High resolution spin texture imaging in spin caloritronics prototype device structures

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Spin caloritronics are currently a science focus due to their potential exploitation in the next generation of spintronics applications. This class of materials combine both spintronic and thermoelectric functionalities by interconversion of charge, spin and heat currents [1]. Revealing how atomic strain and magnetic structure are intertwined at the nanoscale is of central importance to the development of emerging spin caloritronic nanotechnologies [2]. The recent investment in high brilliance 4th generation synchrotron sources hold promise for the development of new microscopic tools to reveal simultaneously atomic and magnetic nano-structure. Here, we present preliminary results from ID01 of the ESRF-EBS, combing Bragg ptychography with X-ray resonant scattering to investigate prototype spin caloritronic devices structures of $Gd_3Fe_5O_{12}$ epitaxial films capped with a Platinum layer. From our analysis exploiting inverse microscopy approaches, we demonstrate the potential to correlate atomic strain and magnetic structures down to 16nm spatial resolution. In addition, we present ptychography results focussed on the structure and strain of the prototype device structures from the nanoMAX beamline of MAX-IV.

References

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