EXAMPLES OF OPTICAL ASSESSMENT OF SURFACE CLEANLINESS OF GENESIS SAMPLES

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Particle Counts

60326 SOS B/C array

Sample has been exposed to UPW cleaning (5 min.,3000RPM, 40°C) and UV ozone cleaning. Additional surface cleaning was done in HCL bath after allocation. An overview scan (Fig. 1) shows that small features were subsequently added to the sample surface. Fig. 2. displays an inset of data for position 1.

61052 Si-FZ B/C array

The sample has been UPW cleaned (5min,3000RPM, 40°C) and exposed to UV ozone cleaning. Additional surface cleaning was done by CO2 snow exposure after allocation. The sample was imaged before allocation and after its return. 464 objects were detected after its return to JSC, compared to 321 objects observed at the time of its allocation.

Brown Stains

60490 Si-FZ B/C array

Before allocation: Images were taken before the sample had any exposure to cleaning treatments. White ovals can be seen in the image to the right.

60326 SOS B/C array

Fig. 1. Features present at the time of allocation are in yellow. Features present after PI return are in red. The area bounded by the square was scanned at higher magnification (position 1).

Fig. 2. Sample 60326. This inset displays 413 objects detected by the software Image Pro Plus. The area is 0.02 mm². The bottom image has been classified into colored size bins.

Example of colorized size binning for sample 60326 using Image Pro Plus.

Inset of sample 61052 Position 1. The sizes (in µm) of detected features are displayed. Objects outlined in red were present before PI return (these do not have measurements displayed). The field of view is ~0.1mm².

60490 Si-FZ B/C array

After allocation: Images were taken after 80 hours of aqua regia cleaning plus RCA cleaning. No white ovals can be seen.

60289 Si-FZ B/C array

Before allocation: Sample was UPW cleaned for 1 min at 40°C. Several white ovals can be seen in the before images.

60490 Si-FZ B/C array

After allocation: Images of the sample were taken after UPW cleaning (5min, 3000RPM, 40°C). Previous handling of the sample include SIMS, TOF SIMS, TRXRF, acid etch. No white ovals can be seen.

Acetone Residue

60966 Si-FZ B/C array

Third image: Pictures were taken after 30 seconds of IPA application and 20 minutes of additional UPW cleaning. Smaller images indicate material that was added to the sample after replica peels and acetone rinse which was not removed by UPW cleaning.

First image: Sample was exposed to UPW cleaning, CO2 snow cleaning, HCL/HF cleaning, HNO3 cleaning, and TRXRF analyses.

Second image: Acetone residue can be seen after replica peels and acetone rinse. Image was taken after 5 min. of UPW cleaning.

Third image: Sample has been exposed to Li Implant, UPW cleaning and XPS analysis. Images were taken after its second Li Implant. Brown stains appeared after XPS analysis.

60966 Si-FZ B/C array

Top three images are 50X magnification of single shots from interesting features (brown stains) of sample 60491 (Fig. 3.).

Position 1, Position 2, and Position 3 are 50X magnification of mosaic scans from selected areas in Fig. 3. Brown stains can be seen in several parts of the sample.