Photons Plus Ultrasound: Imaging and Sensing 2010, San Francisco, CA, January 24-26, 2010

Photoacoustic Correlation Technique for Low-speed Flow Measurement

Chen, Sung-Liang ; Ling, Tao; Huang, Sheng-Wen;
Baac, Hyoungwon ; Chang, Yu-Chung; Guo, L.-Jay

Abstract

A photoacoustic correlation spectroscopy (PACS) technique was proposed for the first time. This technique is inspired by its optical counterpart-the fluorescence correlation spectroscopy (FCS), which is widely used in the characterization of the dynamics of fluorescent species. The fluorescence intensity is measured in FCS while the acoustic signals are detected in PACS. To proof of concept, we demonstrated the flow measurement of light-absorbing beads probed by a pulsed laser. A PACS system with temporal resolution of 0.8 sec was built. Polymer microring resonators were used to detect the photoacoustic signals, which were then signal processed and used to obtain the autocorrelation curves. Flow speeds ranging from 249 to 15.1 μm/s with corresponding flow time from 4.42 to 72.5 sec were measured. The capability of low-speed flow measurement can potentially be used for detecting blood flow in relatively deep capillaries in biological tissues. Moreover, similar to FCS, PACS may have many potential applications in studying the dynamics of photoacoustic beads.