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Effect of Cr doping on the electronic, thermal and magnetic properties of $SrCo_2As_2$

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The layered $ThCr_2Si_2$-type tetragonal compound, $SrCo_2As_2$ 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 $SrCo_2As_2$ via partial substitution of Co by Cr. All the doped compositions crystallize remain in $ThCr_2Si_2$-type structure. The basal plane electrical resistivity ρab 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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