DESIGNING EFFICIENT LOCALIZED SURFACE PLASMON RESONANCE-BASED SENSING PLATFORMS: OPTIMIZATION OF SENSOR RESPONSE BY CONTROLLING THE EDGE LENGTH OF GOLD NANOPRISMS

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Over the last few years, the unique localized surface plasmon resonance (LSPR) properties of plasmonic nanostructures have been used to design label-free biosensors. In this research, we demonstrate that it is the difference in edge length of gold nanoprisms that significantly influences their bulk refractive index sensitivity and local sensing efficiency. Nanoprisms with edge lengths in the range of 28-51 nm were synthesized by the chemical-reduction method and sensing platforms were fabricated by chemisorptions of these nanoprisms onto silanized glass substrates. The plasmonic nanosensors prepared from 28 nm edge length nanoprisms exhibited the largest sensitivity to change in bulk refractive index with a value of 647 nm/RIU. The refractive index sensitivity decreased with increasing edge length, with nanoprisms of 51 nm edge lengths displaying a sensitivity of 384 nm/RIU. In contrast, we found that the biosensing efficiency of sensing platforms modified with biotin increased with increasing edge length, and the sensing platforms fabricated from 51 nm edge length nanoprisms displaying the highest local sensing efficiency. The lowest concentration of streptavidin that could be measured reliably was 1.0 pM and the limit of detection for the sensing platforms fabricated from 51 nm edge length nanoprisms was 0.5 pM, which is much lower than found with gold bipyramids, nanostars, and nanorods.

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The research was supported by in part of start-up funds and IUPUI-MURI program. P.J.M and K.A.S. acknowledge the IUPUI MURI program for financial support.