

CS05

Phase Coexistence in Polycrystalline and Epitaxial in $\text{Nd}_{0.5}\text{Sr}_{0.5}\text{MnO}_3$ Films

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100 nm thick $\text{Nd}_{0.5}\text{Sr}_{0.5}\text{MnO}_3$ (NSMO) thin films are deposited on single crystal LaAlO_3 (LAO/(001)) and ZrO_2 (ZO/(001)) substrates by on axis DC magnetron sputtering. The films on LAO are epitaxial, while those on ZrO_2 are polycrystalline. Multiple magnetic transitions (Fig. 1) caused by the competing FM, AFM and CO phases that are present in the vicinity of $x=0.50$ are observed in both set of films. The first one is PM-FM transition, occurs at $T_C \sim 230$ and 260 K in case of the epitaxial and polycrystalline films respectively. The AFM-CO transition occurs at $T_{CO} \sim 160$ K in both films on LAO and ZrO_2 (Fig. 1). Due to in-plane compressive strain the CO ($T_{CO}=160$ K) is weaker in the film on LAO. In the polycrystalline film $T_{CO} \sim 120$ K is slightly lower. The second ferromagnetic transition is observed just below $T \sim 150$ K in the epitaxial film due to superposition of long range CO phase. Concomitant with the CO, AFM transition is observed in the polycrystalline film. The epitaxial film exhibits metal-insulator (IM) transitions at $T_{IM} \sim 230$ K. The polycrystalline film has IM transition at $T_{IM} \sim 140$ K. The lower T_{IM} in the polycrystalline film is due to the presence of grain boundaries in the polycrystalline film. The epitaxial film exhibits the typical CMR effect (MR $\sim 90\%$ at $H=7T$) in the vicinity of T_C/T_{IM} and a second MR peak corresponding to the third magnetic transition is also observed at $T \sim 100$ K. The polycrystalline thin film shows significant MR that has epitaxial as well as polycrystalline contribution. The electrical transport of these films have also been analysed in frame of small polaron and variable range hopping models.

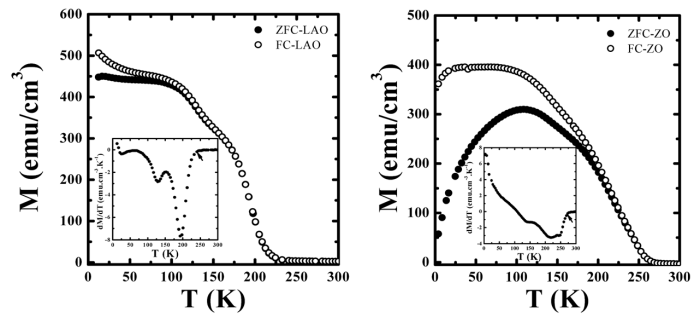


Fig. 1. M-T plots of epitaxial (left) and polycrystalline (right) NSMO thin films.

CS06

Electro-less Deposited Ni-Co-P Nanolayer on Plate-like Particles and Their Magnetic Properties with the Operation of Composition Rate

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Formation of a Ni-Co-P nanolayer on plate-like particles through the electro-less plating route and its related magnetic properties were discussed. Ni-Co-P nanolayer particles with the thickness from several tens to hundreds nanometer size and 30-70% cobalt content were formed by controlling pH and reaction time in a phosphinate electro-less plating bath. The morphology, crystal structure and electromagnetic properties of the Ni-Co-P nanolayer particles were analyzed with field emission scanning electron microscopy (FE-SEM), X-ray diffraction (XRD), vibration sample magnetometer (VSM) and vector network analyzer (VNA). The result shows that the deposition depth and crystallinity of Ni-Co-P nanolayer depend on plating time and annealing temperature. An annealed Ni-Co-P nanolayer at 400-700°C was well-crystallized cubic phase, while as-deposited Ni-Co-P nanolayer by electro-less plating was amorphous phase. It was confirmed that the plating parameter and crystallinity significantly influenced on their magnetic properties such as saturation magnetization and frequency dependency of permeability. The high power loss was observed in a frequency range of 20 M-1 GHz due to controlling deposition depth, crystallinity, and Ni/Co ratio of Ni-Co-P nanolayer.

REFERENCES

- [1] S.X. Wang, N.X. Sun, M. Yamaguchi, S. Yabukami, Nature, 407, 150 (2000).
- [2] N.G. Chechenin *et al.*, Magn. Magn. Mater, 290-291, 1539-1542 (2005).
- [3] J. Shin *et al.*, Magn. Magn. Mater. 290-291, 205-208 (2005).