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Label free bio detection using nanohole array structure

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The different working principles of nano hole array structure from general color can make promising features as a bio-detector because the structural color filter (SCF) changes easily, the filtering colors by covering of different biomaterials. Because the nano-hole arrays were designed to present a filtered peak wavelength in the visible light region, filtered color changes caused by different biomolecules were easily observed with a microscope or even by the naked eye. Generally, many biomolecules are transparent or colorless in the visible range, so that it is hard to distinguish among them using visible observation. However, their molecular structure and composition induce some differences in the dielectric constant or refractive index, causing a filtered color shift in the nano-hole array structure. Here, the contribution of geometric parameters such as the hole diameter and the spacing between nano-holes for bio-detection was evaluated to maximize the change in color among different biomolecules. A larger hole size and space between the holes enabled the biomolecules to be easily distinguished. Even if the change in color was not distinctive enough by eye in some cases, it was possible to distinguish the change by simple analysis of the 'Hue' values or by the 'Lab' color coordinates obtained from the photo images. Therefore, this skill can have high probability of realization for real-time detection of cells without the use of bio-markers.

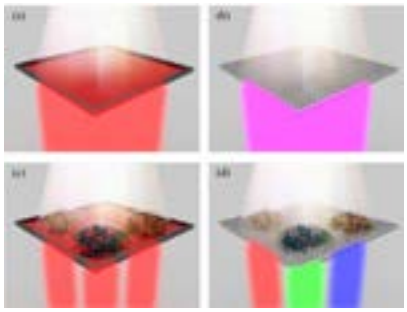

Figure1: Concept images of bio-detection based on a SCF. (a) Image of a general red CF based on red pigments. Except for the red color component, the other components in white light are absorbed by the red pigments (b) Schematic image of a SCF. Nano-hole arrays induce a color filtering effect (c) Even though three different proteins are dropped on a general CF; there are no color changes due to its transparent optical property. (d) Different transparent biomolecules change the dielectric property of the surface of filters when they are dropped on the SCF. This causes spectral shifts in the SCF

Biography

Jae Eun Jang received his PhD degree in Electrical Engineering from the University of Cambridge, UK in 2006. From 2007 to 2011, he was Principal Senior Researcher at Samsung Advanced Institute of Technology, Yongin, Korea. Since 2011, he has been a Professor in Information and Communication Engineering at Daegu Gyeongbuk Institute of Science and Technology (DGIST), Daegu, Korea. He first demonstrated the mechanical nanoswitch and mechanical DRAM concept using vertically aligned carbon nanotubes in 2004 and 2008, respectively. More recently he was involved in nanodevices for ultra-fast driving, biomimic concepts and brain-machine interface. He has authored or co-authored over 200 journal and conference papers, and is an inventor of 100 granted patents.

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