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Magnetic and electrical transport properties of Ce/Ca substituted perovskite oxides

Magnetic and electric transport studies have been made on cerium-calcium substituted perovskites La1-2xCexCaxMnO3 for x = 0.05, 0.10 and 0.15, prepared by solgel method. Magnetization and electrical measurements are reported in the temperature range 20K – 300K and in fields upto 8 kOe and 2K – 300K and in fields upto 14 T respectively. All the samples undergo paramagnetic to ferromagnetic transition. Among the Ce/Ca substituted samples LCeCaM15 is highly disordered. Addition of 10 atomic% Ca into 10 atomic% Ce substituted system drives the FM state towards a more disordered one and when in place of 10 atomic% Ce, the substitution is of 5 atomic% Ce and 5 atomic% Ca, the system shows up to be far better FM ordered. In the series La1-2xCexCaxMnO3 no upturn is seen in resistivity but there is only a slight tendency of increase at ~30K [Figure 1]. This would mean that in the Ce/Ca substituted samples, of the two competing factors – decreasing scattering with lowering of temperature leading to reduction in resistivity and spin polarized tunneling leading to enhancement of resistivity - the factor of decreasing scattering overtakes. In insulating regions of all the samples, at temperatures above the M – I transition points, conduction is controlled by variable range hopping and at higher temperatures small polaron hopping mechanism is operative [1]. Values of activation energy are much smaller those reported in other substituted manganites [2]. The magnetoresistance (MR), plot shown in Fig. 1 as a function of temperature, is observed to be negative and large. For all the three samples, under 5 T field it is as high as ~40% at temperatures close to I – M transition and under 14 T the maximum is ~68% for LCeCaM05. At 300K and under 5 T field it is close to 15% for all the samples.

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Oral

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