C-doped $L1_0$-MnAl ferromagnetic thin films

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Chemically ordered $L1_0$-MnAl alloys reveal high perpendicular magnetic anisotropy energy, small magnetic damping constant, and low magnetization (the latter being important for using low excitation currents in magnetic RAM applications) [1]. A key issue is to obtain such a material on commercial Si wafers, for ensuring compatibility to standard microelectronics processes and allowing the development of a low-cost, commercially viable spintronic devices technology.
In this work, we employed magnetron sputtering deposition of MnAl alloy with addition of carbon on heated single crystal Strontium Titanium Oxide (STO) substrates. Magnetostatic characterization was performed using the magneto-optical Kerr effect (MOKE), as well as Brillouin light scattering (BLS) for dynamic measurements. The results clearly show that a ferromagnetic phase appears. For obtaining the desired $L1_0$ phase on substrates compatible to microelectronics processes, we plan to deposit STO seed layers onto oxidized Si wafers and thereupon grow C-doped MnAl.

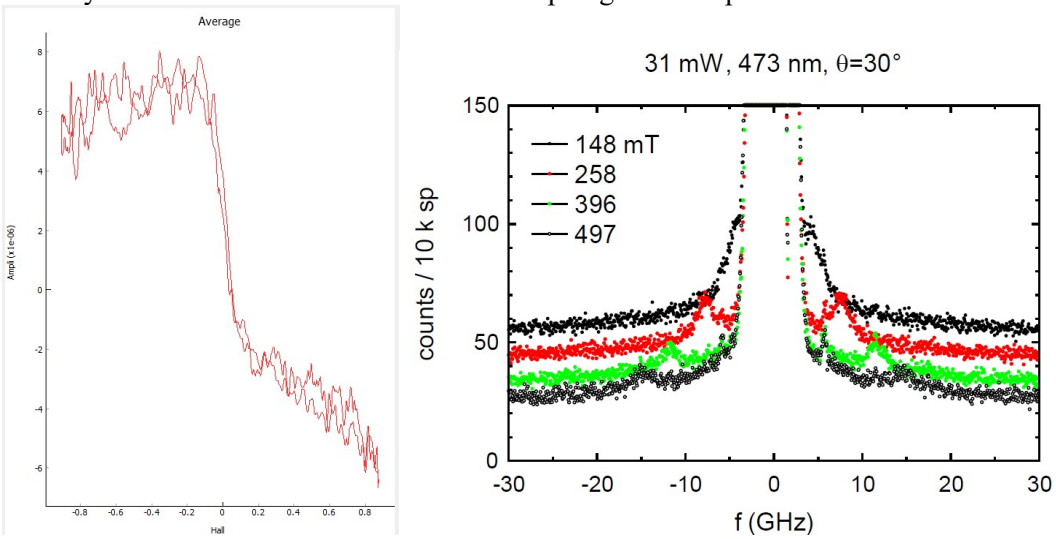

Figure 1 Representative magnetic characterization measurements. (Left) polar-MOKE measurements (out-of-plane field, values in T) of C-MnAl 100 nm thick film; A clear magnetization reversal with coercive field of ~60 mT is apparent in the perpendicular geometry. (Right) BLS measurements of the same sample. A (weak) peak is seen which shifts to higher frequencies when field (applied in the sample plane) is increased.

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References

[1] Takeuchi *et al.* Appl. Phys. Lett. **120**, 052404 (2022).

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