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Influence of deposition conditions on the physical properties and the electronic structures of $Pr_{0.65}Ca_{0.35}Mn_{03}$ films

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$Pr_{0.65}Ca_{0.35}MnO_3$ compound belongs to the family of perovskite-like manganites $R_{1-x}A_xMnO_3$ (R=La, Nd or Pr, and A=Ca, Ba or Sr) which show the colossal magnetoresistance (CMR) phenomenon. These materials exhibit a paramagnetic→ ferromagnetic transition upon cooling, which is accompanied by a sharp drop of resistivity. The CMR results from a rapid shift of the ferromagnetic transition temperature to a higher temperature range in the presence of an applied magnetic.

According to the phase diagram, the $Pr_{1-x}Ca_xMnO_3$ system is very attractive for the investigation of different charge and magnetic states. The magnetic and electronic properties of the CMR compounds have traditionally been explained by the double exchange model which considers the transfer of an electron (or a hole) between the neighboring Mn^{3+} and Mn^{4+} ions through the Mn-O-Mn chains. The electron transfer depends on the relative alignment between the electron spin and the localized Mn^{4+} spin. Another important feature of the manganites is closely related to a strong structural distortion interpreted in terms of the cooperative Jahn-Teller (JT) effect. The orbital ordering resulted from the JT distortion leads to a possibility of the formation of two different states denoted as charge-ordered insulating, and charge-disordered or charge-delocalized metallic-like states in the compound.

In this study we investigate the influence of deposition conditions on the physical properties and the electronic structures of $Pr_{0.65}Ca_{0.35}MnO_3$ films. Two Nd-YAG lasers with a wavelength of 1064 nm, a pulse duration of 7.8-10.5 ns and an energy of 0.3 J/pulse were

used to prepare the films. The substrate was a $LaAlO_3(100)$ single crystal. The substrate temperature during deposition was 750℃. Under these conditions the $Pr_{0.65}Ca_{0.35}MnO_3$ films were obtained wih a thickness of 10~200 nm. In some cases the films were annealed at 900℃ for 1 h in air.

Structural analysis of the films was performed by using x-ray diffraction. The resistivity measurements were carried out by the conventional four-point-probe method in a temperature range of 4.2~300 K. The magnetic properties were also studied in a temperature range of 5~300 K. To investigate the electronic structures of the films, photoemission spectroscopy was performed at the Pohang Light Source. The influence of deposition conditions on the physical properties were analyzed in connection with the changes in electronic structure.