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High magnetic field phase diagram of multiferroic $DyMn_2O_5$ up to 45 T K. H. KIM, T. H. KIM, S. Y. HAAM, Seoul National University, N. HUR, S. PARK, S-W. CHEONG, Rutgers University, Y. JO, J.-G. PARK, Sungkyunkwan University, A. MIGLIORI, NHMFL-LANL — Strong magnetoelectric coupling in multiferroic crystals such as $ReMn_2O_5$ (Re=rare earth) has provided unprecedented opportunity to manipulate ferroelectric (FE) polarization using magnetic fields. Most of investigations to dates have yet been limited to a rather low magnetic field region. Herein, we present the first high magnetic field (B) versus temperature phase diagram of $DyMn_2O_5$ in magnetic fields up to 45 T and temperatures below 50 K, determined from the dielectric constant, pyroelectric, and magnetoelectric current measurements using various magnets; superconducting magnets up to 17 T, a dc resistive magnet up to 33 T, and a mid-pulse magnet up to 45 T. Our phase diagram reveals that at least 4 different kinds of FE domains, which show strong temperature-and field-history- dependence, develop at low temperatures below 40 K, and exhibit dramatic evolution under B. For example, as B increases at 4 K, FE polarization shows successive flopping at B$\sim$2, 7 T and 22 T, producing large dielectric constant changes, $\Delta\epsilon(B)/\epsilon(0\ T)$ $\sim$15, 70, 20%, respectively. We discuss the complex phase diagram in the context of strong spin-lattice coupling that is linked to the exchange interaction between Dy f- and Mn d-spins.

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