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Nondestructive Acoustic Microcharacterisation of Gamma Irradiation Effects on Sodium Oxide Borate Glass X2Na2O-X2B2O3 by Acoustic Signature

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Abstract : We discuss in this work the elastic properties by using acoustic microscopes to measure Rayleigh and longitudinal wave velocities in a no radiated and radiated sodium borate glasses X2Na2O-X2B2O3 with 0 ≤ x ≤ 27 (mol %) at microscopic resolution. The acoustic material signatures were first measured, from which the characteristic surface velocities were determined.Longitudinal and shear ultrasonic velocities were measured in a different composition of sodium borate glass samples before and after irradiation with γ-rays. Results showed that the effect due to increasing sodium oxide content on the ultrasonic velocity appeared more clearly than due to γ-radiation. It was found that as Na2O composition increases, longitudinal velocities vary from 3832 to 5636 m/s in irradiated sample and it vary from 4010 to 5836 m/s in high radiated sample by 10 dose whereas shear velocities vary from 2223 to 3269 m/s in irradiated sample and it vary from 2326 m/s in low radiation to 3385 m/s in high radiated sample by 10 dose. The effect of increasing sodium oxide content on ultrasonic velocity was very clear. The increase of velocity was attributed to the gradual increase in the rigidity of glass and hence strengthening of network due to gradual change of boron atoms from the three-fold to the four-fold coordination of oxygen atoms. The ultrasonic velocities data of glass samples have been used to find the elastic modulus. It was found that ultrasonic velocity, elastic modulus and microhardness increase with increasing barium oxide content and increasing γ-radiation dose.

Keywords : mechanical properties X2Na2O-X2B2O3, acoustic signature, SAW velocities, additives, gamma-radiation dose
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