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Non-destructive study of X_2O-Y -B_2O_3 glass system

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ABSTRACT

Ultrasonic tools are very important for characterizing materials; they can be applied in chemistry, physics, engineering, biology, food industry, medicine, oceanography, seismology, etc. Nearly all of these applications are based on two features of ultrasonic waves: (1) ultrasonic waves travel slowly, about 10^5 times slower than electromagnetic waves. This provides a way to display information in time, create variable delays, etc. (2) Ultrasonic waves can easily penetrate opaque materials, whereas many other types of radiation such as visible light cannot. Since ultrasonic wave sources are nondestructive, inexpensive, sensitive, and reliable, they provide a highly desirable way to probe and image the interior of opaque objects. In this paper, we present elastic property measurements of Li_2O-ZnO-B_2O_3; and Na_2O- B_2O_3–V_2O_5 and their dependence on Li_2O and Na_2O concentrations. Simulations were carried out in the case of normal operating conditions of a conventional scanning acoustic microscope operated in the reflection mode: an operating frequency, f = 10 MHz, an opening angle of the acoustic lens, θ_{lens}. = 50° and water as the most widely used coupling liquid whose longitudinal velocity V_{liq}. = 1500 m/s and density ρ_{liq} = 1000 kg/m^3. The methodology consists of several steps (i) calculation of acoustic materials signatures from angular spectrum model (ii) determination of Rayleigh velocity via fast Fourier transform treatment of such signatures. It was found that the Rayleigh velocities increases linearly with the Li_2O and Na_2O concentrations.The results of the effect of Li_2O and Na_2O concentration on Rayleigh velocities, V_R, are very promising.

KEY WORDS

Glass system, elastic properties, SAW velocities, Li_2O and Na_2O concentrations.