Tailoring Spin-Wave Dispersion Through Substrate-Temperature-Controlled Growth

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Abstract

The increasing demand for smaller, faster, and more energy-efficient high-frequency microwave devices opens the way for magnon-based devices. Although magnons offer low-power information transport, their short propagation length limits device efficiency. One solution to overcoming this limitation is to use materials with low spin-wave damping, such as Heusler alloys[1]. Here, we demonstrate how the Si substrate temperature during the growth of Co_2FeGa films affects spin-wave propagation. The samples were sputtered onto substrates held at 300 °C, 450 °C, and 600 °C, and subsequently annealed at the same respective temperatures. All investigations were performed using Brillouin light scattering and ferromagnetic resonance. Complementary finite element method simulations[2] were used to calculate magnetic anisotropy and spin-wave mode profiles. Substrate temperature significantly modifies the spin-wave dispersion, demonstrating its key influence on magnon propagation in Heusler alloys. These findings are relevant for the design of magnonic signal-processing devices based on Heusler alloys.

References

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