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(POS-15) Resonant X-ray Reflectometry of a Mn_3Ge-based Quantum Heterostructure

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Topological materials offer many interesting quantum phenomena such as anomalous Hall effect (AHE), topological Hall effect (THE), quantum spin liquid state, and skyrmion lattice. Among these materials, Mn3+xGe is one of the interesting quantum materials as it has a triangular spin lattice in the kagome network. Due to this arrangement, collinear antiferromagnetic (AFM) alignment is impossible which creates frustration in the spin system. To minimize energy while stabilizing the frustrations, the Mn spins adopt a 120˚ non-collinear AFM structure instead of collinear AFM. This spin orientation breaks the inversion symmetry locally and produces quantum mechanical effects like AHE, THE, etc. In this work, we systematically studied the electronic, and magnetic properties and exchange coupling between Mn3Ge, and ferromagnetic Fe layered in a quantum heterostructure. For this, depth-resolved elemental and magnetic density profiles were determined through analysis of Resonant X-ray Reflectometry (RXR) data collected at the REIXS beamline of the Canadian Light Source. These structural and magnetic density profiles gave a better visualization of the sample and important information about how magnetization affects the non-collinear AFM Mn3Ge and ferromagnetic Fe in the system and at the interface. This research enhances our understanding of this potential spintronic material and demonstrates RXR to be a powerful technique for studying quantum material heterostructures.

Keyword-1

Quantum materials

Keyword-2

Resonant X-Ray Reflectometry

Keyword-3

Mn3Ge

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