Electronic state of RCo_2 (R: rare-earth) ferrimagnets under high pressure

Recently, high pressure techniques become indispensible in the field of solid state physics and materials science for better understanding of electronic structures of materials. In order to clarify the origin of "pari"-magnetism, we have performed electrical resistivity experiments on $HoCo_2$ single crystal under high pressure.

$HoCo_2$ belongs to a group of intermetallic RCo_2 (R = rare earth) compounds forming a cubic Laves phase ($MgCu_2$-type, space group *Fd-3m*). Localized 4*f* magnetic moments of R element coexist together with the itinerant Co 3*d* moments in RCo_2 compounds. Both magnetic sublattices (R and Co) align antiparallel for heavy rare-earths (Gd, Tb, etc.) below Curie temperature T_C. The magnetic moment of Co appears on the verge of magnetism. Recently, it is found that there is a short-range magnetic correlation between 4*f* and 3*d* moments even above T_C, which is called "*parimagnetism*" [1]. In order to clarify the origin of parimagnetism, we have carried out electrical resistivity measurements on $HoCo_2$ under high pressure.

The single crystalline sample of $HoCo_2$ was grown by flux method. The magnetic transition temperatures on the studied single crystal are checked by Physical Property Measurement System in laboratory for α-emitters in Sendai. High pressure was generated using Bridgman anvil type pressure apparatus. Pressure inside the cell was calibrated by the superconducting transition of lead. Daphne 7373 was used as pressure transmitting medium. Fig.1 shows the temperature dependence of the electrical resistivity on $HoCo_2$ under high pressure.

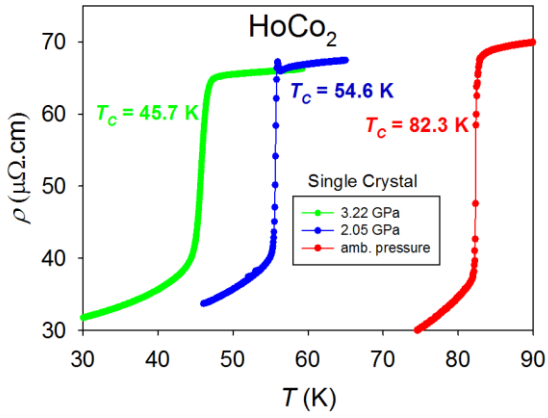

Fig. 1 Temperature dependence of electrical resistivity measured on $HoCo_2$ single crystal.

The pressure evolution of T_C on $HoCo_2$ shows rapid decrease of T_C up to 3.22 GPa and for $P > 4$ GPa T_C is nearly pressure independent which is in good agreement with the data obtained by polycrystalline sample [2], as shown in Fig. 2. On the other hand, the magnetic reorientation temperature T_R, where the easy direction of magnetization changes from the [100] to [110], slowly increases with increasing pressure.

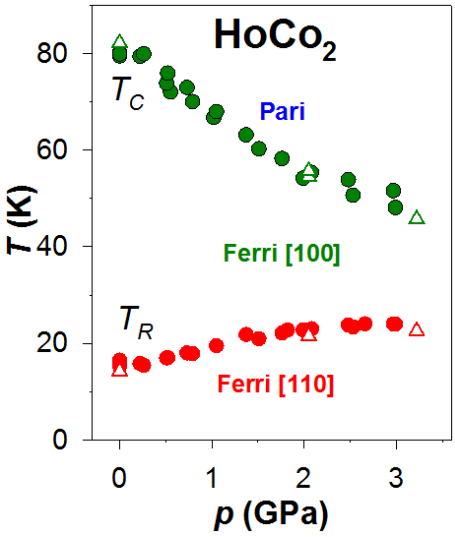

Fig. 2 Obtained *T-P* magnetic phase diagram of $HoCo_2$. Open symbols are obtained by the present study.

This project's impact is extending of the pressure range for the measured data on the studied RCo_2 compounds and considerable is also a great experience of a young scientist with high level pressure equipment in the IMR laboratory.

References

[1] F. Bartolomé *et al.*, Eur. Phys. J. B, **86** (2013) 489.
[2] O. Syshchenko, *et al.*, *J. Alloys and Compd.* **317-318** (2001) 438.

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