1.06 µm emission analysis in Nd^{3+} doped oxyfluoro tellurite glass and glass ceramic containing $NaYF_4$ nanocrystals

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Due to rich potential applications in midinfrared luminescence as well as frequency up and down conversion, rare earth doped glass-ceramics containing nano-scaled fluoride-crystals have attracted a great deal of interest because it combines the merits of lowphonon energy of fluoride and high chemical and mechanical stability of oxide [1-2]. In this connection we were prepared different concentration of Nd^{3+} doped oxyfluo tellurite glass with chemical composition TeO_2-ZnO-YF_3-NaF (TZYN) by melt-quenching technique. Judd–Ofelt analyses of Nd^{3+} ions in the precursor glasses were performed to evaluate the intensity parameters $\Omega_{2,\ 4,\ 6}$. The optimized Nd^{3+} concentration is 0.5 mol% was estimated from NIR emission spectra and calculated emission characteristic parameters such as effective band with ($\Delta\lambda_{eff}$) and stimulated emission concentration (σ_P) for observed three emission transitions, $^4F_{3/2}\rightarrow{}^4I_{9/2,}$ $^4I_{11/2}$ and $^4I_{13/2}$ and also compared to other reported values. Based on decay lifetimes of $^4F_{3/2}$ state, the quantum efficiency was evaluated and it is higher for 0.2 mol% Nd doped glass. The oxy-fluoride glass-ceramics doped with 0.5 mol% Nd^{3+} were obtained by heat treatment at 400^{o}C, which is greater than the glass transition temperature, Tg for different time intervals 1, 3 and 5h. X-ray diffraction (XRD, Fig.1) and Field emission scanning electron microscopy (FE-SEM, Fig.2) investigations reveal that spherical $NaYF_4$ nano-crystals are distributed homogeneously among the glassy matrix. The emission intensity of the $^4F_{3/2}\rightarrow{}^4I_{11/2}$ transition at 1.60 µm is enhanced by 2 times because the presence of $NaYF_4$ nanocrystals. The experimental lifetime of $^4F_{3/2}$ also enhanced from 96 to 119 µs in glass to glass ceramic. These results suggesting that Nd^{3+} doped TZYN glass is potential candidate for 1.06 µm emission application.

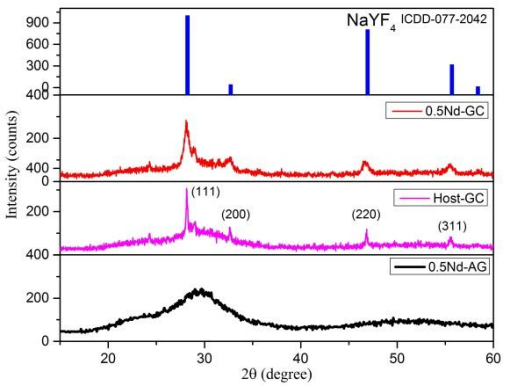

Fig. 1 XRD

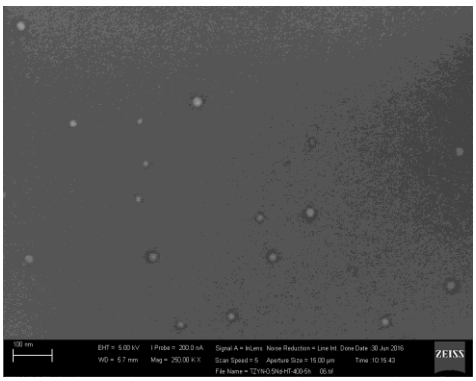

Fig. 2 FE-SEM

References:

1. Pablos-Martín, de A.; F. Muñoz F.; Mather G. C.; Patzig C. S.; Bhattacharyya; Jinschek J. R.; Höche Th.; Durán A.; Pascual M. J; *Cryst. Eng. Comm.* **2013**, *15*, 10323.

2. Dominiak-Dzik G.; Lisiecki R.; Ryba-Romanowski W.; Krajczyk L.; J. *Alloys Compd.* **2012**, *511*, 189.

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