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Effect of probe-sample gap atmosphere on shear-force distance feedback using a near-field scanning microwave microscope NIKOLAI KALUGIN, LEE WICKEY, New Mexico Tech, VLADIMIR TALANOV, Solid State Measurements Inc., NEW MEXICO TECH COLLABORATION, SOLID STATE MEASUREMENTS INC. COLLABORATION — We investigated the effect of various gases (ambient air, Nitrogen, Argon, Helium, and Oxygen) on a probe-sample shear-force distance control in scanning probe microscopy. To quantitatively measure a change in the probe-sample distance due to a gas effect we employed a near-field scanning probe microwave microscope [1], which provides for independent measurement of changes in the distance with 0.1 nm resolution. A heavily doped Si wafer was used as a sample. We found that while air and Oxygen yield similar probe-sample distance, Nitrogen, Argon, and Helium increase it by 1-3 nanometers. Using Argon we also observed a reduction in the shear-force noise from 0.5 nm down to 0.25 nm, which is an important factor for making quantitative measurements. The data suggest that the major contribution into shear force is the attractive Coulomb force due to localized surface charges and/or surface potential difference. [1] V. V. Talanov, A. Scherz, R. L. Moreland, and A. R. Schwartz, Appl. Phys. Lett. **88**, 134106 (2006).

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