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Section 3. Rare-earth-doped glasses

The effect of oxygen on optical absorption and emission of Pr:Ga–La–S glass

A.B. Seddon [a], D. Furniss [a], M.S. Iovu [b,*], S.D. Shutov [b], N.N. Syrbu [b], A.M. Andriesh [b], G.J. Adriaenssens [c]

[a] *Novel Photonic Glasses Group, University of Nottingham, Nottingham, N67 2RD, UK*
[b] *Center of Optoelectronics, Str. Academiei St. 1, MD-2028 Chisinau, Moldova*
[c] *Laboratorium voor Halfgeleiderfysica, K.U. Leuven, B-3001 Heverlee-Leuven, Belgium*

Abstract

The absorption and emission spectra of Ga–La–S–O glasses with fixed cation ratio Ga/La = 0.7/0.3 and two oxygen contents 0.65 wt% and 2.95 wt% were studied for two Pr^{3+} doping levels of 0.1 and 1.0 wt%. Presence of oxygen induces blue shift of the fundamental absorption edge and results in lowering of the low-energy components of the Pr^{3+} absorption bands. The glasses show bright luminescence due to Pr^{3+} ion emission similar to that in other glasses. The effect of oxygen on the luminescence spectra is determined by the shift of the absorption edge in the short-wavelength spectra region with increasing of the oxygen contents, which became visible with oxide content growing.

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1. Introduction

A technologically important area, in which there has recently been substantial interest is that of rare-earth-doped optical glasses. Of particular interest is the praseodymium, as the Pr^{3+} ion exhibits strong fluorescence at a wavelength within the low-loss window for SiO_2-based fibres in the IR spectral region. Pr-doped chalcogenide glasses posses many possible radiative electron transitions in Pr^{3+} ions. These transitions are of interest for amplifiers in near-IR spectral region (the 1.3 or 1.5 μm band) and also for broad-band amplifiers in 3–5 μm spectral region. The optical activity of the Pr^{3+} ion is widely known in various host materials for application in fibre-optical communication systems. Ga–La–S (GLS) glasses have good rare-earth solubility, good mechanical and chemical durabilities, high glass transition temperature and low toxicity. Chalcogenide glasses are rather easily prepared and they appear as good candidates for use as optical materials. Pr^{3+}-doped Ga_2S_3:La_2S_3 (GLS) glasses have been recognized as one of the most promising candidates for fibre amplifiers operating at a wavelength 1.3 μm [1–3]. It was demonstrated that introduction of extra oxide content into GLS glass plays a decisive role

* Corresponding author. Tel.: +373 272 8807; fax: +373 273 9805.
E-mail address: iovu@as.md (M.S. Iovu).

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