Microsymposium

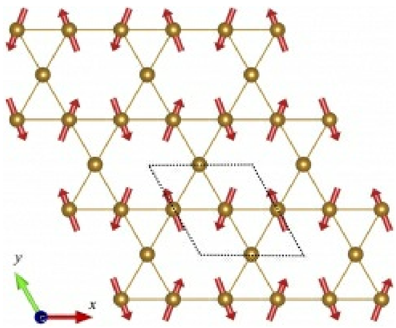
MS103.O02

Striped Magnetic Ground State on an Ideal S=2 Kagomé Lattice

Chris D Ling[1], Morgan Allison[1], Siegbert Schmid[1], Maxim Avdeev[2], Dominic Ryan[3], Tilo Soehnel[4]
[1]School Of Chemistry, The University Of Sydney, Sydney, Australia, [2]Australian Centre for Neutron Scattering, Australian Nuclear Science and Technology Organisation, Menai, Australia, [3]Physics Department and Centre for the Physics of Materials, McGill University, Montreal, Canada, [4]School of Chemical Sciences, University of Auckland, Auckland, New Zealand
E-mail: chris.ling@sydney.edu.au

We have used representational symmetry analysis of neutron powder diffraction data to determine the magnetic ground state of Fe4Si2Sn7O16. We recently reported a long-range antiferromagnetic (AFM) Néel ordering transition in this compound at TN = 3.0 K, based on magnetization measurements. [1] The only magnetic ions present are layers of high-spin Fe2+ (d6, S = 2) arranged on a perfect kagomé lattice (trigonal space group P-3m1). [2] Below TN = 3.0 K, the spins on 2/3 of these magnetic ions order into canted antiferromagnetic chains, separated by the remaining 1/3 which are geometrically frustrated and show no long-range ordered down to at least T = 0.1 K. Moessbauer spectroscopy shows that there is no static order on the latter 1/3 of the magnetic ions – i.e., they are in a liquid-like rather than a frozen state – down to at least 1.65 K. A heavily Mn-doped sample Fe1.45Mn2.55Si2Sn7O16 has the same ground state. Although the magnetic propagation vector k = (0, 1/2, 1/2) breaks hexagonal symmetry, we see no evidence for magnetostriction in the form of a lattice distortion within the resolution of our data. To the best of our knowledge, this type of magnetic order on a kagomé lattice has no precedent experimentally and has not been explicitly predicted theoretically. We will discuss the relationship between our experimental result and a number of theoretical models that predict symmetry breaking ground states for perfect kagomé lattices.

[1] Allison, M. C. et al. (2016). Dalton Trans. 45, 9689
[2] Soehnel, T et al. (1998), Z., Anorg. Allg. Chem. 624, 708



Keywords: kagomé lattice, geometrically frustration magnetism, neutron powder diffraction