

Partial order of conduction electrons in Mn_3CoSi

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Unconventional phase transitions have been discovered in various materials.¹⁾ One of them is a phase separation at the tri-critical point of quantum phase transition.²⁾ Partial magnetic order has been observed in a non-centrosymmetric compound of MnSi near the quantum phase transition under pressure.^{3,4)} On the search of new unconventional magnetic transition, we discovered the highest-temperature magnetic short-range order (SRO) in a new noncentrosymmetric magnet Mn_3RhSi by the complementary use of muon spin relaxation (HiFi and ARGUS at ISIS), neutron, X-ray scattering, electron diffraction, and magnetization measurements.⁵⁾ It has a hyperkagome network of magnetic Mn ions. We think that the unconventional magnetic SRO emerges due to the spatially inhomogeneous order parameter, where the Lifshitz condition is violated by the Dzyalonskii-Moriya interaction in a noncentrosymmetric magnet. The intriguing point of the SRO is not limited in the highest-temperature record of magnetic SRO, but also in the observed Q-position different from long-range antiferromagnetic (AF) order Q-position. At present, however, the mechanism is still unknown. To reveal the mechanism, we believe that it is necessary to complete the phase diagram (Fig. 2) by measuring the related family compounds such as Mn_3CoSi ($a = 6.28 \text{ \AA}$) with a different lattice constant resulting in a different

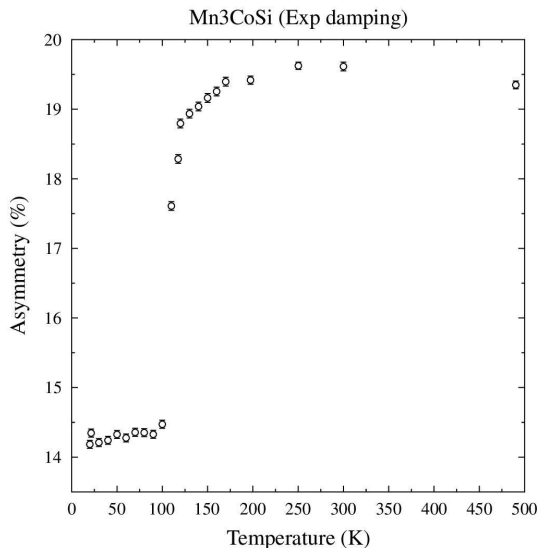


Fig. 1. Temperature dependence of TF μSR asymmetry of Mn_3CoSi .

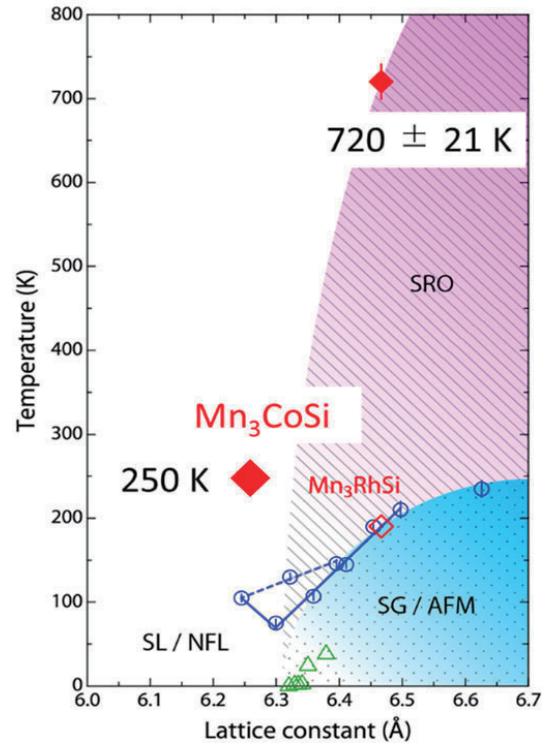


Fig. 2. Phase diagram of β -Mn type structure alloys.

bandwidth from that of Mn_3RhSi ($a = 6.47 \text{ \AA}$). The Néel temperature of Mn_3CoSi is about 100 K, whereas that of Mn_3RhSi is 190 K. However, it was unknown which the SRO transition temperature of Mn_3CoSi becomes lower than that of Mn_3RhSi .

TF μSR measurement of Mn_3CoSi (RB2070006) successfully showed SRO anomaly above Néel temperature in the asymmetry as shown in Fig. 1. The magnetic SRO of Mn_3CoSi is found to start at about 250 K. From this result, we may conclude that the SRO temperature increases with increasing the lattice constants as shown in Fig. 2. This result suggests that the present world record of SRO temperature may further increase with increasing the lattice constant.

References

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