Luminescent Tantalum Germanate Glasses and Glass-ceramics

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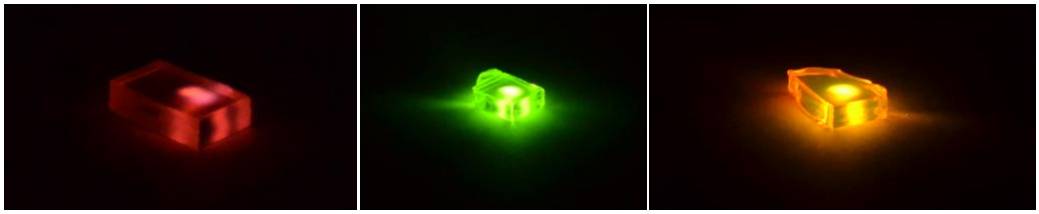
New stable, homogeneous and transparent tantalum germanate glasses[1] were obtained from glass former GeO_2 with increasing Ta_2O_5 contents and addition of M_2O alkali oxides; M = Li, Na, K, Rb, Cs for evaluation of the modifier´s influence in the glass formation of the ternary system, thermal stability against devitrification and melting point of the mixture (T_f (Ta_2O_5) = 1800ºC). Starting materials were melted in platinum crucible at high temperatures between 1400°C and 1600°C and quenched in a preheated steel mold. Glass samples were studied by FTIR, Raman, DRX and thermal analysis (STA). These compositions were also doped with optically active ions (Eu^{3+}, Er^{3+} and Tm^{3+}) and codoped with Er^{3+}/Yb^{3+}, Tm^{3+}/Yb^{3+} and $Er^{3+}/Tm^{3+}/Yb^{3+}$ and the luminescent properties investigated for optical applications. A detailed crystallization study was also performed to determine the best heat-treatment parameters and transparent glass-ceramics containing crystalline tantalum oxide were obtained. Luminescent properties of starting glasses and final glass-ceramics were compared regarding emission around 1,5 μm for optical amplification as well as upconversion emission in the visible. The results pointed out the improved optical properties of glass-ceramics when compared with glasses.



a) b) c)

Figure 1: Observed upconversion after excitation by 980 nm LASER in: a) 89,4GeO.10K_2O:0,1Er_2O_3.0,5Yb_2O_3; b) 69,4GeO_2.20Ta_2O_5.10K_2O:0,1Er_2O_3.0,5Yb_2O_3; c) 69,4GeO_2.20Ta_2O_5.10K_2O:0,1Er_2O_3.0,5Yb_2O_3.

References:

1. Pietro, G.M., Pereira, C.; Gonçalves, R.R.; Ribeiro, S.J.L.; Freschi, C.D.; Cassanjes, F.C.; Poirier, G.Y.; *J. Am. Ceram. Soc/***2015**, *98 [7]*, 2086.

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