



Refractive index behavior in phosphate glass from the view point of B^{3+} and Al^{3+} coordination

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Abstract

Higher refractive index and higher Abbe value were obtained simultaneously at $B_2O_3/Al_2O_3 = 1$ in the system of $65P_2O_5-xAl_2O_3-(20-x)B_2O_3-10CaO-5Li_2O$, although the refractive index generally shows a positive correlation with the dispersion. We investigated the molar volume and the molar refraction by Lorentz–Lorenz’s formula and also studied the coordination number of ^{11}B and ^{27}Al by MAS NMR. By the replacement of Al_2O_3 with B_2O_3 , the molar refraction constantly decreased, but the molar volume was minimized at $B_2O_3/Al_2O_3 = 1$. The refractive index behavior of the glasses was mainly determined by the molar volume in the system. The coordination number of B^{3+} was only IV and it did not change if the composition was changed. On the other hand the coordinations IV, V and VI were observed for Al^{3+} . The ratio of $Al^{3+}(VI)$ was maximized at $B_2O_3/Al_2O_3 = 1$. It is considered that the higher coordination of Al^{3+} brings the improvement of the packing and it leads to high refractive index.
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