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Nanophotonic Finite Difference Time Domain Simulations for Plasmon Enhanced Chemical Sensors[1] ANDREW MAKEPEACE, Miami University of Ohio, PARVEEN KUMAR, University of Cincinnati, JAN YARRISON-RICE, Miami University of Ohio, HOWARD JACKSON, LEIGH SMITH, University of Cincinnati, J.-G. PARK, K.-J. CHOI, Korea Institute of Science and Technology — We propose the fabrication of a plasmon-enhanced semiconductor nanosheet chemical sensor which is small in size and of high sensitivity and selectivity. Gold nanoparticles are photo-excited to produce strong surface plasmons, which amplify their local electric field emission. This enhancement can be several orders of magnitude. Semiconductor CdS nanosheets with a 40-50 nanometer thickness and micron length area are used to produce a two-photon-excited photocurrent when illuminated at energies just above the two photon absorption band. We report on the predicted CdS photocurrent enhancement in the presence of gold nanoparticles of various morphologies. The gold nanoparticle plasmon-enhancement and the enhanced photoexcited current in the CdS nanosheets are modeled using finite difference time domain calculations. Simulations determine the resulting fields produced by nanoparticles, the resulting fields at the nanosheet surface, and the total absorption within the nanosheet. The modeling results provide a predictive strategy for fabricating highly accurate chemical sensors.

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