

Pulsed laser deposition 방법으로 증착된 Co doped $\text{TiO}_{2-\delta}$ 박막의 강자성과 전기적 특성

Ferromagnetic and electrical properties of Co doped $\text{TiO}_{2-\delta}$ thin films with various Co concentration grown by pulsed laser deposition

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Dilute magnetic semiconductors have received considerable attention because of their combined magnetic and transport properties, which are desirable for spintronics applications. Recently, it has been reported that ferromagnetic state exists in Co-doped anatase TiO_2 and Co doped Rutile TiO_2 semiconductors at room temperature.

Here, We have used pulsed laser deposition to grow reduced rutile $\text{Ti}_{1-x}\text{Co}_x\text{O}_{2-\delta}$ ($x=0\sim 0.5$) for various Co concentration, and have measured the magnetic properties and electrical properties of the resulting films. we deposited films onto $\text{R-Al}_2\text{O}_3(1102)$ substrates for reduced rutile (101) structure in vacuum ($\sim 10^{-6}$ torr) at substrate temperature of 700°C . X-ray diffraction (XRD) was carried out to determine the crystal structure and preferred orientation of the films. Atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM) and transmission electron microscopy (TEM) were used the structural characterization of films. Magnetic measurements were performed using a dc superconducting quantum interference device (SQUID) magnetometer and a vibrating sample magnetometer with the magnetic field applied parallel to the film surface. The Hall effect of the films was measured with a four probe method at room temperature. The magnetization measurement showed room temperature ferromagnetism. The Ms of $\text{Ti}_{0.97}\text{Co}_{0.03}\text{O}_{2-\delta}$ thin films were about $10\text{emu}/\text{cm}^3$ at room temperature. In Hall measurements, the reduced Co-doped rutile films have high carrier concentrations ($10^{21}\sim 10^{22}$) and show an anomalous Hall effect (AHE) behavior at 300K.