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Antiferromagnetic–paramagnetic state transition of NiO synthesized by pulsed laser deposition

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Abstract

Thin films of nickel oxide (NiO) were deposited on Al substrates at different substrate temperatures using pulsed laser deposition (PLD). Microwave power absorption measurements at 9.4 GHz (X-band) were carried out on these PLD grown films. Multi-walled carbon nano-tubes (MWCNTs) were incorporated with NiO films and were found not to have any effect on the NiO magnetism at room temperature substrate deposition. The MWCNTs and NiO particles have been found to vary in size from 73 to 44 nm and 20 nm respectively from Raman spectroscopy study. These particle sizes are known be affected by substrate temperature during the deposition. Electron spin resonance (ESR) results demonstrated a strange antiferromagnetic to paramagnetic transition at a room temperature. This magnetic transition was attributed to the substrate temperature variations during the films growth. In addition, the angular dependence measurements were also carried out and were seen to enhance this magnetic transition from NiO films. Normally, such magnetic transitions are observed in situ with temperature variations in the ESR system. Both Raman and ESR measurements suggest the absence of detectable Magnons which act as disturbances to magnetism or electron spins.