Intense UV and visible up-conversion luminescence from SiO_2-$BaGdF_5$ glass-ceramics doped with Yb^{3+}/Er^{3+}, Yb^{3+}/Tm^{3+}or $Yb^{3+}/Er^{3+}/Tm^{3+}$

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UV-visible up-conversion luminescence of materials doped with rare-earths (RE^{3+}) ions has attracted great interest due to their applications in areas such as temperature sensors, solid state lighting, solar cells, biomedical image and so on [1,2]. Herein we study the up-conversion properties of $BaGdF_5$ nanocrystals doped with Yb^{3+}/Er^{3+} and Yb^{3+}/Tm^{3+} pairs of ions. The sol-gel method, allowed us to obtain the precursor glasses that by adequate thermal treatments given rise to the glass-ceramics containing single-phase and homogeneous RE^{3+}-doped $BaGdF_5$ nanocrystals. X-ray diffraction measurements confirmed the precipitation of cubic phase $BaGdF_5$ nanocrystal with cell parameter that varies as function of dopant concentration. Up-conversion luminescence reveals an efficient absorption around 980 nm, leading to intense UV and visible emissions, confirming an energy transfer up-conversion (ETU) mechanism responsible for the observed luminescence as well as the "saturation effect". Additionally, color tuneability was quantified, in Yb-Er-Tm triply doped glass-ceramics, in terms of CIE diagram, and in particular a white colour, close to the standard equal energy white light illumination point, has been achieved for a certain thermal treatment.

References

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Figures

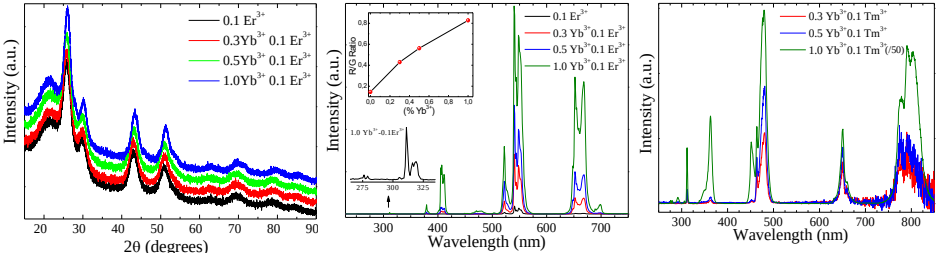

Figure: (a) XRD patterns of xYb^{3+}-Er^{3+}-doped SiO_2-$BaGdF_5$ nGCs, where x=0, 0.3, 0.5 and 1.0, heat-treated at 650 ºC. (b) Up-conversion emission spectra in xYb^{3+}-Er^{3+}-doped SiO_2-$BaGdF_5$ nGCs (mol %) heat-treated at 650 ºC, under 980 nm excitation at 300 mW pump power. (c) Up-conversion emission spectra in xYb^{3+}-Tm^{3+}-doped SiO_2-$BaGdF_5$ nGCs (mol %) heat-treated at 650 ºC, under 980 nm excitation at 300 mW pump power.