Injection-Molded Microfluidic Device for SERS Sensing Using Embedded Au-Capped Polymer Nanocones - DTU Orbit (08/08/2019)

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To enable affordable detection and diagnostic, there is a need for low-cost and mass producible miniaturized sensing platforms. We present a fully polymeric microfluidic lab-on-a-chip device with integrated gold (Au)-capped nanocones for sensing applications based on surface-enhanced Raman spectroscopy (SERS). All base components of the device were fabricated via injection molding (IM) and can be easily integrated using ultrasonic welding. The SERS sensor array, embedded in the bottom of a fluidic channel, was created by evaporating Au onto IM nanocone structures, resulting in densely packed Au-capped SERS active nanostructures. Using a Raman active model analyte, trans-1,2-bis-(4-pyridyl)-ethylene, we found a surface-averaged SERS enhancement factor of $\sim 5 \times 10^6$ with a relative standard deviation of 14% over the sensor area ($2 \times 2 \text{ mm}^2$), and a 18% signal variation among substrates. This reproducible fabrication method is cost-effective, less time consuming, and allows mass production of fully integrated polymeric, microfluidic systems with embedded high-density and high-aspect ratio SERS sensor.

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