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Observation of a vortex lattice spinodal and a Bragg glass in MgB_2 HYUN-SOOK LEE, Department of Physics, Pohang University of Science and Technology, Pohang 790-784, Republic of Korea, S.K. GUPTA, Technical Physics & Prototype Engineering Division, Bhabha Atomic Research Centre, Mumbai-400 085, INDIA, BYEONGWON KANG, Department of Physics, Chungbuk National University, Cheongju 361-763, Republic of Korea, SUNG-IK LEE, Department of Physics, Pohang University of Science and Technology, Pohang 790-784, Republic of Korea — We observed a fully disordered (Spinodal) and a fully ordered (Bragg glass) vortex lattice in MgB_2 single crystals by using fast current measurements to measure I_c for variously prepared vortex states. The obtained I_c showed a very different behavior depending on the vortex states, such as Zero Field Cooled (ZFC), ZFCW (warmed), FC, and FCW. We noticed that the values of $I_c(T)$ for the FC and the FCW states for MgB_2 showed clear history dependence with two reversible points. The one point above the T_{peak} was exactly the same as the spinodal point obtained by using the same method as reported in PRL 92, 227004 (2004). The other point below the T_{peak}, was consistent with the Bragg glass point measured by using the time-resolved transport measurements reported in PRL 96, 017009 (2006). We obtained $H-T$ diagram including several vortex states. The theoretical spinodal line predicted by Li *et al.* based on one-gap superconductivity described the case for $NbSe_2$well, but could not explain the spinodal line for MgB_2.

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