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Magnetic spin structures in amorphous DyCo thin film systems

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Alloys of rare-earth elements and 3d transition metals became recently again in the focus of attention due there rich variety of magnetic effects owed to the different anisotropies of both material classes. In this work, various thin film systems containing the amorphous DyCo alloy will be discussed. Despite of their amorphous nature, the film system show non trivial magnetic ordering leading to extraordinary phenomena. Neutron scattering techniques, in particular polarized neutron reflectometry are essential to investigate such thin film systems providing the sensitivity to study the magnetic structures on a microscopic level that is essential to understand the underlying principles. In DyCo₄ a large Atomic Exchange Bias effect was observed in a single film owned to the competition between the atomic exchange and the Zeemann interaction. In contact with a soft magnetic thin film of permalloy a chirality based exchange bias effect could be created. Here, the direction of the exchange bias effect can be isothermal switched by a moderate perpendicular magnetic field. The presence of an interfacial Dyzalooshinskii-Moriya is one of the keys to explain the observation. In a very recent study, we could demonstrated how skyrmionic objects could be created in DyCo₃ single films. The utilization of ferrimagnetic skyrmions as well as the of novel concepts of exchange bias may be of crucial importance for the development of future applications in the field of magnetic sensors.

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