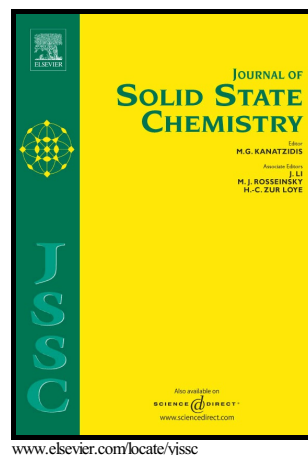


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Evolution of the crystal structure and magnetic properties of $\text{Sr}_{2-x}\text{Ca}_x\text{CrSbO}_6$ with composition

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Abstract

Polycrystalline samples of compositions in the perovskite solid solution $\text{Sr}_{2-x}\text{Ca}_x\text{CrSbO}_6$ ($x=0, 0.25, 0.5, 0.75, 1.0, 1.25, 1.50, 1.75, 2.0$) were synthesized and characterised by synchrotron x-ray diffraction and SQUID magnetometry. Neutron powder diffraction data were collected on the $x=0, 0.25, 0.5, 1.0, 1.5$ and 2.0 compositions. It was found that $\text{Sr}_2\text{CrSbO}_6$ crystallised in the triclinic $\bar{1}$ space group. The other compositions were all found to crystallise in the monoclinic space group $P2_1/n$ although $\text{Sr}_{1.5}\text{Ca}_{0.5}\text{CrSbO}_6$ was found to be phase separated into a calcium-deficient and calcium-rich phase, both having the space group $P2_1/n$. $\text{Sr}_2\text{CrSbO}_6$ was found to order antiferromagnetically at 12 K and the ordered Cr^{3+} moment was refined to be $2.39(1) \mu_B$. The antiferromagnetic order was rapidly quenched on doping with Ca and compositions with $x \geq 0.75$ exhibited ferromagnetic order. T_C increased with x to reach a maximum of 14 K at $x=2.0$, with an ordered moment of $2.56(3) \mu_B$ per Cr^{3+} cation. The tilt angles of the B-site octahedra about $[110]$ and $[001]$ increase from $5.4(1)^\circ$ and $4.6(1)^\circ$ to $13.7(1)^\circ$ and $13.9(1)^\circ$, respectively, across the series; the switch from antiferromagnetism to ferromagnetism occurs when both tilts are at a value of $\sim 8^\circ$.

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