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B7 ACOUSTIC AND THERMAL VIBRATIONAL BEHAVIOR OF RARE EARTH GLASSES

(P54)

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Keywords: *Metaphosphate glasses, acoustic, thermal expansion*

Introduction

Metaphosphate is a very rare composition, it is resistive to water: a valuable feature for device applications. These glasses find applications in the manufacture of magneto-optical devices, such as magnetically tunable lasers, amplifiers and frequency converters for the telecommunication industry [1]. To test predictions of the soft potential model (SPM) for the acoustic and thermal properties of cerium metaphosphate glasses, the ultrasonic wave velocity and the thermal expansion have been measured as functions of temperature and pressure.

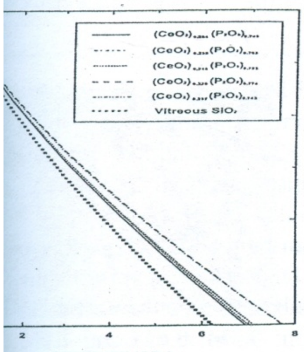
Methodology

The rare earth glass samples were prepared from melts of mixtures of 99.9% purity grades of dry cerium oxide and phosphorous pentoxide, in an alumina crucible [2]. The ultrasonic wave velocity and attenuation were measured as a function of temperature using the pulse-echo-overlap technique [3]. The changes in ultrasonic wave velocity with pressure were measured under hydrostatic pressures. The thermal expansion was determined using a capacitance dilatometer.

cussion

ons $V(P)/V_0$ of the rare earth metaphosphate glasses at 293K
hat of vitreous SiO_2.At comparatively low pressures the compr
nilar, but for vitreous SiO_2 the curve diverge slowly due to the negative sign of
The linear thermal coefficient α(T) data measured for $Ce_2O_3)_{0.254}(P_2O_5)_{0.746}$ glass
compared with those for $(Sm_2O_3)_{0.248}(P_2O_5)^{0.752}$ and $(La_2O_3)_{0.222}(P_2O_5)0.778$ glasses
. The binary $(Sm_2O_3)_{0.248}(P_2O_5)_{0.752}$ glass has the smallest linear thermal expansion
all temperatures, attaining a value of only $\sim 5x10^{-6}K^{-1}$ at 300K; that of
$O_5)_{0.778}$ is rather larger. The thermal expansion coefficient of the
$)_{5})_{0.746}$ glass is intermediate between those of the other two REMG. When pressure
e compressions $V(V)/V_0$ of the glasses with negative $(\partial B^s/\partial P)_{T,P=0}$ such as europium
phosphate glasses display a stronger volume effect under compression as compared
e earth metaphosphate glasses.

wave velocity and thermal expansion of cerium metaphosphate glasses have been
function of temperature and pressure. The results obtained provide the physical
the vibrational anharmonicity of the glasses and are in agreement with predictions
ntial model (SPM).



1 Compression $V(P)/V_0$ vs Pressure (GPa)

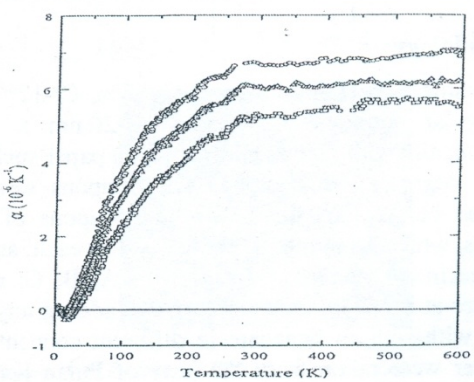


Figure 2 The linear thermal coefficient α(T) measured with

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Abstract

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