# Synthesis-Controlled Vacancy Disorder and Superstructures in Delafossite-Type $Rb_{1-x}CrTe_2$

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The delafossite structure is often regarded as a relatively simple host for triangular-lattice transition-metal layers. [1,2] However, deviations from ideal stoichiometry can reveal a much greater structural flexibility, allowing defects to organize into large superstructures and collective lattice distortions. [3] In this presentation we will report on alkali-deficient $Rb_{1-x}CrTe_2$ phases ($x \approx 0.2 – 0.4$), with delafossite-type chromium dichalcogenide structures. Depending on the synthesis route and resulting Rb content, $Rb_{1-x}CrTe_2$ crystallizes either as a vacancy disordered phase or as commensurately modulated structures with undulated $CrTe_2$ layers. In the latter case, rational fractional Rb-contents lead to large two-dimensional supercells, giving rise to 8×8, 8×9, and 8×10 in-plane superstructures that directly reflect the degree of Rb understoichiometry. Despite these pronounced structural differences, both vacancy disordered and modulated variants exhibit long-range ferromagnetic order. Flux-grown crystals with disordered alkali vacancies order ferromagnetically below $T_C \approx 114$ K, while solid-state-synthesized samples with commensurate superstructures show a slightly higher Curie temperature of $T_C \approx 119$ K. These results demonstrate that synthesis-control of the Rb content provides access to distinct structural and magnetic states within a single delafossite-type system.

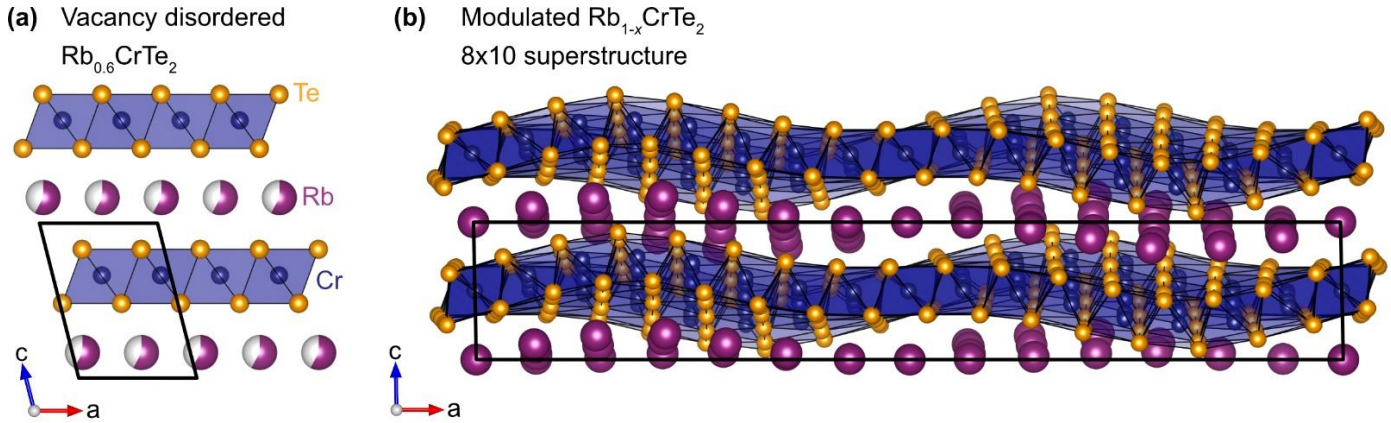



***Figure 1.*** *Crystal structures of (a) flux-grown, vacancy disordered $Rb_{0.6}CrTe_2$ and (b) solid-state synthesized modulated $Rb_{1-x}CrTe_2$ (8×10 superstructure) viewed along the b axis. Cr atoms are depicted in blue, Te in orange, and Rb in purple. Partially filled Rb atoms in $Rb_{0.6}CrTe_2$ resemble understoichiometric occupation.*

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[2] S. Kobayashi, H. Ueda, C. Michioka, K. Yoshimura, Inorganic Chemistry (2016). 55(15), 7407–7413.
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