



A Novel Evaluation Method of Polishing Slurry Flow Using Digital Image Processing



- Mechanical Polishing for Sapphire Using Diamond Slurry -

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Objective

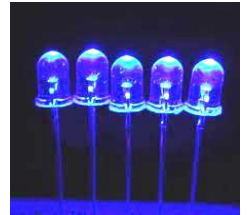
This research aims to establish the novel quantitative evaluation method of slurry flow, which measures polishing slurry flow to the contact surface of the workpiece/ platen, using digital image correlation (DIC) method.

Back ground

- Sapphire and gallium nitride are high performance as the device but, the mechanical polishing is low throughput.
- The mechanical polishing characteristics are affected by the actual slurry flow between the workpiece/ platen.
- Most of previous studies on the slurry flow were focused only qualitative evaluation.

In this study

- ⊙ We discuss effect of the rotational speeds of the workpiece/platen by following parameters;
 - The vector diagrams of the slurry flow in the contact surface
 - The slurry inflow/outflow ratio in the contact surface

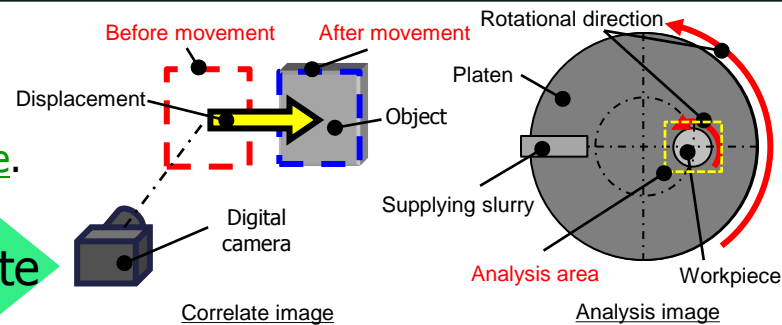


General description of DIC method

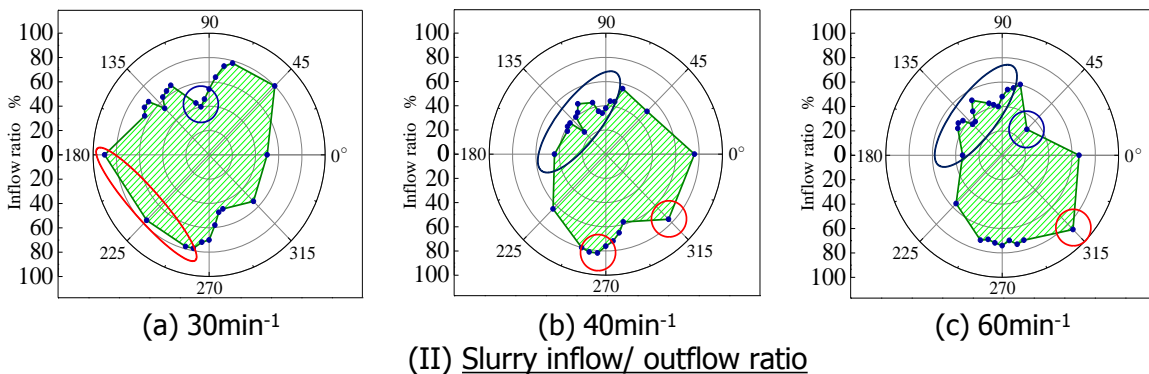
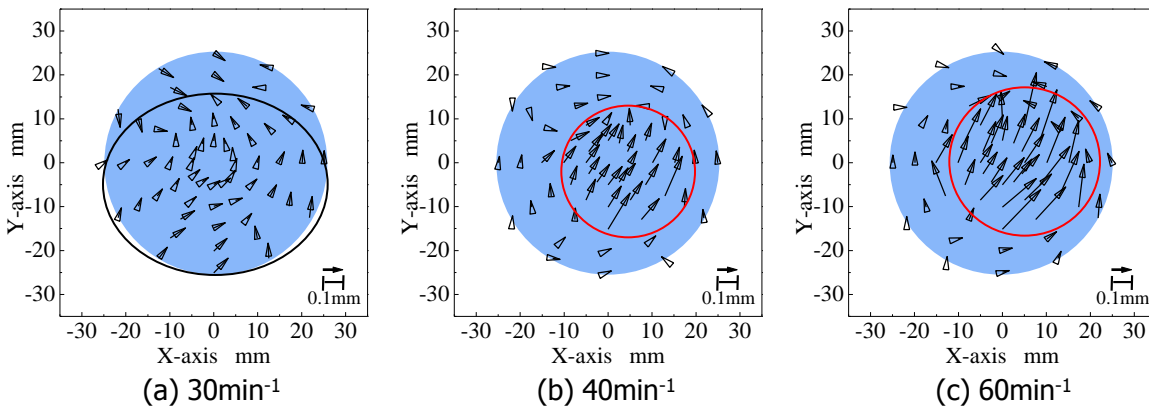
- ⊙ The DIC method is the non contact displacement distribution measurement method in the photographed area by digital camera.
- ⊙ DIC uses two photographs of original image and comparison image.

Original image ⇒ Photographed before movement
Comparison image ⇒ Photographed after movement

Correlate

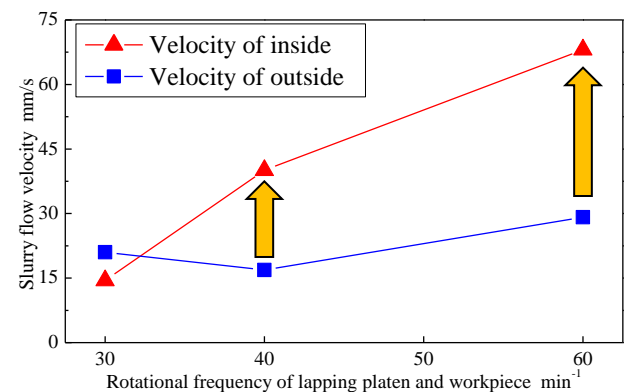


Experimental results and considerations



Experimental conditions

Offset e	65 mm
Polishing pressure	10 kPa
Diameter of platen	300 mm (SS400)
Diameter of workpiece	50.8 mm (Sapphire)
Rotational speeds of workpiece and platen	30, 40, 60 min ⁻¹ (CCW)
Slurry particle	Diamond (3 μm)
Supply rate of slurry	3.3 mL/min
Frames interval	10/3 ms



Relationships between slurry flow velocity and rotational speed of platen/ workpiece

Conclusions

- A novel method and parameters can be used to evaluate the slurry flow quantitatively.
- The slurry flow is depended on the rotational speeds of the workpiece/ platen, the slurry flow vector dramatically increases with an increase in the rotational speed over 40 min⁻¹.
- The inflow ratio to the contact surface and its region decrease with an increase in the rotational speed.