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ULTRASONIC AND THERMAL PROPERTIES OF BORATE AND PHOSPHATE GLASSES DOPED WITH BISMUTH AND LEAD

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ABSTRACT

A systematic series of (B_2O_3,P_2O_5)-Bi_2O_3-PbO glasses have been successfully prepared by using the rapid quenching technique where each oxides contents change for every series based on their weight percentage. Their amorphous natures were confirmed earlier by the X-ray diffraction technique. The experimental results show that the density of both glasses, determined by using the Archimedes' principle, increase with glass modifier content. This is due to the replacement of Bi_2O_3 and PbO in the borate and phosphate glassy networks. The molar volume for borate glass increase with addition of bismuth and lead oxides, however a reverse trend occurs for the phosphate glass. The longitudinal and shear ultrasound velocities, determined by the MBS 8000 system, of both lead bismuth borate and phosphate glasses show decreasing trend as more PbO and Bi_2O_3 are being added into the glass system. The increase in PbO/ Bi_2O_3 content was probably related to the progressive increase in the concentration of nonbridging oxygen (NBOs). Thermal studies of the glass, using Labsys DTA – Setaram machine, show that values for glass transition temperature (*T*g) is closely related to the chemical bond in the system. In lead bismuth borate glasses, the addition of more Pb2+ and Bi^{3+} will result in the ionic bond character became more dominant in the system and hence decreases the *T*g of sample. However, in lead bismuth phosphate glasses, the addition of Pb^{2+} and Bi^{3+} not only failed to weaken the covalent character in P–O–P bonds, but strengthened it further which leads to an increment in *T*g values.

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