

Synthesis-Controlled Polymorphism and Magnetic Properties of $\text{Li}_3\text{Co}_2\text{SbO}_6$

Thursday, 12 November 2020 17:38 (1 minute)

$\text{Li}_3\text{Co}_2\text{SbO}_6$ has been synthesized using high temperature solid-state methods. $\text{Li}_3\text{Co}_2\text{SbO}_6$ is found to adopt two highly distinct structural forms: a pseudohexagonal (monoclinic $C2/m$) layered $\text{O}_3\text{-LiCoO}_2$ type phase with “honeycomb”2:1 ordering of Co and Sb, and an orthorhombic $Fddd$ phase, isostructural with $\text{Li}_3\text{Co}_2\text{TaO}_6$ but with the addition of significant Li/Co ordering. Pure samples of both phases can be obtained by conventional solid-state synthesis via a precursor route using Li_3SbO_4 and CoO , by controlling particle size, initial lithium excess, and reaction time. Both phases show relatively poor performance as lithium-ion battery cathode materials in their as-made states, but complex and interesting low-temperature magnetic properties.

The monoclinic honeycomb phase is the first of its type to show A-type antiferromagnetic order (ferromagnetic planes, antiferromagnetically coupled), with $T_N = 14$ K. Isothermal magnetisation and in-field neutron diffraction below T_N show clear evidence for a metamagnetic transition at $H = 0.7$ T to three-dimensional ferromagnetic order. The orthorhombic phase orders antiferromagnetically below $T_N = 112$ K and then undergoes two more magnetic phase transitions at 80 and 60 K. Neutron diffraction data show that the ground state is incommensurate.

In this presentation the crystal structures of both polymorphs of $\text{Li}_3\text{Co}_2\text{SbO}_6$ will be discussed as elucidated by X-ray powder diffraction and neutron powder diffraction. The low-temperature magnetic ground-states and magnetic behaviour, including in-field metamagnetism displayed by the honeycomb phase will also be discussed.

Level of Expertise

Student

Speakers Gender

Male

Do you wish to take part in the poster slam

Yes

Primary author: BROWN, Alex (Mr)

Presenter: BROWN, Alex (Mr)

Session Classification: Poster Session

Track Classification: Magnetism & Condensed Matter