High frequency observation using coaxial interferometer

○ Kaede Yamauchi, Yoshio Hayasaki*

Center for Optical Research and Education (CORE), Utsunomiya University
7-1-2 Yoto, Utsunomiya 321-8585, Japan
hayasaki@cc.utsunomiya-u.ac.jp

Demand for drilling technology has been increasing in recent years. In the manufacturing of electronic devices, holes are made to make each layer of printed circuit boards conductive, in semiconductors, through holes are made in glass substrates to increase the density of circuits, and in medical devices, holes are made for stainless steel tubes such as nozzles and injection needles. High density, high precision, and mass production are required in various situations such as hole machining. Therefore, in femtosecond laser processing, which is suitable for drilling as there is no thermal effect, the optimal values of multidimensional laser parameters are determined through prior experiments and accumulated results depending on the type and shape of the workpiece. It is necessary to obtain it precisely from the obtained data. Therefore, we focused on processing using laser in-process measurement. In-process measurement of laser processing is a measurement method that provides real-time feedback of information obtained from processing. The advantages of this measurement method are that the optimal parameters for processing unknown materials can be determined without prior measurement, that measurements can be performed at the same time as processing, and that the time required to optimize processing is short. There are many things that can be mentioned. In addition, in-process machining using sound can be applied to non-contact and opaque material machining. Therefore, we decided to observe the sound generated during femtosecond laser processing and use it for in-process control. The sounds generated during processing range from low-frequency sounds in the audible range to high-frequency sounds. The generated sound in the audible range can be observed with a microphone and processed and controlled. Furthermore, by using Webster's Horn equation, it is possible to calculate the depth of a processed hole from the generated high-frequency sound. Therefore, in this study, we observed the high-frequency sound generated from the focused position during laser processing, and aimed to apply it to processing. To observe high-frequency generated sound, we use phase change due to sound pressure. An interferometer measurement device was created. We observed changes in interference due to processing..

Short biography:

Kaede Yamauchi was born in Kanagawa in April 2001. she graduated from Atsugi High School in March 2020. She entered Utsunomiya University Faculty of Engineering in April 2020. She currently he is a student in Utsunomiya University, Center for Optical Research & Education (CORE). He is a fellow member of SPIE. Recently, she is focused to Laser processing using sound measurement.