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CsMn₄As₃: A new layered tetragonal pnictide compound with an antiferromagnetic ground state

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Search for new high- T_c superconductors (SCs) got a boost in 2008 after the discovery of superconductivity in tetragonal iron-based compounds 1111-type $\text{LaFeAsO}_{1-x}\text{F}_x$ and 122-type AFe_2As_2 ($\text{A} = \text{Ba}, \text{Sr}$ and Ca). Efforts begun to discover new SCs or their prospective parent compounds and soon a few other SC families were discovered. Two common ingredients of the parent compounds of the iron-based SC families were—stacked square lattices of transition-metal ions and inherent antiferromagnetic (AFM) fluctuations/ordering. We report here the synthesis and properties of a new layered tetragonal transition-metal pnictide compound CsMn_4As_3 . The material is a small band-gap semiconductor and exhibits an AFM ground state. Its crystal structure can best be described as a completely collapsed variant of the structure of iron-based pnictide superconductor parent compound BaFe_2As_2 , where the entire middle layer of cations as well as As anions are absent. As a result, the ratio of the tetragonal lattice parameters c/a is only 2.44 in CsMn_4As_3 compared to 3.28 in BaFe_2As_2 . Owing to the novelty of its transition metal sublattice, this new addition to the family of tetragonal materials related to the iron-based superconductors brings prospects for doping and pressure studies in the search of new superconducting phases as well as other exciting correlated-electron properties.

Apply to be considered for a student award (Yes / No)?

No

Level for award (Hons, MSc, PhD, N/A)?

PhD

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