패드 그루브 치수에 따른 CMP 특성 및 해석

Groove Size Effect on CMP Characteristics and Analysis

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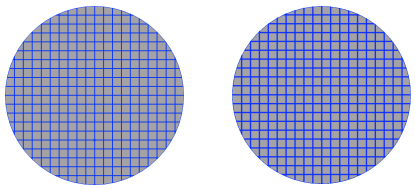
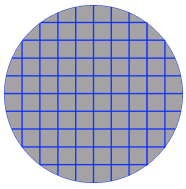
1. Introduction

Polishing pads play an important role in chemical mechanical polishing (CMP). There are two kinds of pads, non-groove and with groove, groove pads have more advantages than non-groove pads for polishing, such as higher uniform slurry distribution, reduce edge effects and so on [1]. Therefore, groove pads are used widely in CMP. But there are so many different types of groove and their dimension sizes are not the same. In order to make better use of groove pads, this paper tries to find the groove size effect on CMP characteristics, including material removal rate (MRR) and within wafer non-uniformity (WIWNU), by changing groove pitch and width of pads, and for this time research, X-Y groove pads have been used in polishing test [2].



Pad 1 (w=1,p=20) **Pad 2 (w=2, p=20)**



Pad 3 (w=2, p=40)

Fig.1 Schematic of X-Y pad groove size

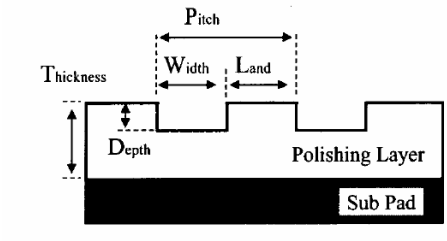


Fig.2 Schematic of pad groove dimensions [3]

2. Experiments

In the experiment, polishing tests with 3 different X-Y groove pads have been done; the pads are different with pitch and width. The MRR and WIWNU have been measured on the 4 inch oxide wafers before and after polishing. During polishing friction force has been measured, and coefficient of friction (COF) also analyzed.

Table 1 Experimental condition

Parameters	Conditions
Pad	X-Y Groove Pad
Polisher	POLI-400 (GnP Tech.)
Target	4 inch dioxide wafer
Slurry	ILD3225, 200 ml/min
Polishing Time	60 sec
Velocity	Head and platen both 60rpm
Pressure	300g/cm^2

3. Result and discussion

Fig.3 shows the MRR results of all the 3

different pads. Authors can find the pad 2 with medium sized groove has the highest MRR, and the pad 1 is the lowest. From the viewpoint of the groove width, 1 mm is too narrow for viscous CMP slurry to run fast which results in occurring a capillarity. But when width is 2 mm, the channel is big enough for slurry flow well. Finally high slurry flow rate makes higher MRR. For pitch change, it does not affect slurry flow a lot, resulting in not much difference with MRR.

Fig.4 shows the COF of each pad. The pad 2 is biggest and the pad 1 is smallest. The COF has a strong relation with slurry flow rate, so as discussed above.

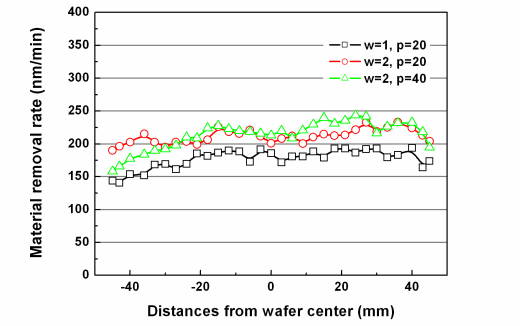


Fig. 3 Results of material removal rate with pitch and width

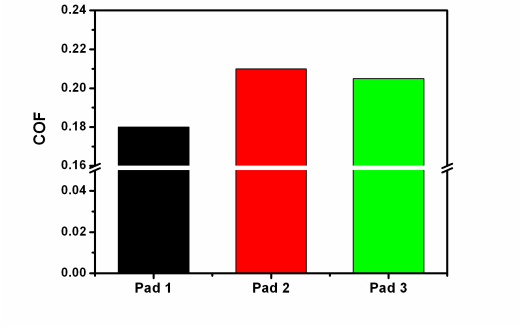


Fig. 4 Results of coefficient of friction with pitch and width

Fig.5 shows that the pad 2 has the best WIWNU and pad 3 is the worst. Channels for slurry to flow become more, the distribution uniformity of slurry is better, because more channels make slurry reach more areas of pad, and slurry uniformity improves, polishing uniformity also finally improves.

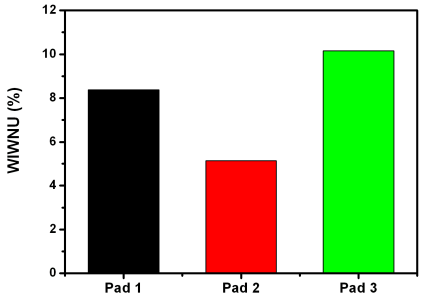


Fig. 5 Results of within wafer non-uniformity

4. Conclusion

Through all the polishing tests with X-Y groove pads, the groove size effect has been found in MRR and polishing uniformity. Width size affects slurry flow a lot and therefore width effect on MRR is obvious, however, pitch does not have much effect. For polishing uniformity, more channels improve slurry flow distribution uniformity and finally improve polishing uniformity.

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Reference

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