Study on Long-range Surface Plasmon Resonance Biosensor Using Electrospun Polymer Fibers

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In recent years, the applications of the sensors have attracted attention in various fields including in electrical appliances and automobiles. The primary role of these sensors intended to measure the physical quantities such as heat, light, pressure, etc. It is called a physical sensor, on the other hand, is referred to a chemical sensor which is a sensor for measuring the chemical.

In this study, the water-stable electrospun polyacrylic acid (PAA) fibers were successfully fabricated by adding β-cyclodextrin as crosslinking agent followed by thermal treatment at 180 °C for 40 min after electrospinning process due to its stability in the aqueous solution. The dip angle of the non-crosslinking fiber was changed due to its peel off from the substrate which indicated the unstable fiber. The water-stability and sensitivity of the fibers were improved using layer-by-layer (LbL) alternate deposition of anionic PAA and cationic poly(diallyldimentylammonium chloride) (PDADMAC) polyelectrolyte solutions. The LbL of PAA and PDADMAC was successfully prepared. In angular scan measurement, the dip angle of LR-SPR reflectivity of the fiber after incubate in aqueous solution for 90 min was not changed which indicating that this obtained LbL crosslinking electrospun fiber was very stable in the aqueous solution and contained more amount of available carboxyl groups which necessary for adsorption the biomolecule. Comparison of the angular scan measurement of the LbL water-stable electrospun fiber with flat MPS surface (the gold substrate after charged with MPS), the dip angle was shifted to higher angle due to the LbL of the fiber. In biosensing study, the reflectivity was increased after injection of each chemical due to the binding process which occurred on the sensor chip. By increasing the concentration of human-IgG, the dip angle in angular scan measurement was changed to higher angle, indicating that this LR-SPR sensor chip has a concentration-dependent and can be used to detect human IgG.

The LbL crosslinked-electrospun PAA fibers can be employed as LR-SPR sensor chip which consists of thin gold film and layer of Cytop. The LR-SPR sensor has larger evanescent field intensity and penetration depth as compared to conventional SPR. Since the LbL crosslinked-electrospun PAA fibers can enhance the signal of LR-SPR spectroscopy, therefore, the water-stable electrospun PAA fibers based LR-SPR immunosensor was successfully constructed for detection of human IgG. The LR-SPR sensor chip based on the water-stable PAA fiber can be used as a biosensor in the further work which more further experiments would be performed.

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