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Interferometric Scanning Microwave Microscope for Nanotechnology Application[1] NICOLAS CLEMENT, THOMAS DARGENT, IEMN-CNRS (France), HASSAN TANBAKUCHI, Agilent Santa Rosa (US), KATSUHIKO NISHIGUCHI, NTT Basic Research Labs (Japan), RAGAVENDRAN SIVAKUMARASAMY, FEI WANG, IEMN-CNRS (France), AKIRA FUJIWARA, NTT Basic Research Labs (Japan), DAMIEN DUCATTEAU, GILLES DAMBRINE, DOMINIQUE VUILLAUME, BERNARD LEGRAND, DIDIER THÉRON, IEMN-CNRS (France) — Scanning probe microscopes (SPMs) allow scientists to image, characterize and even manipulate material structures at exceedingly small scales including features of atomic dimensions. Although most microelectronics devices operate at high frequency, SPMs have mainly been used with electrical excitation at DC (Conducting Atomic Force Microscope) or kHz (Electric Force Microscope, Kelvin Force Microscope). The main reason is that at GHz frequency, nanoscale objects are far from the standard impedance of 50ohms and almost all the signal is reflected. Here we show, using an interferometer to enable extraction and amplification of the signal of interest, that Scanning Microwave Microscopes (SMM) are ideal tools for tiny capacitances imaging. We demonstrate applications in several fields of nanotechnology with capacitance evaluation down to aF of nanoscale integrated capacitors, biased nanotransistors, molecular junctions and biomolecule flow in a nanofluidic channel. The frequency range of excitation varied from 2 GHz to 20 GHz. With a finite element analysis, we discuss the limits of such microscope.

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