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Fluorescence Upconversion Microbarcodes for Multiplexed Biological Detection

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Abstract: Multiplexed suspension arrays of encoded microspheres offer several advantages over planar arrays such as flexibility in target selection, fast binding kinetics, and well controlled binding conditions. For multiplexed detection a reporter dye is required and the region of the spectrum that is occupied by its emission profile is not available for encoding. But for dye and Quantum dots encoding materials described above, the interfering with organic reporter tags that have excitations in the visible or UV is still a major problem. In the present work, we show that this problem could be resolved by the development of upconversion optically encoded microbeads. This encoded bead technology is based on the optical properties of RE ions doped upconversion nanoparticles (UCNPs), which are excited in the infrared region instead of the UV and visible region to give emission in the visible domain. These UCNPs show a high photostability, low toxicity, and their multicolor optical properties can be tuned by variation of lanthanide dopants and the host matrix. In particular, it is extremely important to note that there is no optical cross talk between the upconversion optical code and any reporter dyes. The single wavelength 980-nm continuous wave (CW) laser used to excite the upconversion materials does not excite dyes which absorb in the visible and UV region and, conversely, the upconversion materials are not excited by the visible lasers used to excite the organic dyes. All these favorable properties have indicated the great potential of UCNPs in the multiplexed detection.

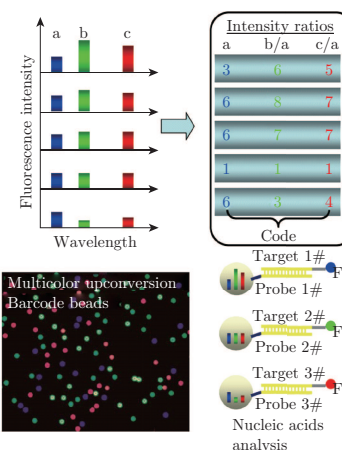
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Dr Fan Zhang received his Ph.D. degree in Chemistry from Fudan University in 2008. He was a postdoctoral fellow from 2008-2010 at the University of California, Santa Barbara (UCSB). He joined the Chemistry Department of Fudan University as a Associate Professor in 2010. He has published about 30 articles in peer-reviewed journals, such as the *J. Am. Chem. Soc.*, *Angew. Chem. Int. Ed.*, *Chem. Mater.*, *Chem. Eur. J.*, *ACS Nano*, *Small*, *J. Mater. Chem.* His current research interests include Inorganic luminescent and magnetic multifunctional nanocrystal and nanostructured materials, applications of inorganic luminescent and nanostructured materials in biomedicine, such as in vivo and in vitro bioimaging, drug storage and release,

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