Micro-flow Cytometry Using Photonic Crystals

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Abstract

In the field of cellular biology, high throughput methods for analyzing individual cells is critical for understanding of fundamental cell properties as well as for diagnosis and treatment of many diseases. Flow cytometry is one of the most widely used method for cellular analysis. Traditional flow cytometers are capable of continuously counting cells while at the same time analyzing their size and shape among many other properties. Despite their numerous capabilities, conventional flow cytometers are large, expensive apparatuses that are difficult to operate.

In order to overcome these weaknesses, we have proposed a novel method for high throughput analysis of cells in an on-chip micro-flow cytometer which incorporates photonic crystals. As individual cells flow past the crystal surface, light is scattered from the photonic crystal, and observed changes in the transmission spectra would contain information regarding the cell and its properties. The system was modeled using specialized FDTD software, where transmission spectra were calculated. Using this method, initial studies demonstrated a potential for continuous counting of cells in a focused stream. With further analysis of transmission spectrum changes additional information, such as cell shape, size, and refractive index have also been determined.

Biographies

JUSTIN STEWART is currently a MS student in Chemical Engineering at University of South Florida. He is the Winner of the Outstanding Research Assistant departmental award. Justin Stewart may be reached at jwstewar@mail.usf.edu.

ANNA PYAYT is currently an Assistant Professor at University of South Florida and the head of the IBIS (Innovative Biomedical Instruments and Systems) Lab. She earned her Ph.D. in Electrical Engineering and Nanotechnology, 2009, from the University of Washington. She was a CIFellow and a postdoctoral scholar at Stanford University. Additionally, she was the first author of papers in Nature Photonics and Nature Nanotechnology and her latest research was highlighted in Science. Dr. Pyayt may be reached at pyayt@usf.edu.