Vanadium doped chalcogenide glasses for broadband near-infrared sources

Richard Curry*, Mark Hughes, Jonathan Aronson, William Brocklesby and Dan Hewak

**Optoelectronics Research Centre, University of Southampton, Southampton, S017 1 BJ, United Kingdom*

The use of transition metal ions to obtain broadband emission and widely tuneable lasers is widely known. In particular, the incorporation of such ions into crystalline hosts has resulted in a wide number of lasers covering the spectral region from ~750nm to ~3μm. The use of metal ions in glass hosts for laser applications has however been limited to the rare-earth ions and therefore to spectrally narrow regions in which gain can be achieved. The ability to obtain broadband emission and lasing from transition metal ions in glass hosts would enable a new generation of efficient, compact, waveguide-based devices to be developed.

We have recently initiated a wide-ranging study of the properties of transition metal doped gallium-lanthanum-sulphide based glasses for their potential as broadband emitters. Of the dopants studied vanadium shows particular promise towards this aim. When incorporated into GLS V^{3+} ions are formed within the glass. Broad emission peaking at ~1450nm ($\lambda_{excitation}$ = 1064nm) is observed with some dependence of the emission wavelength on excitation wavelength. Photoluminescence excitation spectra show peaks at ~570, 750 and 1000nm, the former two most probably due to $^3A_2(^3f)$ – $^3T_1(^3p)$ transitions and the later due to $^3A_2(^3f)$ – $^3T_1(^3f)$. Low temperature (80K) emission spectra have been obtained and show little shift in the emission peak though some slight spectral broadening is observed. The emission lifetime has been measured at 300K to be ~31μs increasing to ~62μs at 80K, significantly long for transition metal ion emission in a glass host.

We present the above mentioned results and discuss their relevance to a number of applications. We then briefly describe the future direction of this and related research.