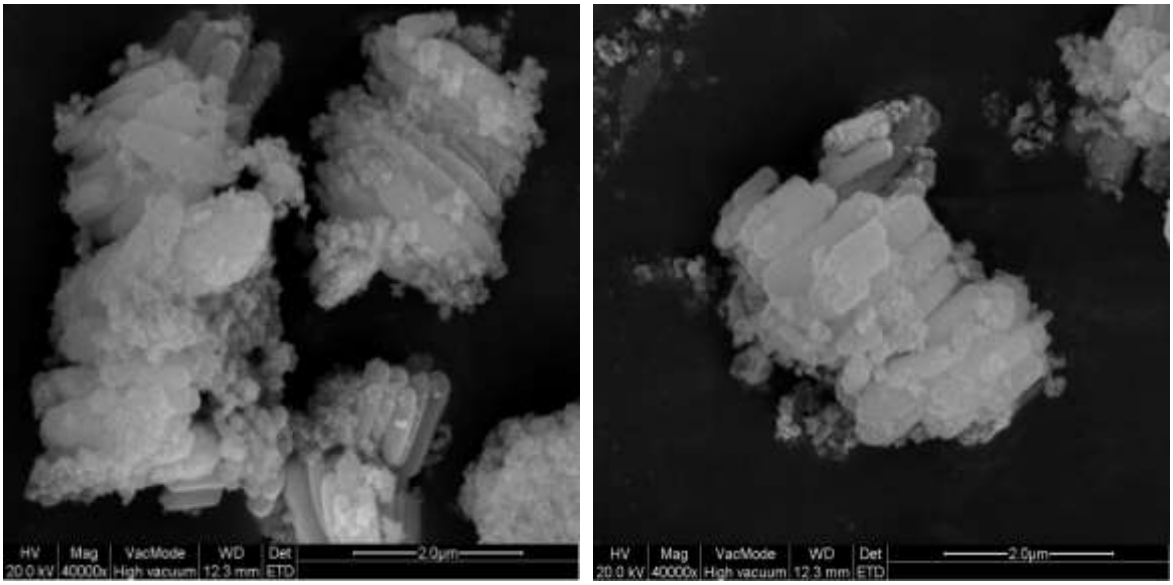

Fig. S23 SEM images of $Ce_2O(CO_3)_2$ particles synthesized hydrothermally from $Ce(OAc)_3$ and urea excess.

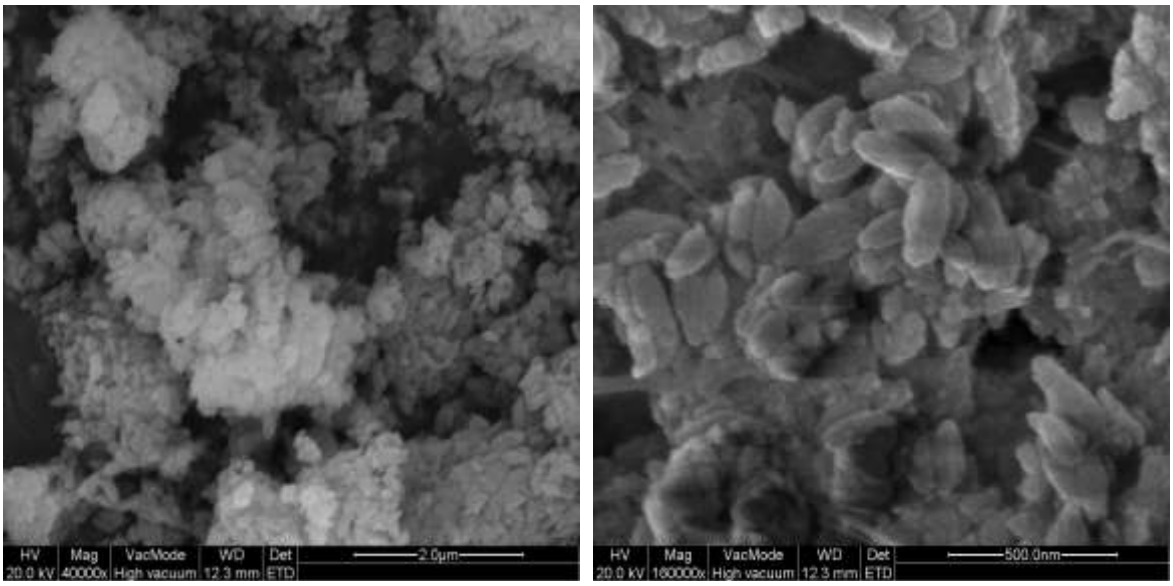

Fig. S24 SEM images of $La_2O(CO_3)_2$ particles synthesized from $La(OAc)_3$ and urea in the presence of glucose.

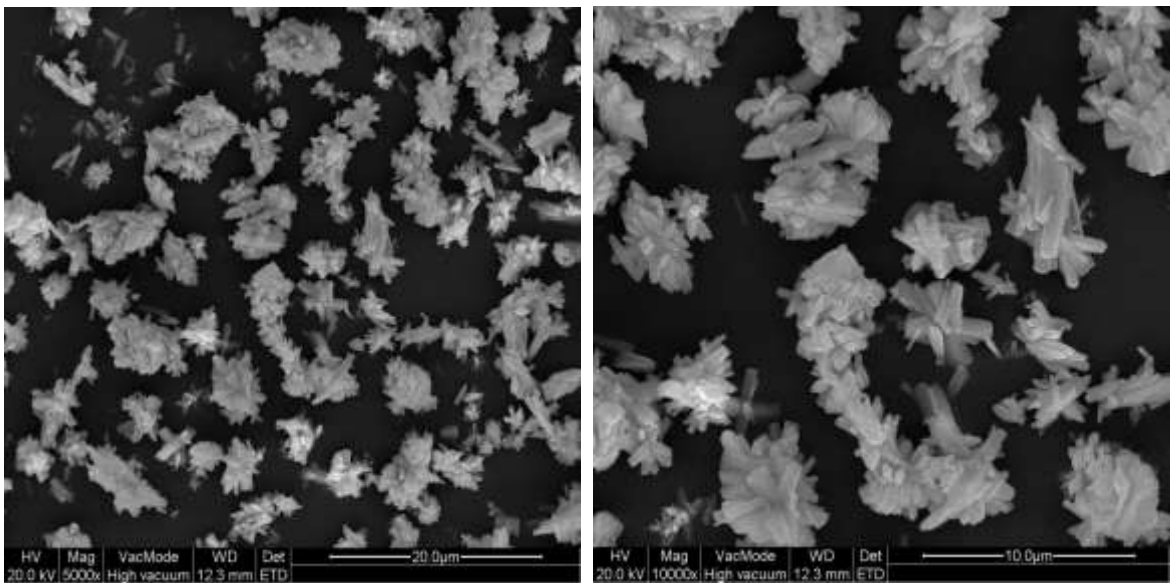

Fig. S25 SEM images of $La_2O(CO_3)_2$ particles synthesized from $La(NO_3)_3$ and urea in the presence of fructose.

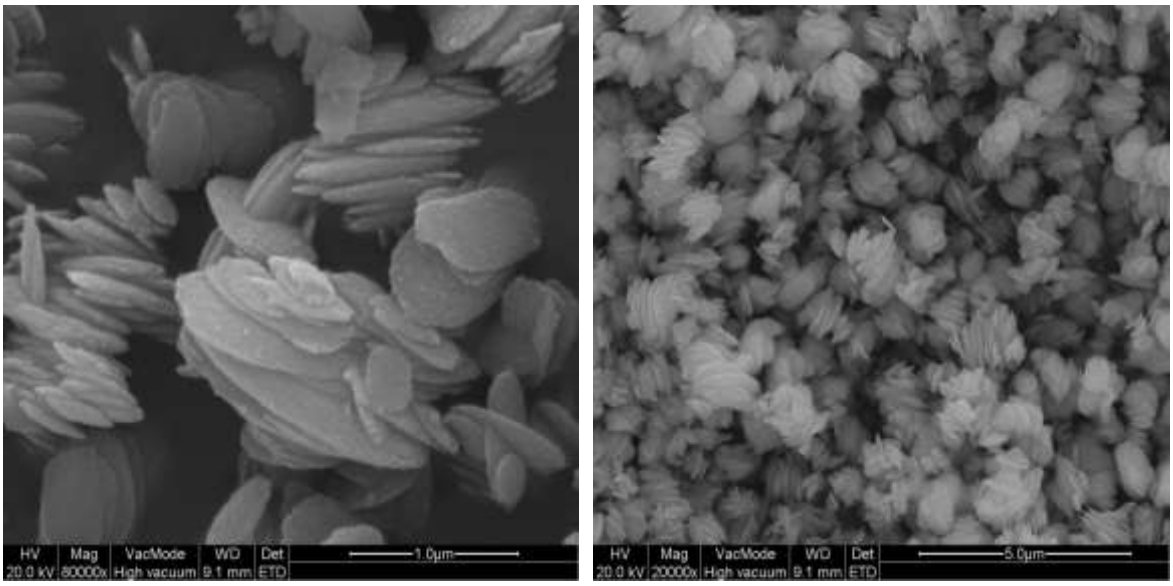

Fig. S26 SEM images of $Ce_2O(CO_3)_2$ particles synthesized from $Ce(NO_3)_3$ and urea in the presence of fructose.