Protein microarray biosensor based on total internal reflection imaging ellipsometry

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Biosensor based on imaging ellipsometry (BIE) has been developed for decades. Working under the external reflection condition, BIE has been used to visualize biomolecule interaction on a patterned surfaces for it enjoys high spatial resolution and fast data acquisition. Although BIE can work in aqueous environment to perform real-time detection, it suffers from the disturbance of solutions and the sensitivity limit of BIE.

Hoping to visualize the biomolecule interaction in real-time with high sensitivity and no solution disturbance, total internal reflection mode of imaging ellipsometry (TIRIE) has been introduced into the biosensor approach. Its high sensitivity results from the evanescent field under the total internal reflection condition. However, the image contrast is insufficient for practical applications. To increase the image contrast, a gold film has been introduced into the sensing surface of TIRIE chip to enhance the amplitude of the evanescent wave. By optimize the polarization of the light beam and the angle of incidence, the image contrast is further improved. By our estimation, the sensitivity of TIRIE biosensor is 30 times larger than that of conventional surface plasmon resonance system which is agreed with others' work.

After the optimization, we use TIRIE biosensor to detect cluster of differentiation 146, a cell adhesion molecule used as a marker for endothelial cell lineage, quantitatively and the weak affinity interaction between tris and lysozeme.