Combined Surface Plasmon Resonance Excitation And Emission For High-Speed Live-Cell Imaging

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Total Internal Reflection Fluorescence Microscopy (TIRFM) allows selective and fast aquisition of membrane biomolecular dynamics with high contrast. However, imaging with desirable speeds faster than 100Hz is still challenging due to the limited signal to noise ratios that typical fluorescence probes and microscopes provide. A promising approach to master this challenge is surface plasmon resonance (SPR) excitable metallic nanofilms [1]. Under SPR illumination the excitation light is completely absorbed yielding an even more confined intensity enhanced evanescent field. In addition, only fluorophores in close vicinity to the metal are forced to radiate a high fraction of their intensity through the metal coatings by Surface Plasmon Coupled Emission (SPCE) [2]. Both effects are able to improve the contrast in TIRFM while supressing scattering and fluorescent background. Here we present biocompatible metal-dielectric coated microscopy slides with tailored nearfield optical properties that can increase the detectability of fluorescent molecules [3]. A special TIRFM design ensures the combination of SPR-illumination and SPCE on such slides improving the signal-to-noise ration and thus the image contrast. Our approach allows to monitor live-cell biomolecular dynamics commonly observed using TIRFM with higher temporal resolution and precision.

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