

Supplementary materials for

Effect of a phosphorus additive on luminescent and scintillation properties of ceramics GYAGG:Ce

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This PDF file includes:

Characterization of as-sintered garnet ceramics: X-ray diffraction, optical images, microstructure.

Figures S1, S2, S3 and the motivation for choosing ammonium dihydrogen phosphate as a model substance.

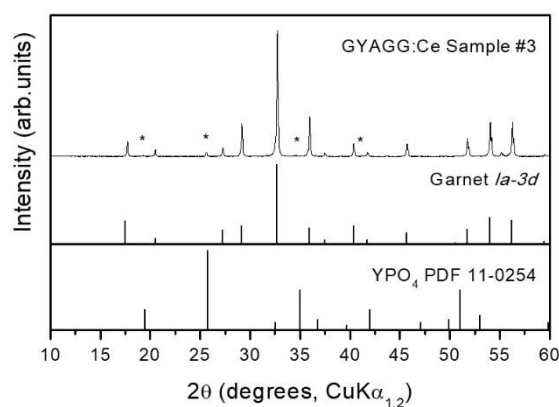


Figure S1. X-ray diffraction pattern of GYAGG:Ce ceramics sample # 3 (maximum phosphorus content). Bars for the garnet phase are given at the bottom (*Ia-3d* with lattice parameter $a = 12.232$ Å). Garnet phase is a dominate in the pattern, but also easy to see a few weak and very weak lines, which can be attributed to tetragonal (*I4₁/amd*) xenotime structure. Xenotime structure is typical modification for YPO₄ and YPO₄-based solid solutions. Lines of monazite-type phosphates (typical for pure GdPO₄) are not observed.

The motivation for choosing ammonium dihydrogen phosphate as a reasonable source of phosphorous are

- (1) NH₄H₂PO₄ is easily soluble in water and water-alcohol mixture, which allows it to be introduced into the precipitate homogeneously;
- (2) the thermal decomposition products of NH₄H₂PO₄ are well described in the literature (see references [41, 42 in the main text]). Phosphorus-containing decomposition products of phosphoric acid esters (PAEs) is identical or very close, namely phosphoric acids and/or phosphorus oxides. These products easily react with as-formed REE oxides. From the chemistry point of view, the processes of decomposition of NH₄H₂PO₄ and PAEs should be the same.

Also, NH₄H₂PO₄ is easily commercially available compound with good purity; it is a safe material and easy to work with. So NH₄H₂PO₄ is an appropriate model substance.

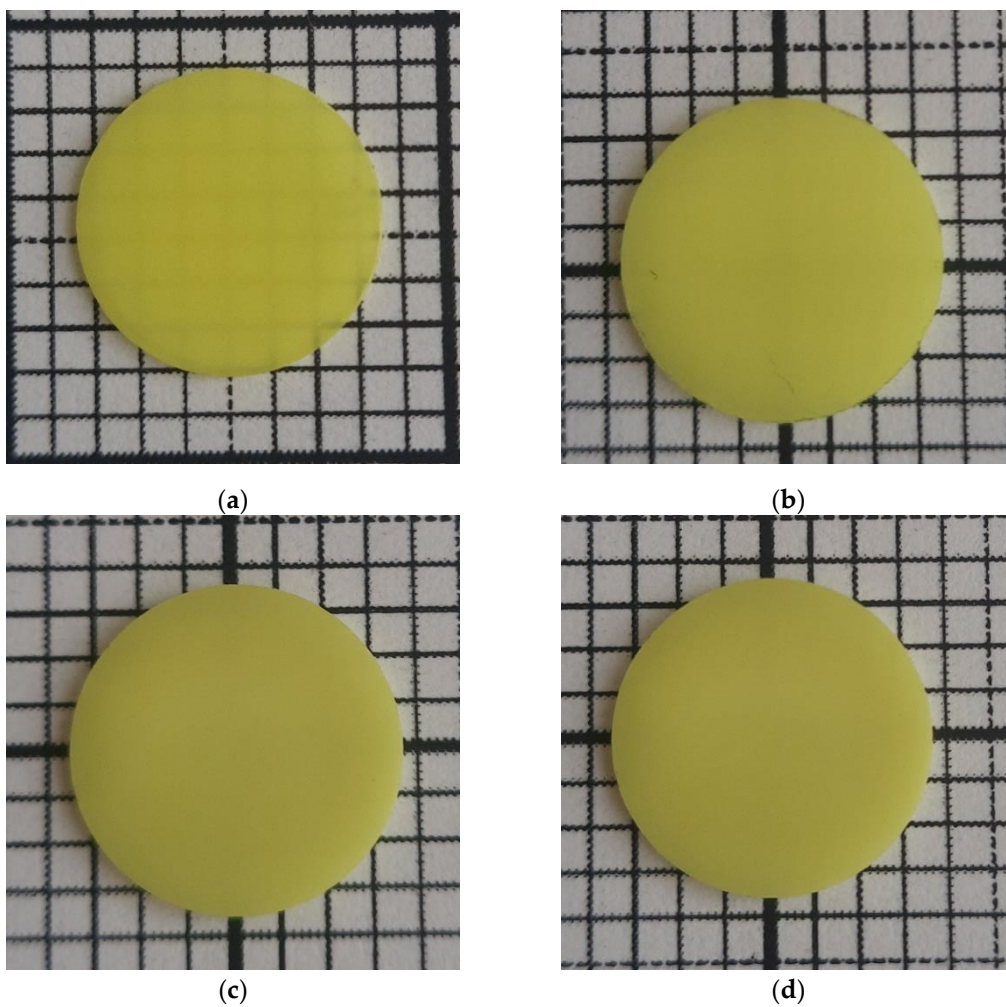


Figure S2. Optical images of GYAGG:Ce ceramics . (a) sample # 0; (b) sample # 1; (c) sample # 2; (d) sample # 3. Sample index 0 is reference ceramic without phosphorus additives; in other samples, the phosphorus content increases with increasing number. Scale bar 2 mm

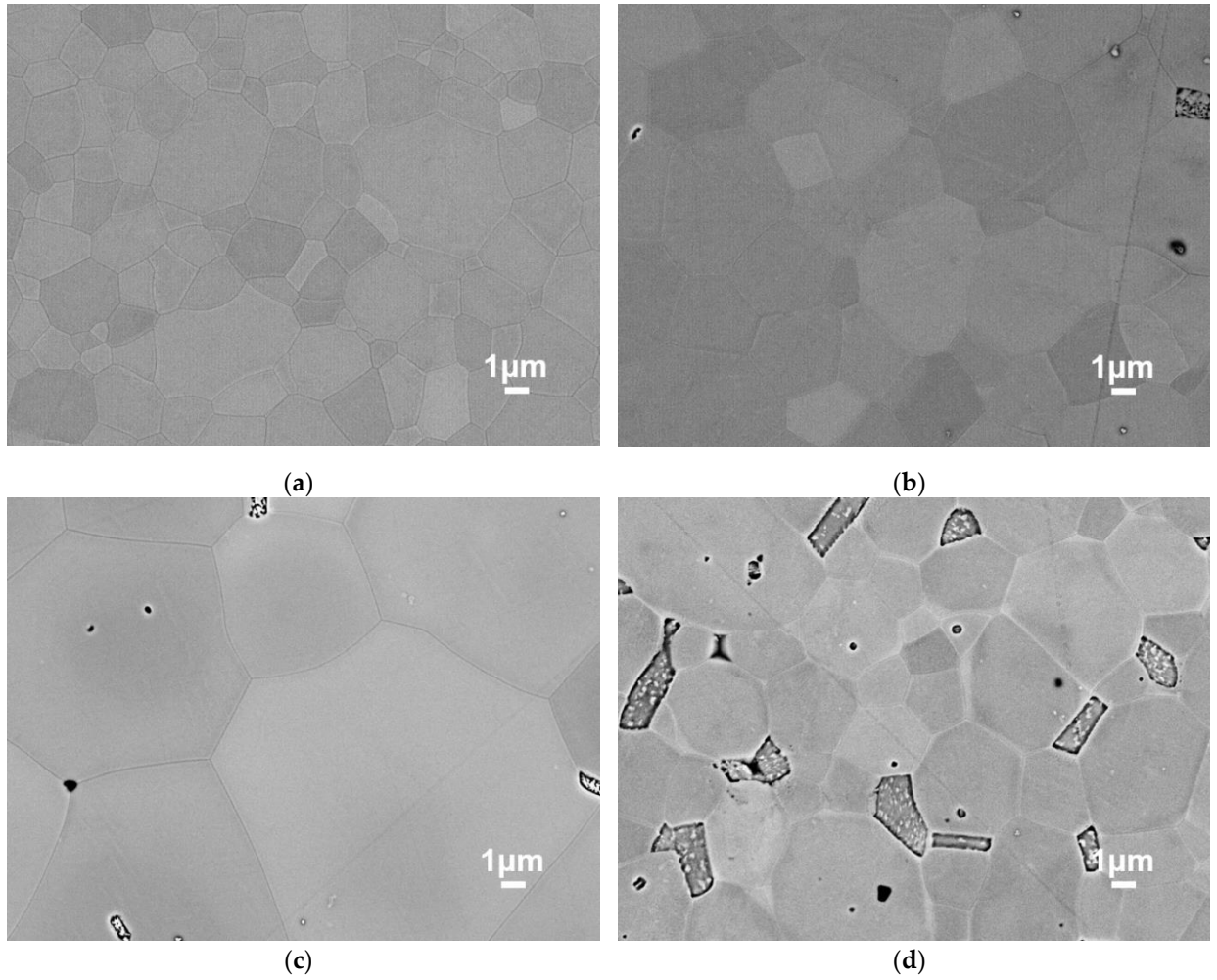


Figure S3. Representative SEM images (5000 \times) recorded in secondary electrons mode of mirror polished and thermally etched surfaces of GYAGG:Ce ceramics. (a) sample # 0; (b) sample # 1; (c) sample # 2; (d) sample # 3. Sample index 0 is reference ceramic without phosphorus additives; in other samples, the phosphorus content increases with increasing number. Scale bar 1 μm .