Resolution of Pad Surface Roughness on Cu CMP

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Conventionally, the correlation between pad surface roughness and wafer contact state is investigated by analyzing the polishing friction force. However, as the friction data includes various parameters, it is difficult to derive the effective pad roughness parameters from the friction force. Accordingly, the relationship between the pad roughness and Cu polishing performance is directly investigated. Pad surface roughness conditioned by several down forces was analyzed with the probe profiler and the laser microscope profiler. The result seems to indicate that the roughness including microspore does not contribute much for removal rate, but the roughness between pores influence mor e to removal rate increase for Cu CMP.

1. INTRODUCTION

The polishing pad is the most important consumable product of the Chemical Mechanical Polishing (CMP) and the pad properties plays a definitive role in both the mechanical and chemical aspects of the polishing. Especially the improvement of wafer planalization, non uniformity and removal rate is an important factor for CMP process [1]. The pad surface topography plays a very important role in the mechanical aspects of CMP [2]. In this study, the surface roughness was measur ed by using a probe profiler and a laser microscope profiler, and was correlated with Cu polishing performance.

2. EXPERIMENT

2.1 Conditioning on pad surface

With pad conditioning, the polishing performance is kept appropriately. The conditioning process is affected by down force and diamond abrasive protrusion height [3]. The conditioning was done as in Table 1.

Table 1 Pad conditioning detail

Conditioner	Type	Diagrid AD3BG-150855 (KINIK Co.)
	Abrasive	Blocky type, 150 [μm] diameter
Pad	Type	IC1000 050 k-grv./S400 24 (NITTA HAAS Inc.)
Conditioning down force	[kgf]	3.0, 5.0, 20.0

2.2 Analysis of pad surface roughness

Various pad surfaces were prepared by changing the conditioning down force, and were analyzed with probe profiler (SJ-201P, Mitutoyo co.) and laser microscope profiler (1LM21D, Lesertech Inc.). The specification of the profiler is listed in Table 2. Figure1 shows a schematic diagram of the sectional pad surface, describing a benchmark model with pad roughness factors. We assume that the pad surface roughness is caused by micro pores, polyurethane waviness, and also conditioning. The