

## Supporting Information

### Sol-gel synthesis of Sr<sub>1-x</sub>Yb<sub>x</sub>F<sub>2+x</sub> nanoparticles dispersible in acrylates

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### Experimental part

#### *Synthesis of Sr<sub>1-x</sub>Yb<sub>x</sub>F<sub>2+x</sub> nanoparticles*

All chemicals were used as received without further purification. Ytterbium oxide (Chempur, 99.9%) was dissolved in HOAc (Carl Roth, 100% p.a.) and H<sub>2</sub>O, respectively, under reflux resulting in the formation of ytterbium acetate tetrahydrate. The formed ytterbium acetate tetrahydrate was dried *in vacuo* at 90 °C for 6 h to give the anhydrous precursor compound. In a typical synthesis of a sol, an aqueous solution (20 ml) of Sr(CH<sub>3</sub>COO)<sub>2</sub> · ½ H<sub>2</sub>O (Aldrich) and Yb (CH<sub>3</sub>COO)<sub>3</sub> at different Sr-to-Yb ratios (total concentration of the metal: 0.2 mol·L<sup>-1</sup>) was mixed under thorough stirring until the precursors were dissolved. Then a stoichiometric amount of HF dissolved in MeOH (c=23.87 M) was added into the mixture. After vigorous stirring at room temperature for about 2 days a sol was obtained. The xerogel was obtained by removing the solvent and the resulting powder was finally dried under vacuum at temperatures up to 60 °C.

For high temperature studies the obtained xerogels were further calcined at the corresponding temperatures for 3 h.

#### *Modification and polymerization of Sr<sub>0.8</sub>Yb<sub>0.2</sub>F<sub>2</sub>(OR)<sub>0.2</sub> nanoparticles*

The resulting powder was modified by redispersing it with a mixture of H<sub>2</sub>O and polyacrylic acid (Alfa Aesar, 25 wt% soln. in water) and removing the water. To form a transparent polymer, we used (0.03 g) Diephenyl(2,4,6-trimethylbenzoyl)phosphine oxide as a polymerization starter in a 2 ml (1.93 g) water/ethanol based methacrylate mixture of HEMA, D3MA and bisGMA and added 0.145 g of Sr<sub>0.8</sub>Yb<sub>0.2</sub>F<sub>2</sub>(OR)<sub>0.2</sub> with 20.1% organic residue. After ten minutes of irradiation with a UV hand lamp (Herolab, 254 nm + 365 nm, 15W tube) we obtained a 0.2 to 0.3 mm transparent thin disc with 6 wt% Sr<sub>0.8</sub>Yb<sub>0.2</sub>F<sub>2</sub>(OR)<sub>0.2</sub>. During the polymerization there is a weight loss of around 0.1 g for 2 ml liquid methacrylate mixture.

Xray experiments were performed using a sirona dentsply unit (tube voltage 60 kV, 0.06 S).

#### *Characterization*

The X-Ray powder patterns were recorded at room temperature on a XRD 3003 TT from Seifert using a CuK $\alpha$  radiation (Wavelength CuK $\alpha$ 1 = 1.54056 Å).

The viscosity was measured with the Anton Paar Falling ball viscometer. For determining the dynamic viscosity, glass capillary with an inner diameter of 1.6 mm was used. The viscosity was detected at a temperature of 25 °C.

The measurements of the hydrodynamic particle diameter using DLS were carried out with a Zetasizer Nano from Malvern. Samples were analysed in the Malvern supplied “size” operating procedure, the light being detected at an angle of 173 ° and at a temperature of 25 °C.

The high-resolution transmission electron microscopy (HRTEM) measurements were performed on a JEOL TEM/STEM 2200 FS, with an acceleration voltage of 200 kV and a field emission source. A high angle annular dark field detector (HAADF) was applied to obtain STEM images. Carbon coated 300 mesh copper grids were used as sample carrier.

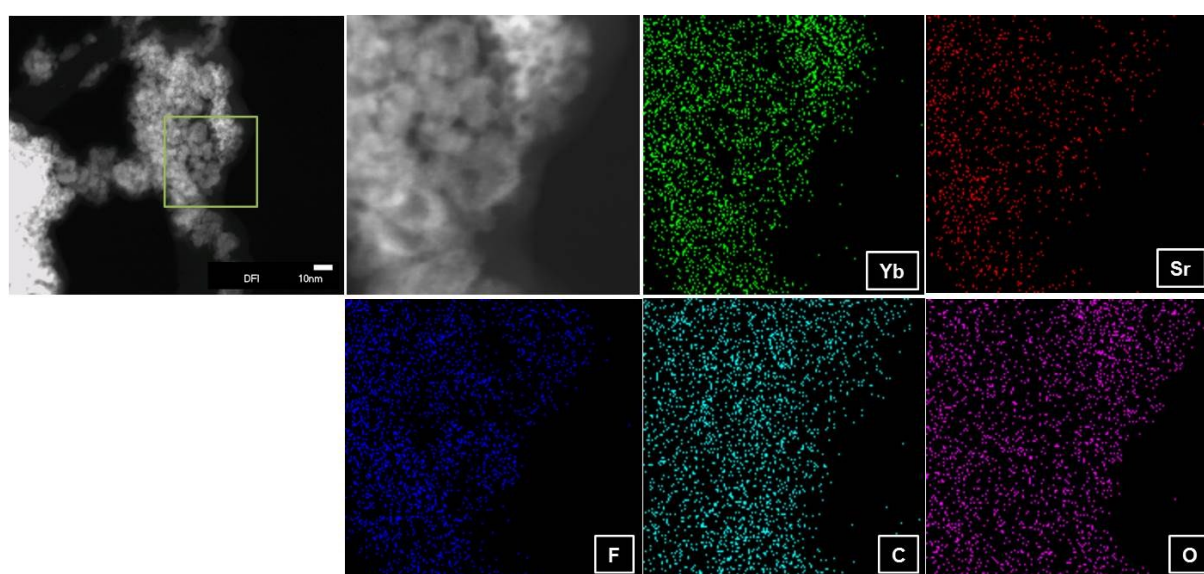


Fig S1: STEM image of Sr<sub>1-x</sub>Yb<sub>x</sub>F<sub>2+x</sub> (x = 0.53) nanoparticles and the corresponding hypermap of the elements Sr, Yb, F, C and O.

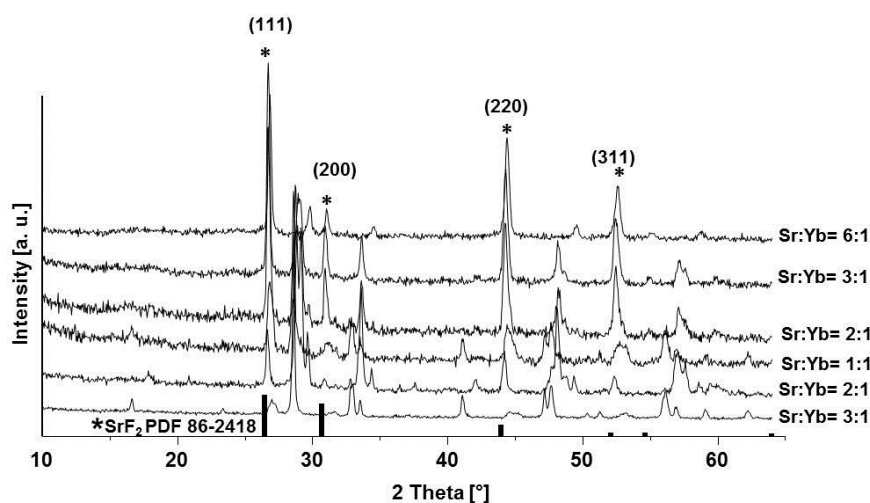


Fig S2: XRD patterns of Sr<sub>1-x</sub>Yb<sub>x</sub>F<sub>2+x</sub> phases after thermal treatment at 700 °C.