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Influence of Surfactant Bilayers and Substrate Immobilization on the Refractive Index Sensitivity of Anisotropic Gold Nanoparticles MOHAMMAD SHAHJAMALI, NICOLAS LARGE, Northwestern University, ERIK MARTINSSON, Linkoping University, NEGIN ZARAEE, GEORGE SCHATZ, Northwestern University, DANIEL AILI, Linkoping University, CHAD MIRKIN, Northwestern University — Shape-controlled synthesis of gold nanoparticles (AuNPs) generally involves the use of surfactants to regulate the nucleation growth process and to obtain colloidally stable AuNPs. The surfactants adsorb on the NP surface making further functionalization difficult and therefore limit their practical use in many applications such as bio- and molecular sensing, surface-enhanced spectrosopies, and NP assembly. Herein, we report on how cetyltrimethylammonium (CTAX, X=Cl^-, Br^-), a common surfactant used in anisotropic AuNPs synthesis, affectsthe nanoparticle sensitivity to local dielectric environment changes and limitsrefractometric plasmonic sensing. We experimentally and theoretically show that the CTAX bilayer significantly reduces the refractive index (RI) sensitivity of anisotropic AuNPs such as flat and concave nanocubes, nanorods, and nanoprisms. We show that the RI sensitivity can be improvedby up to 40% by removing the CTAXfrom immobilized AuNPs using oxygen plasma treatment. The substrate effect on the RI sensitivity caused by NP immobilization isalso investigated. The strategy presented herein is a simple andeffective method to improvethe RI sensitivity of CTAX-stabilized AuNPs, thus increasing their potential in nanoplasmonic sensingand in biomedical applications.

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