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Structural and magnetic characterization of the complete delafos-site solid solution (CuAlO$_2$)$_{1-x}$(CuCrO$_2$)$_x$ PHILLIP BARTON, RAM SE- SHADRI, Materials Department and Materials Research Laboratory, University of California, Santa Barbara, ANDREA KNÖLLER, Institut für Materialwissenschaft, Universität Stuttgart 70569, Germany, MATTHEW ROSSEINSKY, Department of Chemistry, University of Liverpool, England, UK — We have prepared the complete delafossite solid solution between diamagnetic CuAlO$_2$ and the $t_2^3g^1$ frustrated antiferromagnet CuCrO$_2$. The crystal structure and magnetism were studied with powder x-ray diffraction and magnetometry. The unit cell parameters follow the Végard law and $\mu_{\mathrm{eff}}$ is equal to the Cr$^{3+}$ spin-only $S = 3/2$ value. $\Theta_{\mathrm{CW}}$ is negative and its magnitude increases with Cr substitution. For dilute Cr compositions, $J_{\mathrm{BB}}$ was estimated by mean-field theory to be 3.0 meV. Despite the sizable $\Theta_{\mathrm{CW}}$, long-range antiferromagnetic order does not develop until $x$ is almost 1, and is preceded by glassy behavior. For all samples, the 5 K isothermal magnetization is sub-Brillouin and does not saturate in fields up to 5 T. A scaled inverse susceptibility plot reveals that significant short-range antiferromagnetic interactions occur in CuCrO$_2$ above its Néel temperature. Additionally, the Al-substituted samples exhibit uncompensated short-range behavior and $x = 0.75$ shows glassy characteristics. It is suggested that reduction in magnetic frustration due to the presence of non-magnetic Al does not have as dominant an effect on magnetism as do chemical disorder and dilution of magnetic exchange.

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