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Toward Atomic-Scale Optical Probes with UHV STM¹ ÖZGÜN SÜZER, LI GAO, JOSEPH A. SMERDON, JONGWEON CHO, NATHAN P. GUISENGER, JEFFREY R. GUEST, Center for Nanoscale Materials, Argonne National Laboratory, Argonne, IL 60439, USA — We present the details of a variable temperature ultra-high vacuum (UHV) scanning tunneling microscopy (STM) apparatus with optical access for the investigation of optically active materials at the atomic scale. Local field enhancement in close proximity to the ultra-sharp STM tip enables the observation of optical signals from a very small number of surface adsorbates and even single molecules, which, combined with the electronic sensitivity and high spatial resolution of STM, allows the simultaneous optical, electronic, and topographic analysis of nanoscale systems. A high-numerical-aperture (NA) optic is integrated into the STM to achieve sharp and stable focusing of the laser excitation while maintaining polarization integrity and high collection efficiency. The initial findings of investigations carried out on epitaxial graphene grown on SiC and operational characteristics of the apparatus are discussed. A next-generation optically accessible 4K UHV STM apparatus under development is also introduced.

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