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Optical spectroscopic investigations of antiferromagnetic semiconducting BaMn2P2

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Materials with ThCr₂Si₂-type crystal structure (Space Group: I4/mmm) have sparked scientific interest for several decades now owing to their novel properties and exotic ground states. The ThCr₂Si₂-type compounds have physical properties that are highly tunable, making this family of compounds ideal for investigating the structure-property relationship. Unconventional high T_c superconductivity was observed in iron-based arsenides, Ba_{1−x}K_xF [1] and BaFe_{2−x}Co_xAs₂ [2]. The quest for higher T_c superconductivity led research into other BaT₂Pn₂ compounds, where T = transition metal and Pn = P, As, Sb, Bi, revealing a variety of physical properties. BaMn₂P₂ is one such compound that was recently investigated by us [3]. Electrical resistivity and heat capacity measurements on single crystals of BaMn₂P₂ revealed an insulating ground state with a small band gap [3]. Anisotropic magnetic susceptibility measurements confirmed that BaMn₂P₂, like its As-, Sb- and Bi- counterparts, has collinear Néel type antiferromagnetism below T_N = 795(15) K, which is the highest value for the family of 122-pnictide compounds thus far. Moreover, the magnetic susceptibility increases above T_N, like in the As-, Sb-, and Bi-based compounds, suggesting that antiferromagnetic correlations persist above the magnetic ordering temperature. In this contribution, we probe the properties of this interesting compound using Raman spectroscopy, investigating its structure around T_N. We also attempt to probe the effect of tweaking the ground states by changing charge-carrier concentrations.

References

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