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Nanoporous Substrate with Mixed Nanoclusters for Surface Enhanced Raman Scattering. SEHOON CHANG, Georgia Institute of Technology, HYUNHYUB KO, UC Berkeley, SRIKANTH SINGAMANENI, RAY GUNAWIDJAJA, VLADIMIR TSUKRUK, Georgia Institute of Technology — Rapid detection of plastic and liquid explosives is an urgent need due to various societal and technological reasons. We employed a novel design of surface enhanced Raman scattering (SERS)-active substrate based on porous alumina membranes decorated with mixed nanoclusters of gold nanorods and nanoparticles. We demonstrated trace level detection of several important explosives such as dinitrotolene (DNT), trinitrotoluene (TNT), and hexamethylenetriperoxidediamine (HMTD) by fast, sensitive, reliable Raman spectroscopic method. We achieved near molecular-level detection (about 15$\sim$ 30 molecules) of DNT and TNT utilizing the SERS substrate. However, trace level detection is challenging due to the lack of common optical signatures (fluorescence, absorption in UV-vis range) or chemical functionality of peroxide-based explosives such as HMTD. To overcome this, we employed photochemical decomposition approach and analyzed chemical fragments using SERS. We suggest that tailored polymer coating, mixed nanoclusters, and laser-induced photocatalytic decomposition are all critical for achieving this unprecedented sensitivity level..

Sehoon Chang
Georgia Institute of Technology

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