Magnetic and electrical transport studies of the putative antiferromagnetic topological semimetal $EuZn_2Sn_2$

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$EuZn_2Sn_2$ is a dimorphic compound crystallizing in two structures: tetragonal (space group $P4/nmm$) and monoclinic (space group $P2_1$), related to the former one via a small distortion [1]. We grew single crystals of $EuZn_2Sn_2$ with the latter structure, refined that structure and performed extensive measurements of thermodynamic and electrical transport properties at various applied magnetic fields and temperatures. We confirmed that the compound becomes antiferromagnetic below the temperature T_N =10.2 K. Results of magnetic susceptibility in paramagnetic state, magnetization saturation value at lowest temperatures and analysis of the specific heat indicate localized moments of Eu^{+2} ions.

Magnetoresistance of $EuZn_2Sn_2$ reaches about 60%, and in the magnetically ordered state is almost linear in field, with an additional anomalous component clearly related to the antiferromagnetic structure evolution. The Hall resistivity in function of magnetic field is nonlinear and, when the magnetic moments are not antiferromagnetically ordered, can be described well with the two-band Drude model. In antiferromagnetic region an anomalous part of the Hall conductivity was obtained by subtracting the two-band contribution. The magnitude of the anomalous Hall conductivity decreases with increasing temperature, but increases again at T =10 K, just below the ordering temperature. This hints at multiple contributions, possibly including some of topologically nontrivial nature. Our results pave the way for further studies precisely identifying the origin of the anomalous Hall effect and the topological character of $EuZn_2Sn_2$.

References:

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