Terahertz time domain spectroscopy of ordered and disordered half-doped manganites

K.R. MAVANI, M. NAGAI, H. YADA, K. TANAKA, D.S. RANA, I. KAWAYAMA, M. TONOUCHI, DEPARTMENT OF PHYSICS, KYOTO UNIVERSITY, JAPAN TEAM, INSTITUTE OF LASER ENGINEERING, OSAKA UNIVERSITY, JAPAN COLLABORATION — Terahertz (THz) time domain spectroscopic studies were carried on Nd$_{0.5}$Ca$_{0.5}$MnO$_3$ and Nd$_{0.5}$Ca$_{0.48}$Ba$_{0.02}$MnO$_3$ (NCBMO) charge-ordered (CO) manganite thin films. Temperature dependent complex optical conductivity ($\tilde{\sigma} = \sigma_1 + i\sigma_2$) was studied to probe the cation disorder effects on low energy charge dynamics. The frequency dependent $\sigma_1$ suggests formation of charge-density-waves in these manganites. A doping induced cation disorder, as in the case of NCBMO, weakens the CO state. However, at THz frequency, there are subtle effects of disorder on $\tilde{\sigma}$ of NCBMO in a definite low temperature range. As temperature increases to 150 K (Néel temperature), changes are observed on the trends of temperature dependent dielectric constant ($\varepsilon_1$) and $\sigma_1$. The Ba doping effects are dominant above the charge-ordering transition temperature. The $\varepsilon_1$ and $\sigma_1$, both increase with temperature and show a scaling relationship, $\varepsilon_1 \propto \sigma_1$, that is consistent with similar result observed for (PrCaSr)MnO$_3$ manganite.\textsuperscript{2} Mavani \textit{et al.}, Europhys. Lett. (in print). \textsuperscript{2}Pimenov et al., Phys. Rev. B 73.220407(R).

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