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GLASSES OF HEAVY METAL AND GALLIUM OXIDES DOPED WITH NEODYMIUM

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The interference of neodymium in the optical properties of glasses in the system PbO-Bi_2O_3–Ga_2O_3 is presented here. The main characteristics of this host [1,2,3] are the high refractive index of about 2.5 and the high transmission in the visible and infrared regions (0.5μm to 8.8μm). The introduction of neodymium almost does not alter these parameters when incorporated in up to 1 mol%. The optical properties are studied by means of measurements of absorption, luminescence and refractive index; cross section and Judt-Ofelt calculations are also performed. The absorption spectrum reveals four bands at about 580nm, 750nm, 800nm and 880nm related to Nd^{3+} transitions. Three intense fluorescent emissions are observed at approximately 880nm, 1066nm and 1350nm for excitation of 797nm and correspond to the following laser transitions: $^4F_{3/2} \rightarrow {}^4I_{9/2}$, $^4F_{3/2} \rightarrow {}^4I_{11/2}$ $^4F_{3/2} \rightarrow {}^4I_{13/2}$.
The fluorescent lifetime of $^4F_{3/2}$ is of 110 μs; the refractive index is of 2.52 ± 0.02 and was measured with the "apparent depth method" in which the optical thickness is related to its physical thickness. The total spectral linewidth is of about 30nm, for the fluorescent emission of 1066nm. Calculations of cross section are performed and provide 10^{-20} cm^2 for 1066nm. These results motivate us to investigate the use of this example as a new active laser material. Other measurements are being performed and will be published soon.

[1] W.R.Dumbaugh, Physics and Chemistry of Glasses (1978)121.
[2] W.R.Dumbaugh, Physics and Chemistry of Glasses (1986)119.
[3] J.G.Clemente, L.R.P.Kassab, S.H.Tatumi, 4th Brazilian Symposium on Glasses and Related Materials, Ouro Preto, MG, November (1998).