Compositional Effects on the Thermo-optic Coefficients of Barium Borophosphate Glasses

E.T.Y. LEE and E.M. TAYLOR

Optoelectronics Research Centre, University of Southampton, Southampton SO17 1BJ, UK

Thermal stability of wavelength is crucial in Dense Wavelength Division Multiplexing (DWDM) systems. Therefore there is a need to address the problem with lightwave devices such as gratings, where the central wavelength changes with temperature. Using an athermal device is one method to eliminate this problem. We are currently investigating borophosphate glasses as hosts for athermal devices as both B$_2$O$_3$ and P$_2$O$_5$ exhibit negative thermo-optic coefficient (dn/dT), which can be utilised to counter the effect of expansion. In addition, B$_2$O$_3$ has the advantage of contributing to the photosensitivity of the glasses and UV-writing can be explored to produce waveguides and gratings on these glasses.

The present work involves investigation into the properties of barium borophosphate glasses and how different compositions affect the properties of the glasses, especially the glass transition temperature ($T_g$), coefficient of thermal expansion (CTE) and dn/dT. The compositions at which athermality is achieved, where glasses exhibit negative dn/dT, will be reported. Such glasses must show a CTE greater than 10×10$^{-6}$/°C. The refractive index, $T_g$, CTE and dn/dT as a function of glass compositions will be presented. The practicality of using such athermal glasses for lightwave devices will also be presented, including the various techniques to produce waveguides in these glasses.

Keywords: Athermal, borophosphate, thermo-optic coefficient