



Influence into Platen and Polishing Pad Surface Temperature on Removal Rate in Sapphire-Chemical Mechanical Polishing

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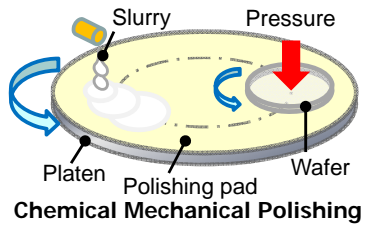
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Objective

This study investigates between the removal rate and the several behavior analysis parameters in the sapphire-CMP.

Back ground

- Sapphire substrate is one of most important materials for fabricating the LEDs.
- Sapphire substrate has an excellent mechanical and chemical characteristics.
- Therefore, the sapphire-CMP requires a long time to process.



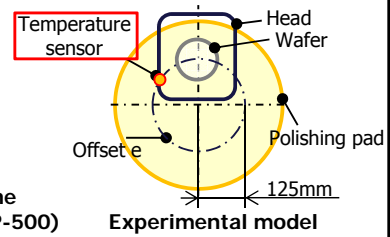
This study examines the effects of evaluation parameters on the removal rate from the view point of change in the rotational speed and the platen temperatures set by the chiller unit.

Experimental method

- The pasting methods of the polishing pad.
 - Direct pasting on the SUS platen
 - Using the removable polishing pad <J-Fit>
 - Using the auxiliary plate <SAISEI ECO CAP>
- The polishing pad surface temperature.
 - A non-contact type temperature was set on the offset of 125 mm.
 - The sampling period was 100 μs.
 - Evaluating the average temperature of polishing time from 1 min to 5 min.



Single side polishing machine (Fujikoshi Machinery Corp.: RDP-500)

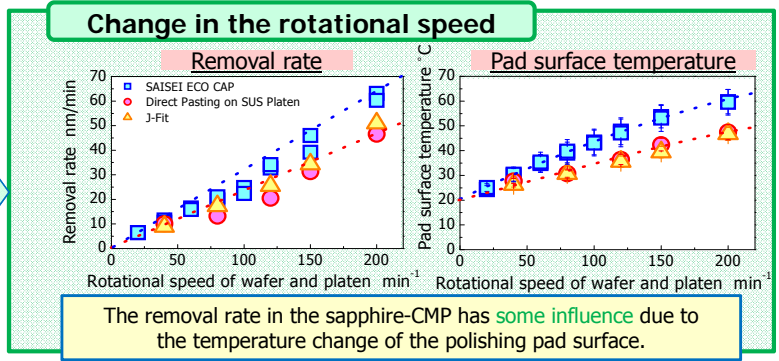


Experimental model

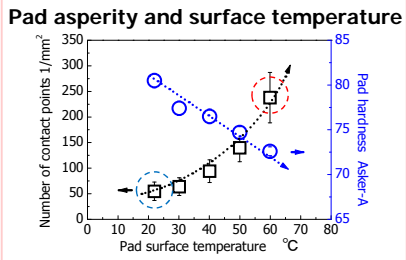
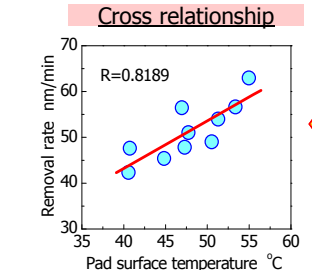
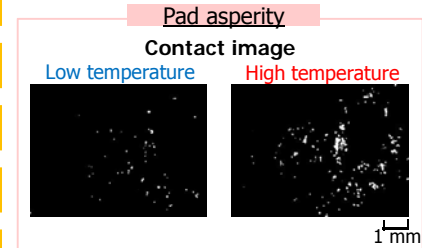
Experimental result

Experimental condition

Experiment	Change in the rotational speed	Change in the platen temperature
Polishing time	5 min	
Polishing pressure	90 kPa	
Offset e	125 mm	
Type of Pad	Non-woven fabric type (NITTA HAAS Inc.: SUBA800)	
Workpiece	Sapphire (4 inch)	
Type of slurry	Colloidal silica	
Slurry flow rate	50 mL/min	
Particle concentration	4.0 wt%	
Platen temperature	20 °C	5, 15, 20, 30, 35 °C
Rotational speed of wafer and platen	20, 40, 60, 80, 100, 120, 150, 200 min ⁻¹	200 min ⁻¹

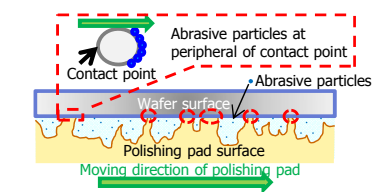


Consideration

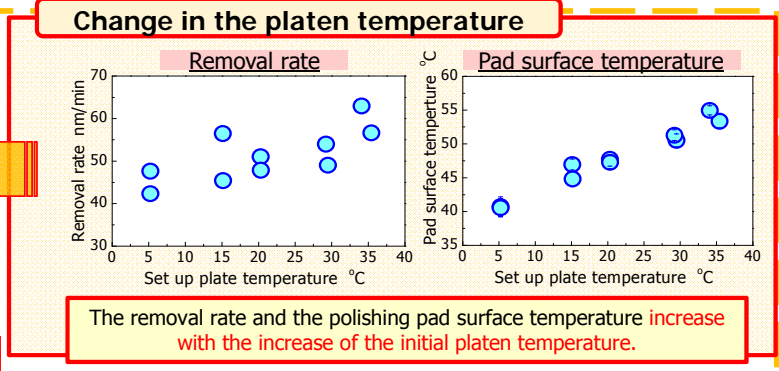


- Pad hardness is soften
- Number of contact points are increasing

Removal rate and Surface temperature



Model of abrasive action during CMP



- The pad hardness decrease with the increase of the polishing pad surface temperature.
- The contact points increase with the increase of the polishing pad surface temperature.
- The abrasive action particles between the wafer and the polishing pad during the CMP has high influence into the increasing the removal rate.

Conclusion

- The following are the main findings of this study.
- The removal rate increases with the increase of the polishing pad surface temperature in the sapphire-CMP.
 - The pad asperity of the non-woven fabric pad is changed owing to the effect of the polishing pad surface temperature.
 - In the sapphire-CMP, the increasing of the number of the contact points can lead to the high removal rate.