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Ultraviolet surface-enhanced Raman spectroscopy using aluminum plasmonic gratings ADAM T. ROBERTS, Army Aviation & Missile RDEC, SERKAN BUTUN, KORAY AYDIN, Dept. of Electrical Engineering & Computer Science, Northwestern University, HENRY O. EVERITT, MARK BLOEMER, Army Aviation & Missile RDEC, GIUSEPPE D'AGUANNO, NADIA MATTIUCCI, Aegis Technologies — Surface-enhanced Raman scattering (SERS) has been widely studied both theoretically and experimentally for chemical and biological sensing, primarily in the visible and near-infrared wavelengths. Although in the ultraviolet (UV) plasmonic behavior is limited by metallic dampening, we have theoretically shown that SERS enhancement factors as large as 10^5 can be achieved when the laser is tuned to the plasmonic band edge of an Al metallic grating grown on a sapphire substrate. Using electron beam lithography, aluminum gratings were fabricated whose pitch (150-300 nm), slit widths (64 nm), and thickness (50 nm) were chosen to produce large enhancement factors at wavelengths in the UV. Analytes such as thiophenol were then deposited on the gratings, and UV-SERS spectroscopy was performed to measure the enhancement factors and compare with theoretical estimates. Enhancement factors were measured by comparing the strength of the Raman signal from the grating region with the strength of the Raman signal from adjacent regions without a grating. The dependence of the enhancement factor on laser wavelength relative to the plasmonic band edge for a given grating pitch was explored, as was the effect of using a tapered slit geometry that focuses the local field on the nanoscale.

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