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Magnetic force microscopy of magnetic domains in UMn_2Ge_2 ¹

MORGANN BERG, ALEX DE LOZANNE, University of Texas at Austin, RYAN E. BAUMBACH, JEEHOON KIM, ERIC D. BAUER, JOE D. THOMPSON, FILIP RONNING, Los Alamos National Laboratory — UMn_2Ge_2 , a distant cousin to the heavy-fermion compound URu_2Si_2 , is a ternary intermetallic compound with a tetragonal crystal structure of type ThCr_2Si_2 and with space group $I4/mmm$. Local U and Mn moments in UMn_2Ge_2 order on their respective sublattices at temperatures near 100 and 380 K, respectively. Previous high-pressure x-ray diffraction and Kerr rotation angle measurements point to structural and magnetic phase transitions that reflect the competition between U and Mn spins at low temperatures. As U moments order with a reduction in temperature, they are predicted to align the Mn moments along the c-axis, altering the anisotropy of the material and the easy axis direction. A reduction of inter-atomic distances between the U and Mn atoms is also projected to induce hybridization between uranium 5f and manganese 3d states, leading to a delocalization of magnetic moments and reduction in magnetization. We use a variable temperature atomic force microscope in magnetic force microscopy (MFM) mode to obtain some initial images of magnetic domains in UMn_2Ge_2 . Room temperature MFM images display branching magnetic domains with uniaxial anisotropy.

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