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Evolution of ferroelectric and antiferromagnetic phases of $TbMn_2O_5$ under high magnetic fields up to 45 T S.Y. HAAM, T.H. KIM, K.H. KIM, Seoul National University, S. PARK, N. HUR, S.-W. CHEONG, Rutgers University, A. MIGLIORI, NHMFL-LANL — Recent discovery of ferroelectric (FE) polarization reversal/imprint actuated by an external magnetic field in multiferroic $TbMn_2O_5$ has opened up promising device application potentials such as magnetically-recorded ferroelectric memory [1]. For better understanding of the interplay between magnetism and ferroelectricity in the multiferroic, we determined high field vs temperature phase diagram of $TbMn_2O_5$ from dielectric constant, pyroelectric current and magnetoelectric current measurements (along b axis) under static or pulsed magnetic field (B) (along a axis) up to 45 T. Our results reveal that (1) as B increases, negative FE polarization phase coined with the Mn d-spin reorientation transition below T=25 K at B=0 T expands its region in temperature to merge into the main FE phase boundary below T$\sim$38 K and B$\sim$20 T (2) low temperature positive FE polarization phase stabilized with the ferromagnetic order of Tb f-spin survive up to 25 K under B$\sim$4T. [1] N. Hur et al., Nature 429, 392 (2004).

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