Highly sensitive biological detections using surface plasmon resonance on nanocolumn-supported nanoparticle array for space applications

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Abstract

Developing an integrated health management system that allows efficient, lower cost, and early detection of diseases is important for space applications, where small and reusable devices have obvious advantage in reducing weight, saving launch energy, and enhancing sensitivity, etc. Nanostructured materials with large surface area and controlled property open new possibilities for the sensitive detections of disease biomarkers. We have developed a method of making glass nanocolumn array with controlled size, inter-column distance and aspect ratio by combining the scalable fiber drawing and the state-of-the-art chemical etching. We propose here to utilize such array as in-situ label-free localized surface plasmon resonance sensor: after modifying the top of each column with metal particle, the sequential attachments of bioreceptors and target molecules will lead to the shift of resonance peak. The sensitivity will be greatly enhanced as the result of structural uniformity, enabling the early detection of biomarkers and the precise measurement of biomolecular interactions. Such developments will be beneficial to few communities including NASA, NIH, and DOD. The preliminary results from this grant will be used to search for funds through NSF, NASA, NIH, and DOD, etc.