



Contribution ID : 66

Type : not specified

Neutron diffraction study of double tungstates $\text{Li}_2\text{M}^{II}(\text{WO}_4)_2$ (M=Co and Ni)

Neutron diffraction study of double tungstates $\text{Li}_2\text{M}^{II}(\text{WO}_4)_2$ (M=Co and Ni)

The isostructural $\text{Li}_2\text{Co}(\text{WO}_4)_2$ and $\text{Li}_2\text{Ni}(\text{WO}_4)_2$ crystallize in the triclinic structure (space group P-1, Z = 1). The crystal structures can be viewed as alternating layers of WO layers and Li-MO layers along the b-axis. The WO layers built up of edge-sharing WO_6 octahedra forming infinite zigzag chains along the a-axis as in many other tungstates. The edge-sharing LiO_6 octahedrons also form infinite chains extending along the c-axis. The divalent ions, Co^{2+} and Ni^{2+} , are locating in the octahedral oxide environment, in the mesh forming by crossing LiO and WO chains, isolated from each other. Due to the lack of direct connection of the MO_6 octahedral, the magnetic coupling between the nearest neighboring M cannot through the strong M-O-M superexchange path (SE). Nevertheless the magnetic coupling can be achieved through more complex pathways, which is bridging by the oxygen ions in LiO_6 or WO_6 . In $\text{Li}_2\text{M}^{II}(\text{WO}_4)_2$ the weak M-O-O-M pathways, known as super-superexchange (SSE) form complex network with magnetic frustrations, gives raise to complex magnetic behaviors.

The temperature dependent magnetic susceptibility and heat capacity clearly mark the two magnetic transition temperatures of each of the two compounds. In $\text{Li}_2\text{Ni}(\text{WO}_4)_2$ the two magnetic transition temperatures are $\text{TN}_1 = 12.8$ K and $\text{TN}_2 = 17.5$ K, whereas the slightly lower $\text{TN}_1 = 7.2$ K and $\text{TN}_2 = 9.5$ K for $\text{Li}_2\text{Co}(\text{WO}_4)_2$. The magnetic structures have been determined from neutron powder diffraction measurement conducted on Wombat and Echidna at ANSTO. For both compounds the magnetic correlation develops below TN_1 , as an incommensurate modulation and the magnetic moments order into commensurate super cells below TN_2 . Both compounds possess collinear antiferromagnetic spin configurations in the magnetic order phases. Surprisingly the magnetic unit cells of the two isostructural compounds are different. The magnetic unit cell of $\text{Li}_2\text{Ni}(\text{WO}_4)_2$ is (2a b 2c), and the magnetic moment of Ni^{2+} at 3 K is $1.925 \mu\text{B}$, roughly pointing along the a direction. Whereas a much larger magnetic unit cell of (2a 4b 4c) is realized in $\text{Li}_2\text{Co}(\text{WO}_4)_2$ below TN_2 . Co spins in the {+ + -} sequence are observed when moving to the neighboring magnetic sites along b and c-axis. The magnetic moment of Co^{2+} is $2.836 \mu\text{B}$ at 5.5 K closely align along the a-axis as well. The different magnetic ground states in the two compounds might be resulted from to the slight differences in the crystal structure and magnetic couplings.

Primary author(s) : Dr WANG, Chin-Wei (National Synchrotron Research Center)

Co-author(s) : Prof. CHOU, F. C. (Center For Condensed Matter Science, National Taiwan University); Dr SANKAR, Raman (Center For Condensed Matter Science, National Taiwan University); Dr KARNA, Sunil (Center For Condensed Matter Science, National Taiwan University)

Presenter(s) : Dr WANG, Chin-Wei (National Synchrotron Research Center)