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Implementation of a cryogenic scanning microwave impedance microscope KEJI LAI, WORASOM KUNDHIKANJANA, MICHAEL KELLY, ZHI-XUN SHEN, Stanford University — We have implemented a near-field scanning microwave impedance microscope in a variable temperature (2-300K) cryostat equipped with 9T magnet. Reflected microwave signals at 1GHz from a shielded cantilever probe were detected using room-temperature electronics. During the tip-sample approach, a small oscillating voltage was applied to the z-piezo and the modulated microwave signals were monitored to locate the sample surface. The approaching curve toward bulk dielectric materials can be quantitatively simulated by finite-element analysis. We have obtained the first low-T and high-B microwave images on a patterned silicon wafer with ion-implanted stripes. The results show clear impedance contrast in both the capacitive and loss channels. In particular, high-loss regions were seen between the heavily doped areas and the insulating substrate, allowing us to visualize the local conductivity variation. With this novel instrument, we expect to study electronic inhomogeneity in complex materials and explore local properties during phase transitions.

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