The Phase Diagram of $Ca_{2-x}Sr_xRuO_4$: Crystal Structure and Physical Properties

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The phase-diagram of $Ca_{2-x}Sr_xRuO_4$ has been studied by several diffraction techniques and by analysis of thermodynamic properties as function of concentration, temperature, pressure and magnetic field. The substitution of Sr through the smaller Ca induces a series of structural phase transitions with a strong impact on the physical properties. The spin triplet superconductor Sr_2RuO_4 exhibits an undistorted crystal structure, and the Mott-insulator Ca_2RuO_4 shows strong structural distortions characterized by tilting, rotating and flattening of the RuO_6-octahedra. For intermediate structural distortions samples stay metallic but with outstanding physical properties. Throughout the phase diagram we find a close coupling between the crystal structure on one side and magnetic and electronic behavior on the other side.

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