Microsphere-based reflective optical probe

Yongjae Jo, Junhwan Kwon, Myunghwan Choi
Department of Biomedical Engineering, Sungkyunkwan University
Center for Neuroscience Imaging Research, Institute of Basic Science (IBS)
Suwon 16419, Republic of Korea
E-mail : photomodulation@gmail.com

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1. ABSTRACT

Optical probes have played a critical role in biomedical science for multiplexed labeling of specific biomolecules and cells of interests. In doing so, fluorescence has been the most widely used as a gold-standard, but the broad spectral emission limits the number of distinguishable elements and photobleaching obscures prolonged observation [1]. To solve these problems, various optical contrast mechanisms have been suggested, such as luminescent life-time, lasing and barcoded particles [2]. Yet, they have failed to be adapted widely because of either a demanding fabrication process or a complex decoding hardware. Here, we report a conceptually new optical probe, termed reflectophore, which is based on spectral interference from a dielectric microsphere (Fig .1). Reflectophore is orders-of-magnitudes brighter than conventional fluorophores and is free from photobleaching, enabling practically unlimited readout at high fidelity. It also offers high-degree multiplexing encoded by its physical size, which can be readily decoded by interferometric detection at nanoscale accuracy. We further demonstrate biological applications in cellular barcoding and molecular sensing.

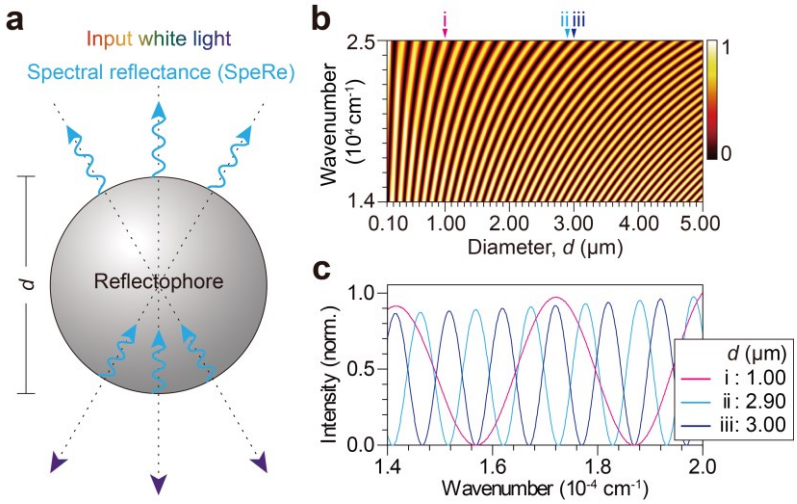

Figure 1 | Concept of reflectophore. (**a**) Schematic representation of the reflectophore. A dielectric microsphere can serve as a reflectophore by Fresnel reflections and interference from the broadband input source. (**b**) Simulated reflectance spectra of polystyrene- reflectophores. (**c**) Representative simulated reflectance spectrums of the polystyrene-based reflectophores. Note that the diameter is encoded in the frequency and phase of the reflectance spectrum.

2. REFERENCES

[1] J. W. Lichtman; J. A. Conchello, "Fluorescence microscopy" *Nat. methods*, **2,** 910-919 (2005).

[2] Y. Leng; K. Sun, X. Chen and W. Li, “Suspecsion arrays based on nanoparticle-encoded microspheres for high-throughput multiplexed detection” *Chem. Soc. Rev.* **44,** 5552-5595 (2015)