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Mechanochemical synthesis of upconverting materials

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Upconversion is a process where there is the absorption of two or more photons leading to an emission of visible or UV light by infrared excitation. The area of mechanochemistry has shown to be innovating in photonics by its the simple and green methodology to upscale the synthesis nanomaterials. In this project, the synthesis of two distinct materials were explored, Y_2O_3:Er,Yb and $NaYF_4$:Er,Yb. They were prepared using a planetary ball milling P7- Premium Line (Fritsch). The jar used was a 20 mL ZrO_2 with 10 spheres that were 10 mm in diameter. The first, Y_2O_3:Er,Yb, was prepared using the respective oxides as precursors (Y_2O_3, Er_2O_3 e Yb_2O_3), and a milling frequency of 400 rpm, 18 cycles of 10 min each and 5 min pause. It was possible to observe red up conversion emission to the naked eye using a 10 mW 980 nm laser as excitation source. The $NaYF_4$:Er,Yb was prepared using the fluoride as precursors (NaF, YF_3, YbF_3 e ErF_3) and under the same milling conditions as the oxide counterpart. In this material a green up conversion emission can be observed, and, upon a XRD analyses, it was found that the material exhibits only the upconversion-efficient hexagonal phase.
We believe that mechanochemistry presents great promise in the field of luminescent materials, with newer and simpler methodologies to obtain high performance materials.

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References

[1] Bünzil, J.-C., Piguet, C., Chem. Soc. Rev., 2005, 34,1048-1077
[2] Cotton, S., Lanthanide and Actinide Chemistry, West Sussex, John Willey and Sons, 2006.