Eu-doped on-chip blue-light emitting glass-ceramic waveguides

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Rare-earth (RE) activated glass-ceramics are two phase composite materials consisting of nanocrystals embedded in amorphous matrix, combining the advantages of optical glasses with the crystal-like environment for RE-ions [1, 2]. Hence, RE-doped transparent glass-ceramic waveguides are widely adopted for integrated optic applications such as on-chip lasers, optical amplifiers etc. [3, 4] because of their narrow and intense emission from 4*f*-intrashell transition.

We report fabrication and characterization of low-loss (0.5 ± 0.2 dB/cm) Eu-doped 70 SiO_2 - 23 HfO_2 - 7 ZnO (mol%) ternary glass-ceramic planar waveguides as blue-light emitting sources for integrated optics applications. The reduction of $Eu^{3+} \rightarrow Eu^{2+}$ in the presence of ZnO nanocrystals leads to enhanced blue-emission in the low-loss waveguides. The room temperature photoluminescence (PL) spectra of 1 mol% Eu-doped 70 SiO_2 - 23 HfO_2 - 7 ZnO (mol%) ternary film, under the excitation of 325 nm line of Xe lamp, as a function of heat-treatment temperature are shown in Fig. 1. The detail analysis of structural and waveguide properties for on-chip blue-emission sources will be presented in the conference.

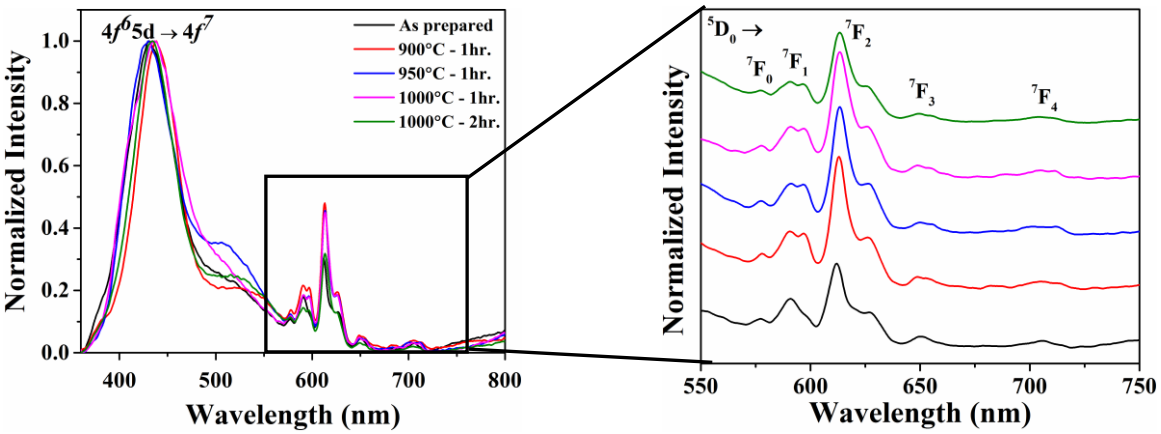

Fig. 1. PL spectra of 70 SiO_2 - 23 HfO_2 - 7 ZnO (mol %) ternary films under 325 nm Xe lamp excitation. Inset shows the Eu^{3+} emission lines correspond to $^5D_0 \rightarrow {}^7F_j$ (j = 1, 2, 3 and 4) energy levels.

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References

[1] Y. Jestin, C. Armellini, A. Chiasera, A. Chiappini, M. Ferrari, E. Moser, R. Retoux, and G. C. Righini,J. M. P. J. Verstegen, Appl. Phys.Lett. **91** (2007) 071909.
[2] S.Ghosh and S. N. B. Bhaktha, Nanotechnology **27** (2016) 105202.
[3] G. C. Righini, M. Brenci, M. A. Forastiere, S. Pelli, G. Ricci, G. N. Conti, N. Peyghambarian, M. Ferrari and M. Montagna, Philo. Mag. B **82** (2002) 721-734.
[4] A. Peled, A. Chiasera, M. Nathan, M. Ferrari, and S. Ruschin, Appl. Phys. Lett. **92** (2008) 221104.