dependence on optical basicity. We suggest that red and NIR PL bands result from Bi^{2+} and Bi_n clusters, respectively. Comparing contour plots of PL spectra at various excitation wavelengths of Bi-doped chalcogenide, Bi-doped germanate and Pb-doped germanate glasses, indicates that five absorption/PL bands are in approximately the same position. This suggests that very similar active centers are present in Bi- and Pb-doped oxide and chalcogenide glasses.

When excited at 782 nm, Bi- and Pb- implanted GaLaSO thin films display PL bands centered at 820 and 860 nm, respectively. The intensity (I) of the 820 nm PL band has a power law dependence on Bi dose (d) of $I \propto d^{1.4}$; a similar power-law dependence was presented for a Bi melt-doped oxide glass. When excited at 514 nm, Bi-implanted GaLaSO thin films display a PL band at 700 nm, which is not present in a Bi melt-doped chalcogenide glass having a similar composition to the implanted glass. This indicates that new Bi centers are formed through implantation, which are absent in the melt-doped glasses. This has important implications for Bi-doped glass lasers, in which the control of Bi centers is critical for improving performance. We report Bi-related red PL bands in Bi-implanted bulk $Ge_{33}S_{67}$ and $Ga_5Ge_{25}S_{70}$ glasses, and highlight NIR PL bands in $Ge_{23}Ga_{12}S_{64}Bi_1$ glass; all of which have very similar compositions to those in which carrier-type reversal has been observed. This indicates that Bi-related PL and carrier-type reversal may be caused by the same Bi centers, which we suggest are interstitial Bi^{2+} and Bi clusters.

Acknowledgments

We would like to thank Prof. Guoping Dong and Dr. Mikhail Sharonov for supplying data from their publications. This work was supported by the UK EPSRC grants EP/I018414/1, EP/I019065/1 and EP/I018050/1.

#185108 - $15.00 USD Received 8 Feb 2013; revised 2 Mar 2013; accepted 10 Mar 2013; published 27 Mar 2013