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Oscillation of T_c in $\text{Pr}_{0.5}\text{Ca}_{0.5}\text{MnO}_3/\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ Multilayer

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Content :

Thin film of $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ (YBCO) with thickness of $\sim 60\text{nm}$ has been deposited on (100) oriented SrTiO_3 substrate by Pulsed Laser Deposition technique. A half portion of the base YBCO layer was masked insitu using mechanical shadow mask. In the remaining half portion, five alternate layers of $\text{Pr}_{0.5}\text{Ca}_{0.5}\text{MnO}_3$ (PCMO) thin film and YBCO thin film were deposited. Thickness of these individual layers were maintained at $\sim 60\text{ nm}$. KrF excimer laser (wave length: 248nm) with fluence of $\sim 1.5\text{ J/cm}^2$ and pulse repetition rate of 2Hz was used for the deposition of the multilayer film. XRD measurement confirms the formation of the YBCO and PCMO thin films. A four terminal injection geometry has been used for non-equilibrium quasiparticle distribution in the multilayer. Magnetoresistance measurements were carried out under externally applied magnetic field varied from 0T to 15T . In addition an injection current of $200\text{ }\mu\text{A}$ was applied and the variation in transition temperature (T_c) was measured at different externally applied magnetic field. A noticeable damped oscillation of the superconducting transition temperature (T_c) of this multilayer with respect to magnetic field was observed. The possible reason for this damped oscillatory behavior of the T_c is the different coupling mechanism between the electrons of the FM phases of PCMO and superconducting YBCO. Further studies are being done to identify the cause of damped oscillatory behavior of T_c .

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