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# STUDIES ON COLOSSAL MAGNETORESISTANCE $La_{1-x}Ca_xMnO_3$ ($x$ = 0.25, 0.33 AND 0.45) BY ULTRASOUND METHOD

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## ABSTRACT

$La_{1-x}Ca_xMnO_3$ which exhibits colossal magnetoresistance (CMR) effect for $x$ = 0.25, 0.33 and 0.45, was subjected to ultrasound investigations. For all samples, temperature-dependent electrical resistivity measurements showed a metal-insulator transition identified by a peak in resistivity, typical transport behaviour of a CMR material. The $x$ = 0.25 sample showed the highest $T_{IM}$ at 260 K, $x$ = 0.33 at 240 K and $x$ = 0.45 at 150 K. For $x$ = 0.45 sample, a large resistivity hysteresis occurs between 90 to 190 K. Temperature-dependent sound velocity measurements (80 to 300 K) showed a large change in longitudinal velocity of ~6 % takes place just below $T_{IM}$ (insulator-metal transition) for $x$ = 0.25 and 0.33 samples. The sudden increase in $\Delta v$ was also observed in shear mode for both samples. These frequency hardenings which take place below $T_c$, indicate the prominent role of lattice vibrations on the physical properties of this material. A characteristic behaviour of ultrasonic attenuation, which decrease sharply in the region below $T_c$, accompanied the anomalous phonon hardenings. These features, which are closely related with the mechanisme at $T_c$, have been previously predicted from theoretical calculations based on the combined double-exchange and lattice polaron model. Elastic measurements for $x$ = 0.45 sample showed a completely different behaviour compared to the $x$ = 0.25 and 0.33 samples. This sample showed the largest $\Delta v$ for both modes within 80 to 210 K measurement range (>10 %). Large thermal hysteresis between 130 to 190 K observed in both shear and longitudinal velocity measurements, were attributed to simultaneous occurrence of conducting ferromagnetic state and charge-ordered state.

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