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Evolution of magnetic ground state in ACo$_2$As$_2$ (A = K, Ca, Sr, Ba) system

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ACo$_2$As$_2$ (A = K, Ca, Sr, Ba) and BaMn$_2X_2$ (X = P, As, Sb, Bi) compounds that both crystallize in ThCr$_2$Si$_2$-type tetragonal structure together present a text-book type example of how the structural parameters and electronic band structure can indirectly govern the magnetic ground state of a crystalline system. ACo$_2$As$_2$ compounds exhibit properties that delicately depend upon the interlayer As-As distance $d_{\mathrm{As-As}}$ which regulates the oxidation state of Co-ions by controlling the extent of the interlayer As-As bonds. As a result, it controls the magnetic ground state of these materials. On the other hand, d_{X-X} does not show any significant variation within BaMn$_2X_2$ compounds and because of the localized nature of d-bands, it does not affect the oxidation state of the Mn-ions as well as the magnetic ground state of these compounds. In this work, we present a comparative study on ACo$_2$As$_2$ and BaMn$_2X_2$ systems. Further, we explore the combined effect of the change of electron count as well as the increase in $d_{\mathrm{As-As}}$ introduced through the partial substitution of alkaline-earth ions in the ACo$_2$As$_2$ system. We report on the magnetic characteristics and electron transport properties of this hole-doped system and explore the interdependency of structural parameters, charge density and many-body interactions within the material.

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

No

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

N/A

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