Polymer Microring Resonators for High-Frequency Ultrasound Detection and Imaging

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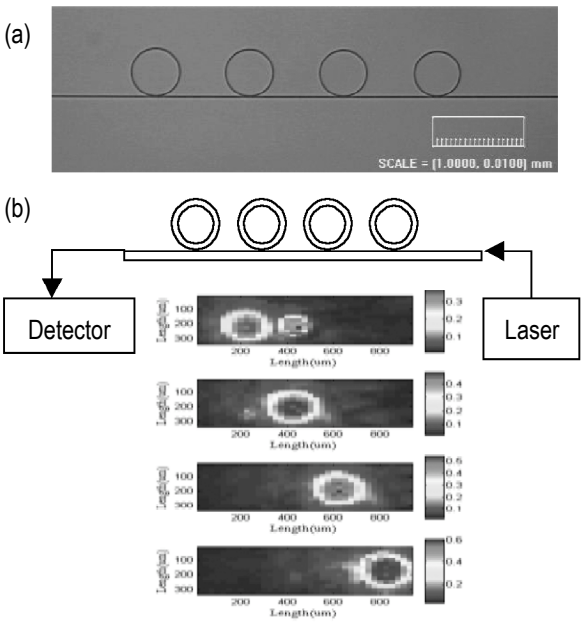
High-frequency ultrasound imaging is an excellent tool for *in-vitro* biomedical microscopy, providing high resolution and real-time imaging. This project is to develop Polymer Resonator for Optical Ultrasound Detection (PROUD), which offers several advantages over traditional piezoelectric technology in element size, spacing, and signal transduction. This project seeks to develop highly sensitive devices for broadband ultrasound detection. Our recent measurements at several frequencies showed a high sensitivity and record low noise-equivalent pressure. The angular response is determined by sensing the optoacoustic excitation of a 49μm polyester microsphere and shows wide-angle sensitivity. A fiber-coupled 1-D array consisting of four polymer microrings coupled to a single bus waveguide is demonstrated using wavelength multiplexing for addressing each element. The high sensitivity, bandwidth, and angular response make it a potentially useful sensor platform for many applications including high-frequency ultrasonic and photoacoustic imaging. This project is supported by the National Institute of Health under award numbers EB004933 and EB007619.



(a) Optical micrograph of the fabricated four-microring device, (b) Four rings in serial create four distinct resonance peaks that can be probed from the same waveguide. Two-dimensional spatial sensitivity of the microring array for each of the 4 wavelengths tested by using a scanning ultrasound transducer.