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Single crystal growth and neutron diffraction study of non-collinear antiferromagnets Mn3Sn

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Following the recent observations of large anomalous Hall effect (AHE) and the possible realisation of magnetic Weyl fermions in the intermetallic non-collinear antiferromagnet (AFM) Mn3Sn, this compound has rapidly emerged as a promising quantum material that may find huge potentials for future information and quantum technologies [1-3]. Geometric frustration in the Kagome lattice of Mn atoms within the ab-plane leads to a non-collinear AFM order with an inverse triangular spin configuration below TN=420 K. However, it has been controversial concerning the low-temperature phase transition to a modulated triangular AFM i.e. a spiral magnetic order[4]. For instance, the transition at T1 is clearly shown in a flux method grown crystal, it has not been observed in any Czochralski method grown crystals. This strong sample dependence is largely due to small variations of the Mn content in various samples. We have grown Mn3Sn single crystals via flux method successfully. Magnetometry measurement showed an obvious transition at T1=275K, and it was also verified by neutron diffraction measurement at DNS. When temperature decreases below 275K, two spiral phases were observed as indicated by the satellite peaks around (-100) peak in neutron spin flip measurement at DNS. Besides, temperature dependence of the spiral phases was also disscussed.

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[2] K. Kuroda, et al., Nat. Mat. 16, 1090 (2017).
[3] A.K. Nayak, et al., Sc. Adv. 2, e1501870 (2016).
[4] N.H. Sung, et al., Appl. Phys. Lett. 112, 132406 (2018).

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