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Properties of Rare-Earth Doped Gallium Lanthanum Sulphide Glass

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Gallium lanthanum sulphide (Ga:La:S) glass is now emerging as a promising material for active optical fibre device applications and in particular new fibre amplifiers and lasers. Recent success in fibre drawing, long wavelength spectroscopy and the demonstration of laser action [1,2,3] has opened up applications which extend in wavelength from the visible to over 5 microns. Moreover, Ga:La:S glass is an ideal host for the rare earths, with the dopant ions substituting directly for the lanthanum ion in the glass matrix. Its high refractive index of around 2.5, and its low maximum phonon energy of 425 cm^{-1} shift the balance of radiative emission to non-radiative decay to among the most favourable known for glasses.

In this paper we present the results of a spectroscopic evaluation of Ga:La:S glass. Results of measurements made on samples doped with praseodymium, dysprosium, erbium and neodymium are presented, identifying the key new applications these glasses have to offer. This includes a Judd-Ofelt analysis to reveal radiative transition probabilities, lifetime measurement and fluorescence measurements. Careful study of the absorption spectrum of undoped samples reveal the principle impurities which remain in the bulk glass and which must be removed before a practical fibre device can be realized. We conclude with recent results on optical fibre drawing trials thereby bringing together the spectroscopic results with the prospects for new fibre-based devices.

[1] D.W. Hewak, R.C. Moore, T. Schweizer, J. Wang, B. Samson, W.S. Brocklesby, D.N. Payne and E.J. Tarbox, Electron. Lett., **32** (1996) 384-385.

[2] T. Schweizer, D.W. Hewak and D.N. Payne, **Spectroscopy of potential mid-infrared laser transitions in gallium lanthanum sulphide glass**, accepted for oral presentation ICL'96, Prague.

[3] T. Schweizer, D.W. Hewak and D.N. Payne, **Rare-earth Doped Chalcogenide Glass Laser**, Electron. Lett., **32** (1996) 666-667.