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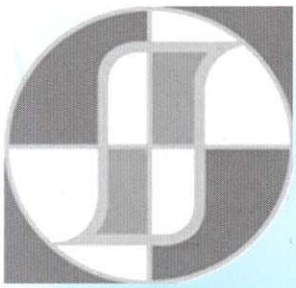
The 2nd Asian Forum on Magnetics & KMS 2005 Winter Conference

논문개요집



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Magnetic and Electronic Properties of Reduced Rutile $Ti_{1-x}Mn_xO_{2-\delta}$ Thin Films

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Magnetic and electronic properties of Mn-doped rutile $TiO_{2-\delta}$ thin films grown on Al_2O_3(0001) substrates by a sol-gel method have been investigated. Rutile $Ti_{1-x}Mn_xO_{2-\delta}$ thin films with x = 3.9 at.% were found to exhibit ferromagnetism at room temperature by vibrating sample magnetometry (VSM) with a saturation magnetic moment (M_S) of about 0.75 μ_B per Mn ion as shown in Fig. 1. The films with x = 5.6 at.% also showed room-temperature ferromagnetism but with reduced M_S compared to x = 3.9 at.%. However, the films with x = 2.5 at.% showed no ferromagnetic behavior. Hall measurements revealed that all the Mn-doped films are p-type semiconductors with the hole concentration of about 10^{19} cm^{-3} while the undoped films n-type with electron concentration of about 10^{18} cm^{-3}. The electrical conductivity of the Mn-doped films were found to decrease with increasing Mn content. Thus, the ferromagnetism in the present rutile $Ti_{1-x}Mn_xO_{2-\delta}$ films is not attributable to the hole carriers but to a direct ferromagnetic coupling between neighboring Mn ions via an electron trapped in nearby oxygen vacancy.

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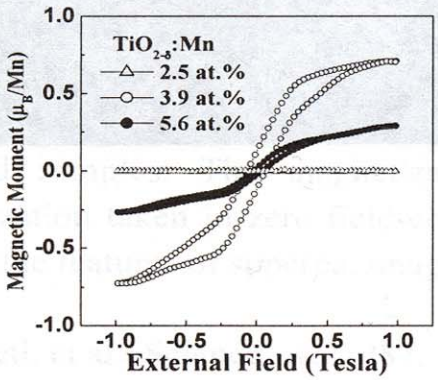

Figure 1. VSM measurement result of rutile $TiO_{2-\delta}$:Mn films at room temperature.