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High Frequency, All-Optical Ultrasound Transducer for Biomedical Applications

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Et al.

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Title: High Frequency, All-Optical Ultrasound Transducer for Biomedical Applications

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Abstract:

High-frequency (> 30 MHz), high-resolution (<100 μm) ultrasonic imaging has been increasingly demanded in applications that include dermatology, ophthalmology, intravascular imaging, and small animal imaging. It is also a valuable imaging tool for non-invasive studies of disease progression and regression. The conventional approach that relies on piezoelectric transducers is difficult to design at high frequencies. An all-optical photoacoustic transducer, which can operate above 50 MHz, can circumvent this problem. It converts pulsed laser energy exerted onto a thin photoabsorptive film into thermoelastic waves. The center frequency and bandwidth of the generated ultrasound are determined by the incident laser pulse. In addition, the size and spacing of each generation/receiving element, which are defined by the focal point of a laser beam, can be easily reduced to several microns. This poster presents a novel fiber-optic ultrasound transducer based on optical generation and detection approaches. The ultimate goal of the project is to integrate generation and detection functions onto a single optical fiber and to achieve ultrasound beam steering via phased array technique. The ultrasound transducer presented in this poster has great potential in biomedical applications including intravascular ultrasound imaging and noncontact characterization of biological tissues. The high-frequency of the transducer gives it the capability to achieve high axial resolution (< 100 μm) and the compact size (125 μm in diameter) makes it a perfect candidate for intravascular applications.