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Spatiotemporal evolution of a laser-induced shock wave measured by the background-oriented schlieren technique YOSHIYUKI TAGAWA, SHOTA YAMAMOTO, MASAHARU KAMEDA, Tokyo Univ of Agri & Tech —
We investigate the spatiotemporal evolution of a laser-induced shock wave in a liquid filled thin tube. In order to measure pressure distribution at shock front, we adopt the background-oriented schlieren (BOS) technique. This technique provides two- or three-dimensional pressure field in a small region with a simple setup. With an ultra high-speed video camera and a laser stroboscope, we successfully capture the spatial evolution of the shock every 0.2 μs. We find an angular variation of the pressure at the shock front. The maximum pressure is in the direction of the laser shot while the minimum value is in the perpendicular direction. We compare the temporal evolution of the pressure measured by BOS technique with those obtained by another method, i.e. pressure estimation from the shock front position. Overall trend from both methods show a good agreement. The pressure from the shock front position exists between the maximum and minimum values from BOS technique. It indicates that our quantification method can measure more detailed pressure field in two- or three-dimensions. Our results might be used for the efficient generation systems for the microjet, which can be applicable for needle free injection devices.

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