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Direct observation of mesoscopic phase separation in $K_xFe_ySe_2$ by scanning microwave microscopy ATSUTAKA MAEDA, HIDEYUKI TAKAHASHI, YOSHINORI IMAI, Department of Basic Science, University of Tokyo — $K_xFe_ySe_2$ is isostructural to 122-FeAs compounds. However, its electronic structure is unique among Fe-based superconductors in the sense that hole Fermi pocket is absent at the center of the Brillouin zone. Therefore, it is important to study this compounds in terms of the mechanism of superconductivity since some pairing (for example, $s\pm$-wave) needs the interaction between hole and electron Fermi pockets. However, the phase separation in this material makes studies using conventional macroscopic measurement techniques very difficult. Scanning near-field microwave microscope (SMM), which can measure local electric property of inhomogeneous conducting samples, should be a powerful tool. Recently we developed the combined instrument of STM and SMM with high sensitivity, and investigated the local electric property of $K_xFe_ySe_2$ (x =0.8, y =1.6$\sim$2, T_c = 31 K) using this scanning tunneling/microwave microscope. The characteristic pattern of mesoscopic phase separation of the metallic and the semiconducting phase was observed. From the comparison with previously reported SEM/EDS result we identified the metallic phase and the semiconducting phase as the minor Fe-rich phase and the major $K_2Fe_4Se_5$ phase, respectively.

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