

# Micro Machining of Brittle Materials

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## Abstract

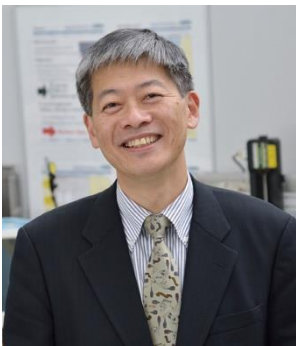
Many parts of brittle materials are used in devices for medical, information, material developments and so on. Many processes such as laser have recently been applied to manufacturing of the parts at high efficiencies. Micro machining has also been required for sophisticated devices. In machining of brittle material, high quality should be achieved with a crack free surface.

Mechanical machining processes of glass and sapphire are described to control surface qualities. Some monitoring approaches are presented to detect crack initiation/propagation in glass cuttings. Typical process in glass milling is compared with metal machining in terms of the cutting force. The glass and sapphire millings, then, are performed with inclination of the cutter axis. The effect of the cutter axis inclination on the surface finish and tool life is discussed in the cutting simulation. Some applications of glass machining are presented for micro medical devices.

As another process, an abrasive water jet process is described to fabricate micro grooves for testing microorganism such as blood cells. The flow control is discussed to finish crack free surfaces in the process. Some of machining examples are shown in the fabrication on quartz and silicon plates.

Technical discussions and issues are reviewed for machining parts of brittle materials with high quality surfaces as conclusions of the topics.

## Biography



Professor Matsumura was graduated from Graduate School of Mechanical Engineering Science in Tokyo Institute of Technology in 1987. He worked as Research Associate in Department of Mechanical Engineering Science from 1987 to 1992 and received PhD. in 1992. He has been working as Professor in Department of Mechanical Engineering, Tokyo Denki University since 1992. He became the Director of Research Collaboration in 2006 and Director of the University in 2015. He was also a visiting scholar, Mechanical Engineering Department, Massachusetts Institute of Technology from 1997 to 2006; and a

visiting professor, Mechanical Engineering Department, Mondragon University supported by Ikerbasque Science in 2011. He served as Chairman of Steering Committee, Japan Society of Automobile Engineers; Director, Japan Society for Abrasive Technology; Associate Editor, Precision Engineering; Director, Japan Society for Precision Engineering; Chairman, Research Committee of Cutting Technology, Japan Society for Precision Engineering; Chairman, Manufacturing and machine tool division, Japan Society of Mechanical Engineers; General Director, Japan Society for Precision Engineering; and Auditor, Japan Society for Precision Engineering. He is now serving as Chairman, Manufacturing Engineering division, Japan Society of Automobile Engineers; Associate Editor, Journal of Advanced Mechanical Design, System, and Manufacturing, Japan Society of Mechanical Engineers; Director, The Japan Society for Die and Mould Technology; Associate Editor, Journal of Micro Nano Manufacturing; Chairman, Research Committee RC295 in Japan Society of Mechanical Engineers. He has been studying in machining process modeling, micro/nano machining, tribology, surface engineering and intelligent manufacturing technology. He has published more than 200 papers and received 27 awards including 2 best paper awards in the International Institution for Micro-Manufacturing, the 4M Association and the International Forum on MicroManufacturing.