HETERODYNE DETECTED SUM FREQUENCY GENERATION (SFG) AS A NOVEL TOOL TO MEASURE ADSORBANT CONCENTRATION AT INTERFACES

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The dynamics of molecular binding at interfaces is a central area in cell biology, toxicology, molecular electronics, and physical chemistry. However, detecting of low concentrations of untagged molecules at interfaces still remains a great challenge. In this talk we present a novel optical heterodyne-detected SFG technique sensitive to ultralow interface adsorbant concentrations. We demonstrate the superiority of our technique to the conventional homodyne SFG technique on octanol:deuturated octanol mixture at air/water interface system. In our technique the SFG signal is generated by interaction of the broad-band infrared laser pulse resonant with the adsorbant intramolecular vibrational modes and of the narrowband nonresonant optical laser pulse with the air/water interface. The SFG signal is heterodyne-detected and spectral interferograms are recorded with CCD equipped spectrometer. Spectral interferometry is used to recover the SFG signal spectrum. Improved signal to noise ratio and linear scaling of the recovered signal with the adsorbant concentration allowed us to detect concentrations as low as 1% of the monolayer coverage while the conventional homodyne-detected SFG technique was effective only at the monolayer coverage above 25%.