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Contrast sensitive imaging with a cantilever-based near-field microwave probe[1] KEJI LAI, WORASOM KUNDHIKANJANA, MICHAEL KELLY, ZHI-XUN SHEN, Geballe Laboratory for Advanced Materials, Stanford University — We have developed a procedure to systematically study the contrast mechanism of our cantilever-based near-field scanning microwave probes with separated excitation and sensing electrodes. Finite-element analysis was employed to model the small impedance change due to the tip-sample interaction. The near-field signal can then be calculated from the S-parameters of the matching network that routes the tip impedance to 50 Ohm feed lines. Using a common-mode cancellation scheme, the microwave electronics is sensitive down to 1aF capacitance change at our working frequencies near 1GHz. Experimental characterization of the microwave probes was performed on ion-implanted Si wafers and patterned semiconductor samples. Pure electrical or topographical signals, in qualitative agreement with simulation, can be obtained using different reflection modes of the probe. Our microscope also shows very high contrast due to conductivity variations of the sample, which can lead to potential applications of the technique.

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