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Magnetic, optical, and magneto-optical properties of Ni₂MnIn Heusler alloy films

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Recently, Ni₂MnIn Heusler alloy is considered as a promising candidate for spin-injector layer in spintronic and optoelectronic modulator devices. In this study, the structural dependences of magnetic, magneto-optical (MO) and optical properties of the Ni₂MnIn alloy films were investigated. The films were prepared by flash evaporation onto glass substrates in a vacuum better than 2×10^{-5} Pa. To obtain the highly-ordered films, the deposition was performed onto substrates heated up to 730 K, while a significantly-disordered alloy film was prepared by vapor-quenching deposition onto substrates cooled by liquid nitrogen. The magnetic properties were measured in a temperature range of 4 - 300 K by using SQUID and vibrating-sample magnetometers. It was shown that the structural disordering results in a prominent decrease in the magnetization of films. It was also found that the MO response from the Ni₂MnIn alloy films depend strongly on the film structures. An annealing of the disordered Ni₂MnIn alloy film at 750 K for 120 min restores its crystallinity and the ferromagnetic order. The optical-conductivity (OC) spectrum of the ordered crystalline Ni₂MnIn alloy film (as well as the bulk sample) is characterized by two pronounced absorption peaks at 1.8 and 3.2 eV. The structural disordering causes a red-shift (by about 0.6 eV) of the high-energy peak in the OC spectrum.