Name	Job Title	Area of Expertise
MOTOMURA Fumitaka	Assistant Professor	Laser Processing

1. Main Research Topics

① **Elucidation of modified layer formation mechanism inside transparent material using ultrashort pulse laser**

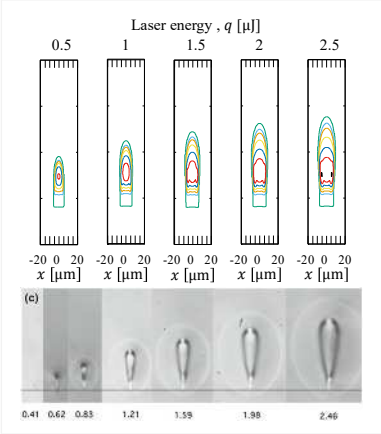
In this study, we developed a numerical simulator that reproduces the transformation inside a transparent solid caused by the advection and diffusion of laser light focused inside the solid. We found a correlation between the heterogeneous layer formed inside the solid and the spatial distribution of the refractive index obtained from the analysis. (refer to left figure below)

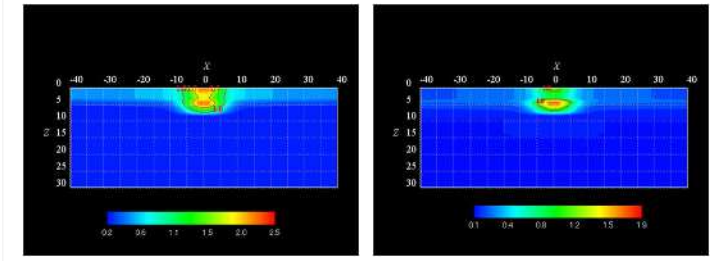
② **Development of laser dicing simulator for Si based multilayer film using pulsed laser**

This simulator allows the selection of optimal processing conditions for the simultaneous removal of multilayer films made of various compositions (metal, glass, resin), contributing to the desired processing accuracy and efficiency. An example of analytical results of the amount of ablation removal taking into account the temperature dependence of thermal and optical properties. (refer to right figure below)

③ **Refractive index analysis of Si based multilayer film using spectroscopy**

If the wavelength profile of refractive index of multilayer films with light-transmitting layer can be formulated, it will be advantageous for selecting the laser wavelength to be used in dicing processing. The wavelength profiles of laser beam absorbed in multilayer films are applied to estimate the spatiotemporal profile of the laser intensity in a numerical simulator.





Melting criteria　　Boiling criteria

2. Keywords

Laser dicing processing, Silicon based multilayer film, Numerical simulator, Spectroscopy

3. Remarks and Websites

In post-processing of semiconductor devices such as CMOS sensors, dicing processing using laser ablation phenomenon requires selection of optimal processing conditions according to model changes in multilayer structures. If we can elucidate complex and high-speed ablation phenomenon that is difficult to observe in situ and involves solid-liquid phase changes, we believe that even higher-precision processing can be achieved.

researchmap：https://researchmap.jp/fmtk_motomura

Laser dicing is key technology not only for single-layer structures of power semiconductors (such as SiC), but also for the singulation of CMOS sensor modules, etc. Developing a numerical simulator that reproduces complex laser ablation phenomenon will help us to correctly understand processing results and improve processing efficiency and accuracy.