

Turkish Journal of Physics

Turkish Journal



of

Physics

Dielectric Dispersion in $\text{PbO-Bi}_2\text{O}_3\text{-B}_2\text{O}_3$ Glasses Mixed with TiO_2

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Abstract: $[(\text{PbO})_{0.20-x} \cdot (\text{Bi}_2\text{O}_3)_{0.40} \cdot (\text{B}_2\text{O}_3)_{0.40}] : (\text{TiO}_2)_x$, $0.0 \leq x \leq 0.02$ glasses were prepared. Dielectric properties (dielectric constant ϵ' , loss $\tan \delta$ and a.c. conductivity σ_{ac} , over a wide range of frequency and temperature), optical absorption, ESR and IR spectra of these glass materials have been investigated. The dielectric study has revealed that the glasses possess high insulating strength when TiO_2 concentration is >0.8 mol% in the glass matrix. The optical absorption spectra of these glasses exhibited bands due to Ti^{3+} ions in the visible region. ESR spectral studies have also indicated that a fraction of Ti^{4+} ions reduced to Ti^{3+} ions. IR spectra of these glasses exhibited bands due to TiO_4 and TiO_6 structural units. Quantitative studies indicate that as concentration of TiO_2 is increased to 0.8 mol% in the glass matrix, a large proportion of titanium ions exist in Ti^{3+} state and has influenced the physical properties of these glasses to a substantial extent.

Turk. J. Phys., **32**, (2008), 341-356.

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