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Effect of Cr doping on the electronic, thermal and magnetic properties of SrCo₂As₂

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The layered ThCr₂Si₂-type tetragonal compound, SrCo₂As₂ shows antiferromagnetic fluctuations, which are believed to be a precursor for superconductivity in the iron-arsenide family. However, the co-existence of ferromagnetic (FM) fluctuations likely precludes a superconducting ground state in this compound. Hence, it is important to investigate whether chemical doping suppresses FM fluctuations in order to reach a superconducting phase. We report here the effect of hole doping on structural, magnetic, and transport properties of high-quality single crystals of SrCo₂As₂ via partial substitution of Co by Cr. All the doped compositions crystallize remain in ThCr₂Si₂-type structure. The basal plane electrical resistivity pab shows metallic behavior for all the doped compositions. The heat capacity $C_{\rm p}(T)$ and magnetic susceptibility $\chi(T)$ of the doped compositions infer the absence of long-range magnetic ordering down to 1.8 K. Sommerfeld coefficient obtained from low-temperature $C_{\rm p}(T)$ data decreases with an increase in Cr concentration, indicating the reduction of the density of states at the Fermi level $E_{\rm F}$. The $\chi_{ab}(T)$ ($H \parallel ab$ -plane) and $\chi_c(T)$ ($H \parallel c$ -axis) are anisotropic and the isothermal magnetization M is proportional to H for both orientations of the applied field. We provide a detailed overview of the dependence of physical properties and electronic states with changes in carrier concentration.

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Primary author: Dr MONDAL, Sampad (1Materials Physics Research Institute, School of Physics, University of the Witwatersrand, Johannesburg 2000, Gauteng, South Africa 2Ramsaday College, Amta, Howrah 711401, West Bengal, India)

Co-authors: PANDEY, Abhishek (Materials Physics Research Institute, School of Physics, University of the Witwatersrand, Johannesburg 2000, Gauteng, South Africa); Prof. WAMWANGI, Daniel (Materials Physics Research Institute, School of Physics, University of the Witwatersrand, Johannesburg 2000, Gauteng, South Africa); Ms MORENA, Mahlogonolo (Materials Physics Research Institute, School of Physics, University of the Witwatersrand, Johannesburg 2000, Gauteng, South Africa)

Presenter: Dr MONDAL, Sampad (1Materials Physics Research Institute, School of Physics, University of the Witwatersrand, Johannesburg 2000, Gauteng, South Africa 2Ramsaday College, Amta, Howrah 711401, West Bengal, India)

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