Effectiveness Evaluation of Novel Pad Dressing Method by Flexible Fiber Dresser
—Tool Life Evaluation of Flexible Fiber Dresser—

Date Sep. 24, 2014

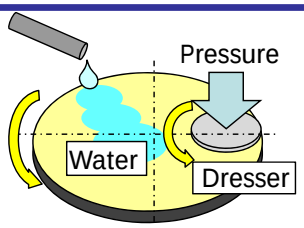
Kanazawa Institute of Technology: Michio Uneda and Naoki Takahashi
Showa Industry Co., Ltd.: Yutaro Arai, Tokyo Seimitsu Co., Ltd.: Takashi Fujita

Objective

Trial to the quantitative evaluation of t6he effectiveness and tool life of the flexible fiber dresser

Background

Chemical mechanical polishing/ planarization (CMP) is one of the most important technologies for fabricating high-efficient semiconductor devices.
→The CMP characteristics (removal rate and accuracy, etc.) is depended on the consumables represented by slurry, pad and dresser used in the CMP process.



Dressing process model

Dressing

Aiming at control the pad surface asperity
→Diamond dresser is frequently used to recover the pad surface asperity, however, the diamond dresser has a disadvantage of the deterioration of the diamond grains, thus, it is difficult to keep the dressing performance stability for a long time.

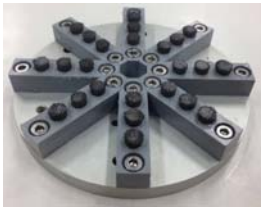
For this reason, we propose a novel flexible fiber dresser that would ensure high performance and longer life of tools.

Experimental method

Tool life test (accumulation dressing time: 70 hours) was carried out by both the fiber dresser and the diamond dresser.

◎Removal rate
◎Contact image analysis
◎Pad cut rate
◎Fiber height

The results of tool life test evaluation of the flexible fiber dresser using a quantitative evaluation method

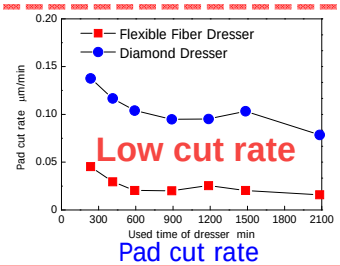

Flexible fiber dresser


Diamond disc dresser

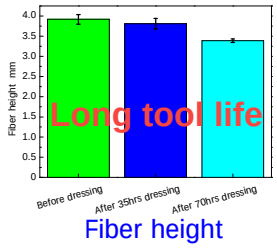
Experimental result

Experimental conditions

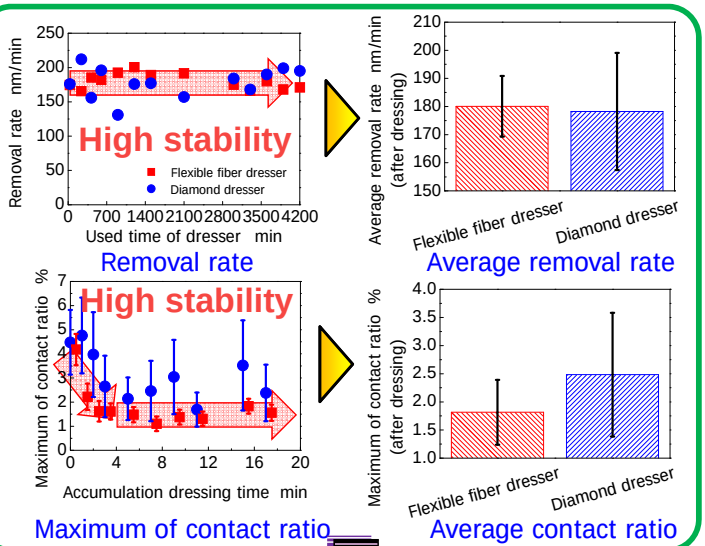
Dressing time	30, 60, 120, 180, 300, 600 min	
Polishing and Dressing pressure	30.0 kPa	
Rotational speed of dresser	200 min^{-1} (CCW)	
Rotational speed of platen and wafer	100 min^{-1} (CCW)	
Polishing time	1, 2 min	
Offset	80 mm	
Slurry	Type	Colloidal silica (FUJIMI:COMPOL-80)
	Flow rate	3 mL/min
	Density	10 wt%
Wafer	Type	Silicon wafer (2 inch)
Polishing pad	Type	IC1570 (Layered structures pad (k-grooved))
	Diameter	300 mm
Fiber dresser	Fiber size	ϕ0.1 mm×1.2 mm
	Type	SUS304
	Diameter	110 mm
	Height	4 mm



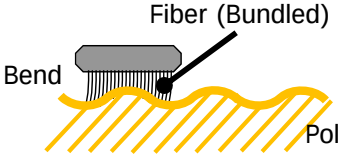
Pad cut rate



Fiber height

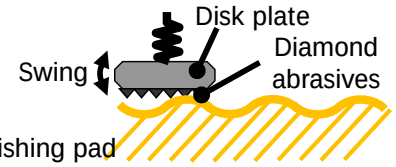


Flexible fiber dresser



Uniform dressing which imitated on the surface of polishing pad

Diamond dresser



Non-uniform dressing by intermittent contact

Conclusions

① In the flexible fiber dresser, the removal rate increase immediately after dressing, and that the removal rate maintain the stable value. Furthermore, the removal rate show more stable compared with the results by the diamond dresser in the tool life test.
② The pad cut rate by the flexible fiber dresser is smaller than that by the diamond conditioner.
③ The variation of the pad surface asperity can be reduced by the flexible fiber dresser.