

Epitaxial film of Heusler-like $\text{Rh}_2\text{Mn}_5\text{Bi}_4$ phase

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The study is focused on epitaxial thin films from the Rh-Mn-Bi system. Select ternary alloys from the system were predicted as strong half-metallic ferro or antiferromagnets for magnetic and magneto-optic applications, as for example the Rh_2MnBi full Heusler. The films were grown by plasma sputtering on a heated $\text{MgO}(001)$ substrate. High demands are put on growth conditions with this kind of alloys as their properties depend heavily on structural quality. During the experiments, it was observed that the film morphology and Bi content (at a given set up magnetron power put on the Bi target) is a strong function of the preparation temperature. As it is sometimes the case with predicted Heusler alloys, experimental results showed that the mentioned Heusler phase probably does not exist. In fact, under the preparation conditions directed towards Rh_2MnBi , a Heusler-like ferromagnetic $\text{Rh}_2\text{Mn}_5\text{Bi}_4$ phase with high magneto-optical response was obtained with excellent morphology and structural order as evidenced by Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM) and X ray Diffraction (XRD). Due to almost completely matching crystallographic properties of the $\text{Rh}_2\text{Mn}_5\text{Bi}_4$ phase and the predicted full Heusler phase, conditions for a superior epitaxial growth of $\text{Rh}_2\text{Mn}_5\text{Bi}_4$ were fulfilled. $\text{Rh}_2\text{Mn}_5\text{Bi}_4$ belongs to the group of rather specific Bi alloys with $\text{Cu}_3\text{Ni}_4\text{Bi}_3$ and $\text{Pd}_2\text{Mn}_5\text{Bi}_4$ as other examples. In summary we were able to fabricate and characterize the cubic $\text{Rh}_2\text{Mn}_5\text{Bi}_4$ grown epitaxially in the [001] direction with favorable ferromagnetic behavior.

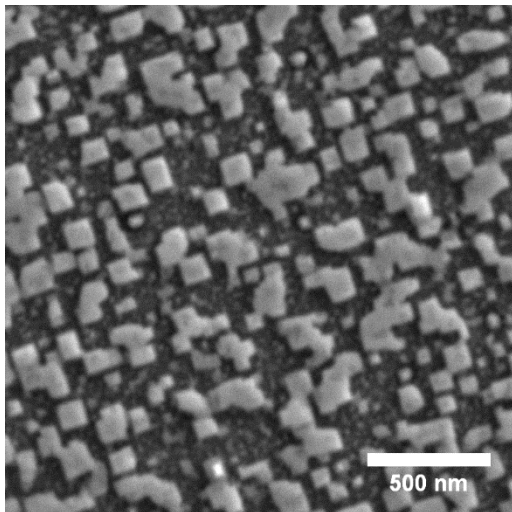


Fig.1: SEM micrograph of $\text{Rh}_2\text{Mn}_5\text{Bi}_4$ film.

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