Epitaxial $CaMnO_3$ Thin Film Grown in Reduced Oxygen Pressure

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Bulk $CaMnO_3$ is a G-type antiferromagnetic insulator and a constituent phase of colossal magnetoresistance (CMR) material-$La_{(1-x)}Ca_xMnO_3$ (LCMO). $CaMnO_3$ thin films are conventionally grown in ambient pressure of oxygen or stronger oxidizing gases, such as ozone or atomic oxygen, in order to achieve single-crystalline structure and bulk-like qualities. Here we report a reduced-oxygen-pressure epitaxial growth of $CaMnO_3$ thin film of thickness ~ 500Å on top of $SrTiO_3$ substrate, using pulsed laser deposition (PLD). The films were grown in 5×10^{-5}torr oxygen and at a substrate temperature of 660^0C. Reflective high energy electron diffraction (RHEED) and atomic force microscopy (AFM) images show 2 dimensional growth mode and smooth surfaces with typical rms roughness of 0.23nm. We observed a signature of an anti-ferromagnetic transition at T=100K in the temperature dependence of the magnetization. Low temperature electronic transport measurements showed thermally activated behavior, $R \sim \exp(\Delta/2kT)$. This reduced-oxygen-pressure growth makes possible the synthesis of chemically abrupt interfaces between $CaMnO_3$ and metallic counter-electrodes which are usually unstable in strong oxidizing conditions.

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