Optical conductivity in La0.8Sr0.2-x(Ca,Ba)XMn1-yRuyO3

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Abstract

The structural, electronic and magnetic properties of manganites cannot be fully explained by the double exchange theory alone. The systems La0.8Sr0.2-xAxMn1-yRuyO3 (0x 0.2 - A= Ca, Ba - 0.05y 0.15) have been studied in order to better understand the mechanisms that govern these properties. Since the chemical pressure seems to be very important, in a first step, Sr has been substituted by Ca and Ba to change simultaneously the average ionic radii on the A-site ¡rA¿ and the disorder s2. Then, Ru doping on the B-site has been studied to check the correlations between structural and physical properties. The reflectivity measurements were carried out at room temperature between 5 meV and 3 eV on polycrystalline samples that were prepared by an organic gel-assisted citrate process. High-density samples with a good optical quality were obtained. The Curie temperature (TC) was determined by the Electron Spin Resonance (ESR) and the metal-insulator transition (TIM) was obtained by transport measurements. Each optical conductivity spectrum can be divided into two parts: the low-frequency region that contains the characteristic signature of phonons associated to a Drude peak, and the middle infrared (MIR) at higher frequencies. By fitting the MIR part, two main contributions were deduced: an absorption peak centred at 0.4 eV and another one around 1.1 eV. The evolution of these two contributions is correlated to the electric and magnetic transition. The MIR contributions are shifted to the low-frequency region by transiting from the insulating to the metallic state according to carrier delocalisation.