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The Meissner and Mesoscopic Superconducting States in the Ultrathin FeSe-Films L. Z. DENG, B. LV, Z. WU, Y. Y. XUE, Texas Center for Superconductivity at the University of Houston, W. H. ZHANG, F. H. LI, Department of Physics, Tsinghua University, Beijing, L. L. WANG, X. C. MA, Institute of Physics, Chinese Academy of Sciences, Beijing, Q. K. XUE, Department of Physics, Tsinghua University, Beijing, C. W. CHU, Texas Center for Superconductivity at the University of Houston; Lawrence Berkeley National Laboratory, Berkeley, California — We carried out a detailed investigation on the superconductivity in eight 1-4 unit-cell FeSe-films on SrTiO3(STO) substrates by measuring their magnetization and resistivity in a field between 5E2 and 7E4 Oe over the last one and half years as a function of temperature and frequency, from 2 to 300 K and 0 to 1.5 kHz, respectively. Systematic aging effect for these samples was also well studied. The results show that samples display a complex superconducting structure, i.e. a Meissner state but populated with weak-links below 20 K, and an unusual superconducting mesostructure up to 45 K. A model is proposed to account for such a superconducting mesoscopic structure, similar to the Andreev reflection between the normal and superconducting carriers. Above 45 K, collective glass-like excitations are evident although their nature is yet to be determined.

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