Thermal-Diffusivity and Heat Capacity of Iron- Phosphate Glasses

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The Phosphate glasses are known due to their characteristic of being useful to immobilization and disposal of nuclear waste. The combination of iron phosphate glasses with various types of simulated nuclear waste showed that it is possible to have nuclear wasteform with corrosion rate one thousand times less than that a comparable borosilicate glass. For other systems based in phosphate glasses such as lead iron phosphate glass this fact was observed when the glass was combined with appropriate simulated wastes.

The structure of an ultraphosphate glass is based on corner-sharing PO_4 groups. With the addition of Fe_2O_3, The P-O-P bonds are replaced by more chemically durable P-O-Fe^{2+} and/or P-O-Fe^{3+} bonds. The proportion between the two valence states of the iron depends upon the composition melting temperature and atmosphere. Previous work has found that concentration of Fe^{3+} ions in the $30Fe_2O_3$-$10ZnO$-$60P_2O_5$ (mol%) or in the F40 ($40Fe_2O_3$-$60P_2O_5$ (mol%)) glasses decreases strongly with increasing melting temperature. Although demonstrated that the chemical durability in aqueous solution of the F40 glass was independent of the relative concentration of Fe^{2+} or Fe^{3+} ions, the reasons for the increased chemical durability is still unknown, the expected increased hydration resistance of the P–O–Fe links being cited as a possible reason.

The aim of the present work is to investigate the role of the Fe ions in the thermal properties of F40 glasses using the photoacoustic technique. Specifically we are interested in the determination of the thermal diffusivity and thermal conductivity. The latter can be obtained from the former with the aim of a specific thermal capacity technique. Our preliminary results show that the thermal diffusivity is much bigger than that of the usual glasses.