[QMS2020 invited talk]

Searching for the origin of phase transition characteristics of FeRh films

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The physical origin of the phase transition of FeRh is not fully understood and various experimental approaches were applied to investigate the origin of the phase transition. In this presentation, we will explain our efforts to understand the physical origin of the phase transition of FeRh.
First, the correlation between the structural and physical properties of the FeRh films was investigated by inducing defects. To generate the defects, hydrogen implantation is used. As a result, the residual ferromagnetism in the antiferromagnetic region (i.e., below the transition temperature) increased and a magnetic phase transition temperature decreased as the implantation dose increased. Further, the electrical resistivity and electrical transition temperature decreased with increasing hydrogen dose contents. The structural analysis revealed that the increased tetragonality (c/a) with increasing hydrogen dose contents is the source of magnetic and electrical characterization variations. Second, the origin of the residual ferromagnetism below the transition temperature is examined. Interestingly, the origin of the residual ferromagnetism below the transition temperature is related to the ferromagnetic ordering at the interfaces which is confirmed by polarized neutron reflectometry. Furthermore, the asymmetric temperature dependence of interfacial magnetism is related to the different origins at both interfaces. Last, FeRh film grown on different orientations exhibited bifurcation of magnetic moments during the thermal cycle. This unusual effect is related to the spin-glass state in the antiferromagnetic region of FeRh. The detailed experimental observation with proper explanation will be provided.

Keywords: FeRh, Interface magnetism, Structural distortion, Polarized neutron reflectometry, Spin-glass