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Amino Groups Functionalization onto Carbon Nanotube Dot Array by Capillary Atmospheric Pressure Plasma Jet and Simulating Biotin-Avidin Immobilization for Microarray Biosensor

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Recently, there has been great interest in applying carbon nanotubes (CNT) for the sensitive detection of biomolecules due to their remarkable biomolecular recognition and unique physical properties. For successful realization of microarray biosensors based on CNT, it requires proper control of their functionalization and surface immobilization. Compared to the conventional chemical functionalization treatments, plasma treatments have the advantages of low temperature, little damaging effects, and providing a wide range of different functional groups [1]. Among the plasma treatments, atmospheric pressure plasma treatment has attracted many researchers to functionalize and immobilize CNT because of fast reaction time, simple equipment (not require expensive vacuum equipment), and great potential for micro-scale surface functionalization [2]. In this work, an atmospheric pressure plasma jet (APPJ) technique is developed to functionalize amino groups on CNT array selectively. To simulate immobilization of the virus consentration, we employed biotin-avidin system in place of antibody and antigen reaction.

An APPJ with a micro-capillary was used to functionalize amino groups onto CNT dot array. The vertically aligned CNT were fabricated in an array form for realizing the development of microarray biosensor. Figure 1 shows that fluorescent microscope image of the selective functionalization of amino groups onto CNT dot array by APPJ, before and after APPJ treatment. Additionally, Fig. 2 illustrates a model for the formation of the FTIC-Avidin/Biotin/NH_2 pattern onto CNT dot array. The results give us an idea about the feasibility of the techniques for microarray biosensor demonstrated by successfully functionalization of amino groups and simulating biotin-avidin immobilization onto CNT dot array.

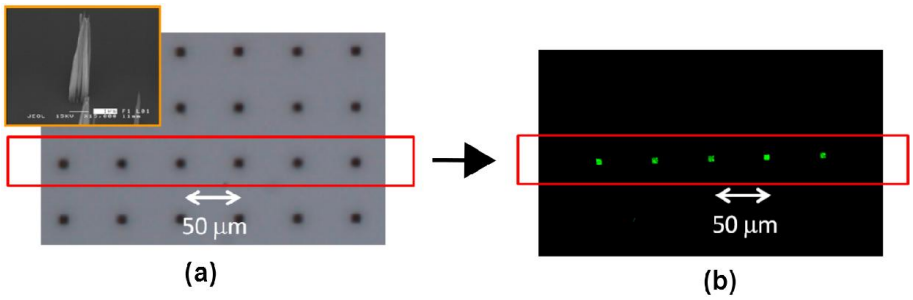

Figure 1. Fluorescent microscope image of the selective functionalization of amino groups onto CNT array (a) before and (b) after APPJ treatment.

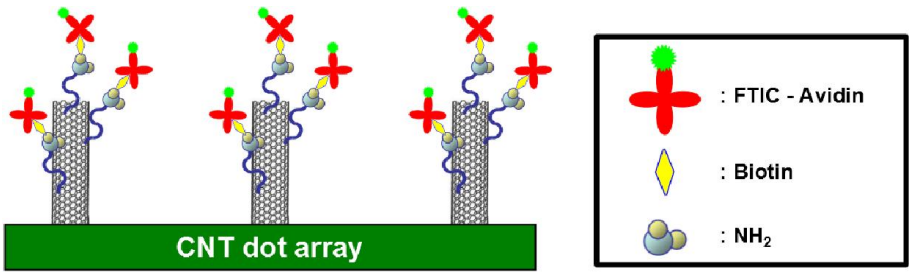

Figure 2. A model for the formation of the FTIC-Avidin/Biotin/NH_2 pattern onto CNT dot array.

References

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