Effect of wafer backside on particle addition behaviour of HF-RCA sequence

M.Strada, D.Lodi, E.Bellandi and M.Alessandri

STMicroelectronics, Central R&D,

Via C.Olivetti 2, Agrate B.za (MI), ITALY

Diluted HF in re-circulated bath is widely used for oxide etching on wafers prior to RCA cleaning. Often etch and cleaning is performed sequentially inside the same tool. In some initial process flow operations, wafers are completely covered with a sacrificial oxide, and HF etching is aimed to strip completely off this layer. After this etch step a strong particle contamination has been observed, as shown in Figure 1. Different kinds and brands of wet stations were tested and the particle pattern was found to be mainly tool or tank dependent.

This phenomenon has strong analogies with the one described in reference 1. Particles are generated after HF step and only partially removed in the following SC1 treatment.

Results presented in this work have been obtained using a DNS FC821L wet station that allows a HF etch in a dedicated re-circulated tank (CHB) or in a single tank module (ONB). In the single tank module it is also possible to run SC1 and SC2 cleaning. In this tool wafers can be loaded single pitch (25 wafer per batch) or half pitch (50wafers per batch). In the last case wafers can be loaded front-to-front or back-to-back.

In case of normal pitch loading, a strong correlation between the wafer backside and the amount of added particles was found. As shown in Figure 2, if an oxide is present on the wafer backside (that is very common situation for EPI wafers), there is a high particle addition, while when the oxide is not present on the backside etch, there is no particle addition.

Several experiments were performed loading three test wafers in slot 1,2 and 3 of the batch, and filling up with silicon dummies the remaining 22 slots. Particle addition is reported in Figure 3. The first two wafers, which are facing an oxidised back-side, are heavily contaminated, while the third wafer, which faces the backside of a silicon dummy, is far less contaminated, but not clean. A certain contamination is surprisingly found even if wafers are loaded front to front, and half pitch.

A possible solution to this issue has been illustrated in reference 1, and consist in adding surfactant to the HF bath. Another effective solution is to perform HF oxide etching and SC1 in the same tank, using a single tank module, avoiding crossing of liquid surface when the surface is strongly hydrophobic. In this case there is no contamination, regardless of wafer backside, pitch and wafer position (see Figure 4).

This behaviour supports the hypothesis that the contamination occurs at liquid surface, because of the different surface tension between the oxidised surface and the hydrophobic surface that seems to catalyse particle deposition. Diluted or low temperature SC1 is often not effective for removing this kind of defects.

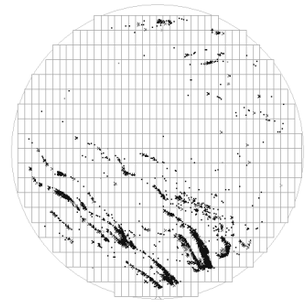

Figure 1: Particle contamination after HF strip

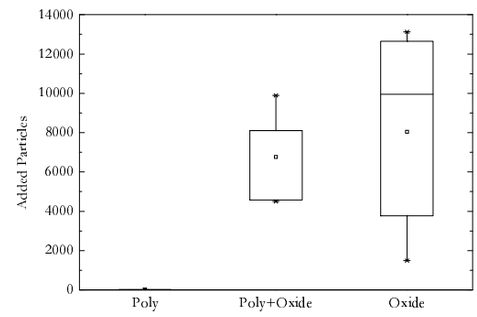

Figure 2: Particle count as a function of wafer backside

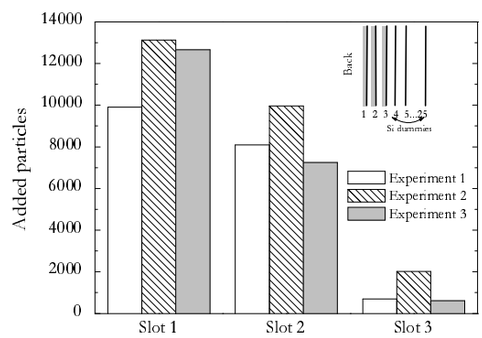

Figure 3: Particle counts for Vs wafer position.

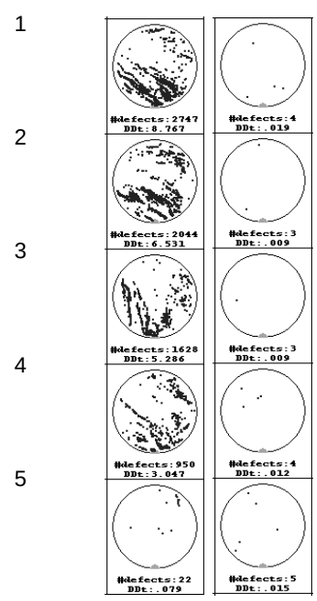

Figure 4: Particle counts after (left) re-circulated HF and single tank etch (right)

---

[1] E. Bellandi, M. Alessandri, F. Pipia and A. Tonti, *Proc. 4th Intl. Symp. UCPSS*, Oostende, Belgium, 35 (1998)