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FRUSTRATED SHASTRY-SUTHERLAND METALLIC SYSTEMS TmB₄ AND ErB₄

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Geometrically frustrated lattices play an important role in emergent quantum mechanical phases, which have been rather well investigated in electronic insulators. A system that exhibits both lattice frustration and metallic behaviour are the rare-earth (RE) tetraborides REB₄. They have a tetragonal structure with magnetic RE ions embedded in boron network and forming a lattice topologically equivalent to the frustrated Shastry-Sutherland lattice with the strong Ising single-ion anisotropy.

In our contribution we compare the behaviour of TmB₄ and ErB₄ by investigating the angular dependencies of their thermal and magnetic properties in a wide range of temperatures (T) and magnetic fields (H) as well as transport properties under pressure up to 3 GPa. Compared are also the rotating magneto-caloric effects (R-MCE) of both compounds. Spin-electron model was suggested to explain the complex behaviour of R-MCE, which is based on the idea of two interacting systems: the localized spins of RE ions and the itinerant electrons in conduction band. The received results from Monte Carlo approach successfully reproduce the observed heating and cooling regions in H - T phase diagrams of TmB₄. Thus, our study shows that measurements of R-MCE can be an effective tool for investigating the microscopic properties of magnetization processes.

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