表題：正方晶 Mn3+xGe1-x の結晶構造特性と磁気特性に関する中性子回折実験

Neutron diffraction study on structural and magnetic properties of the tetragonal Mn3+xGe1-x

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Ferrimagnetic Mn3Ga and Mn3Ge with a tetragonal structure are expected to be candidates for novel spintronics and permanent magnet materials [1]. The compounds undergo a structural phase transition accompanied by a magnetic transition from the ferrimagnetic tetragonal phase to a paramagnetic hexagonal high temperature phase. It is known that the offstoichiometric composition is required to obtain the single phase of the tetragonal phase. Recently, we have found that thermal stability of the tetragonal phase in Mn3Ge is expanded by introducing excess Mn. Furthermore, as the result of the enhancement on the thermal stability, we observed that an intrinsic magnetic transition from ferrimagnetic to paramagnetic phases in the tetragonal phase occurs at 860 K. Although the magnetic transition temperature is robust against the introduction of the excess Mn, the magnetization decreases with increasing Mn content. These results clearly indicate that the excess Mn strongly affects the structural and magnetic properties of the tetragonal manganese-germanium compound. A previous report of neutron diffraction experiments suggests that the excess Mn is located at the Ge site [2]. However, the magnitude of magnetic moment is estimated to be 4 - 7 Bohr magneton, which is too large value for magnetic moment. The results obtained from accurate measurement and analysis would lead to further experimental and theoretical investigation and understanding of correlations between the electronic properties and the structural and magnetic properties. In this study, to directly observe the structural phase transition, we have performed neutron diffraction experiments for Mn3+xGe1-x at ECHIDNA in Australian Nuclear Science and Technology Organisation. As shown in the Figure, neutron diffraction pattern of Mn3.03Ge0.97 clearly changes in the vicinity of 858 K, indicating that the tetragonal D022 structure transforms to the hexagonal D019 structure. In case of Mn3.09Ge0.91, the structural phase transition occurs in the vicinity of 928 K, which is higher temperature than that in Mn3.03Ge0.97. These results directly prove that thermal stability of D022 structure in Mn-Ge is expanded by introducing small amount of excess Mn.

[1] B. Balke et al, Appl. Phys. Lett. 90, 152504, 2007.
[2] N. Yamada et al., J. Phys. Soc. Jpn 59 273, 1990.

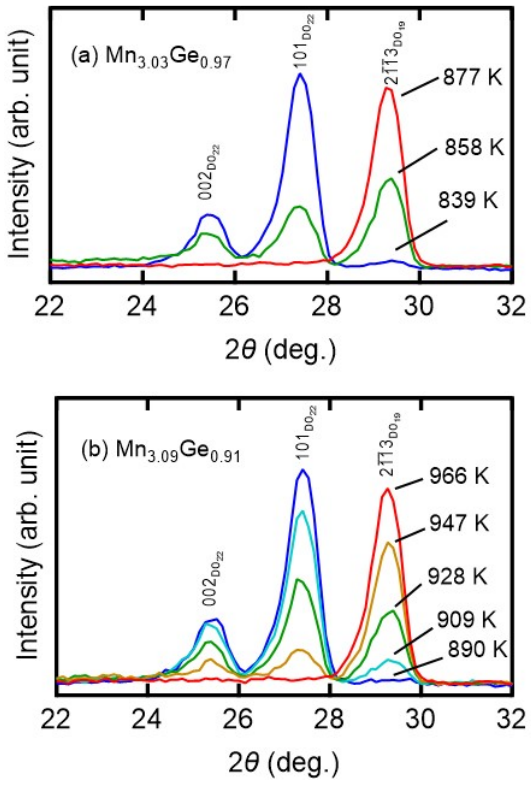

Fig. 1. Neutron diffraction patterns of (a)Mn3.03Ge0.97 and (b)Mn3.09Ge0.91

使用施設：JRR-3M, 装置：T1-3:HERMES
分野：Magnetism