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On-Chip Nanoplasmonic Biosensors with Actively Controlled Nanofluidic Surface Delivery AHMET YANIK, MIN YUANG, ALP ARTAR, Electrical & Computer Engineering, Boston University , TSUNG-YAO CHANG, MIT, HATICE ALTUG, Electrical & Computer Engineering, Boston University — Performances of biosensors are often limited by the depletion zones created around the sensing area which impede the effective analyte transport. To overcome this limitation, we propose and demonstrate a novel nanoplasmonic-nanofluidic sensor with dramatic improvements in mass transport efficiency. Unlike previous approaches where the analytes simply stream pass over the surface, our platform enables targetted delivery of the analytes to the biosensor surface. Using our platform, we show 14-fold improvement in the mass transport rate constants. Considering that this rate constant appears in the exponential term, such an improvement means much superior analyte delivery to the sensing surface with respect to conventional fluidic schemes. Our detection platform is based on extraordinary light transmission effect (EOT) in suspended plasmonic nanohole arrays. The nanoholes here act as nanofluidic channels connecting the fluidic chambers on both sides of the sensors. To fabricate these nanostructures, we introduce a lift-off free plasmonic device fabrication technique based on positive resist electron beam lithography (EBL). The simplicity of this fabrication technique allows us to fabricate nanostructures with extremely high yield/reproducibility and minimal surface roughness.

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