Objective

Trial to the quantitative evaluation of the 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

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

Experimental result

| Experimental conditions | Dressing | 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    | Collodial silica (FUJIMI: COMPOL-80) | Flow rate | 3 mL/min | Density | 10 wt% | Wafer | Type | Silicon wafer (2 inch) | IC1570 | Polishing pad | Type | (Layered structures pad (k-grooved)) | Diameter | 300 mm |
| Fiber dresser           | Fiber size | 0.1 mm x 1.2 mm | Type | SUS304 | Diameter | 110 mm | Height | 4 mm |

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.