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Magnetostructural transitions and metamagnetism induced by Ising spins in spinel-rock salt intergrowth $Co_{10}Ge_3O_{16}$ PHILLIP BARTON, RAM SESHADRI, Materials Department and Materials Research Laboratory, University of California, Santa Barbara — $Co_{10}Ge_3O_{16}$ crystallizes in an intergrowth structure featuring alternating layers of spinel and rock salt, making it related to $GeCo_2O_4$. Variable-temperature synchrotron X-ray powder diffraction, magnetometry, and heat capacity experiments reveal a magnetostructural transition at antiferromagnetic $T_N = 205$ K. This rhombohedral-to-monoclinic transition involves a slight elongation of the CoO_6 octahedra. Curie-Weiss analysis suggests that the Co^{2+}, with $S = 3/2$ and $L = 3$, acts as a Kramer's doublet due to spin-orbit coupling. Below T_N, the Ising-like Co^{2+} causes spin reorientation at high applied magnetic field that is first seen as an upward kink in M-H near $H_C = 3.9$ T. A "butterfly" loop emerges when $T < 150$ K, with the transition causing hysteresis at high fields while linear and reversible behavior persists at low fields. H_C decreases as temperature is lowered and the loops at positive and negative fields merge beneath $T = 20$ K. The low-temperature behavior is complicated by a field-induced first-order transition that is observed in temperature-dependent measurements for $H > 1000$ Oe. We discuss the H-T phase diagram with reference to other measurements including neutron powder diffraction and high-field magnetometry.

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