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Sensitivity Improvement and Cryogenic Application of Scanning Microwave Microscope HIDEYUKI TAKAHASHI, YOSHINORI IMAI, ATSUTAKA MAEDA, Department of Basic Science, the University of Tokyo — The technique to probe the spatial distribution of electric properties has been more important in modern material science. Scanning near-field microwave microscope (SMM) can be a powerful tool to study inhomogeneous materials. Recently we have developed scanning tunneling/microwave microscope (STM/SMM) with high sensitivity[1,2]. The SMM probe is a modified coaxial resonator whose resonant frequency is 10.7 GHz and Q-factor is 1200-1300 at room temperature. It is applicable to measurements at cryogenic environment. By downsizing the resonator probe, we achieved stable operation down to liquid helium temperature. Q-factor is enhanced to 2000-3000 below 77 K. As an example of application of our STM-SMM, we present the study on inhomogeneous iron-based superconductor $K_xFe_ySe_2$. We successfully observed the characteristic mesoscopic phase separation of the metallic phase and the semiconducting phase by two different scanning modes; constant current mode and constant Q-factor mode. The spatial resolution is no worse than 200nm, which is comparable to curvature radius of a probe tip.
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