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

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Search for new high-Tc superconductors (SCs) got a boost in 2008 after the discovery of superconductivity in tetragonal iron-based compounds 1111-type LaFeAsO1-xFx and 122-type AFe2As2 (A = Ba, 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 CsMn4As3. The material is a small band-gap semiconductor and exhibits an AFM ground state. Its crystal structure can best described as a completely collapsed variant of the structure of iron-based pnictide superconductor parent compound BaFe2As2, 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 CsMn4As3 compared to 3.28 in BaFe2As2. 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.

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