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Global and local flux jumps in MgB_2 films: Magneto-optical imaging and theory D.V. SHANTSEV, D.V. DENISOV, Y.M. GALPERIN, T.H. JOHANSEN, Department of Physics, University of Oslo, Norway, SUNG-IK LEE, Pohang University of Science and Technology, Korea, A.L. RAKHMANOV, Inst. for Theoretical and Applied Electrodynamics, Moscow, A.V. BOBYL, Ioffe Physico-Technical Institute, St. Petersburg, Russia — MgB_2 is one of the most unstable superconducting materials, where flux jumps are commonly observed at low temperatures jeopardizing its potential for applications. We present a detailed MO imaging study of the jumps in MgB_2 films, where we observe large dendritic flux patterns as well as much smaller jumps down to 50 flux quanta. The large jumps destroy the critical state and dramatically suppress $\boldsymbol{J}_c$. The small jumps, instead, lead to a new type of the critical state where $\boldsymbol{J}_c$ is determined not only by the pinning, but also by the jump characteristics. A linear theory assuming a thermal origin of dendritic jumps gives the threshold fields for the instability to start and to form a dendritic pattern and reproduces its experimental temperature dependence. We also determine the size of flux jumps in the adiabatic approximation. Its field dependence as well as the flux density profiles after jumps, are in good agreement with the direct observations, see Denisov et al., cond-mat/0508679, and Shantsev et al. Phys. Rev. B 72, 024541 (2005).

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