

# 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.



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).

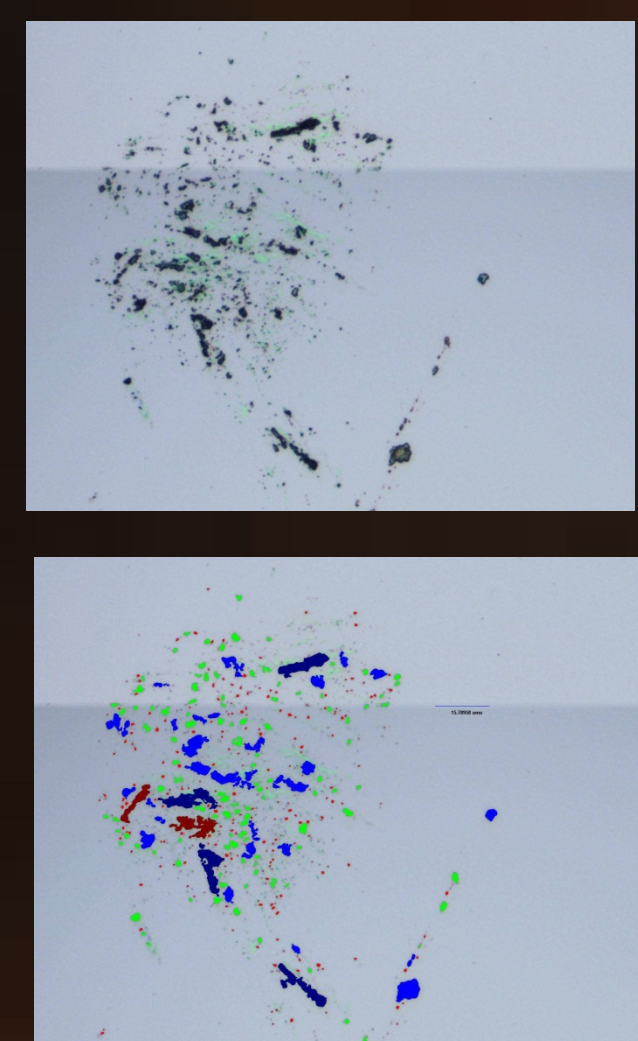


Fig. 2. Sample 60326. This inset displays 413 objects detected by the software Image Pro Plus. The area is 0.02 mm<sup>2</sup>. The bottom image has been classified into colored size bins.

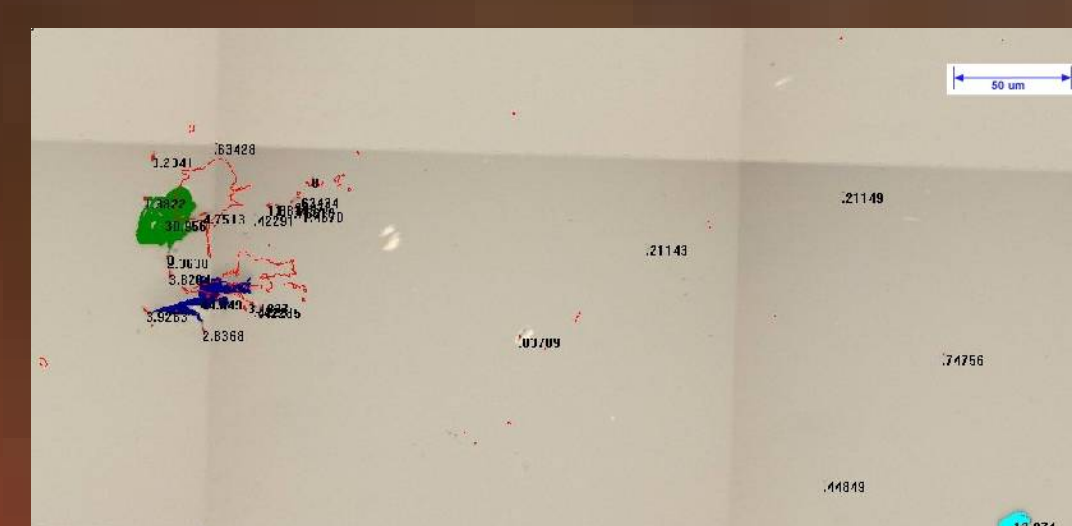
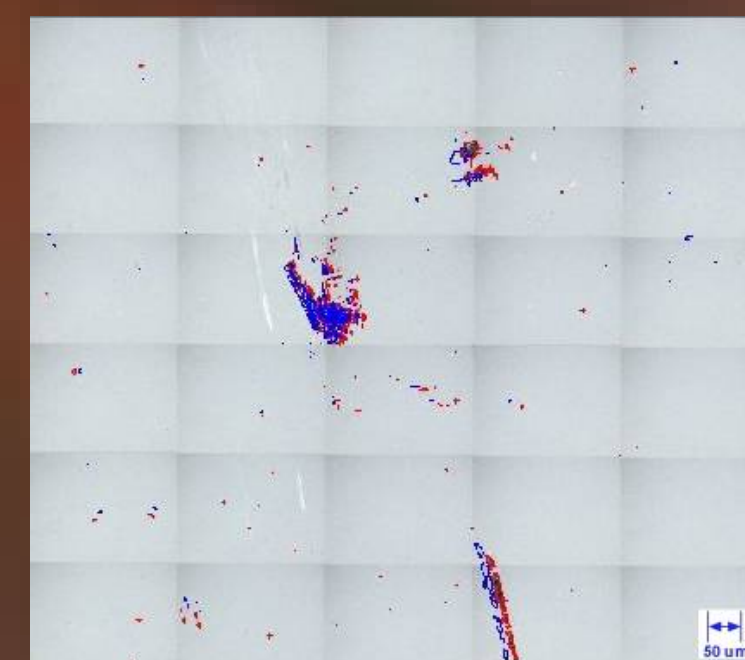
Class	Objects	% Objects
1	456	98.275864
2	4	0.956895
3	2	0.43103448
4	1	0.21551724
5	1	0.21551724

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

### 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 CO<sub>2</sub> 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.

Sample 61052 Position1, image on the right. Features present at the time of allocation are in red. Features present after PI return are in blue. The field of view is ~1mm<sup>2</sup>.

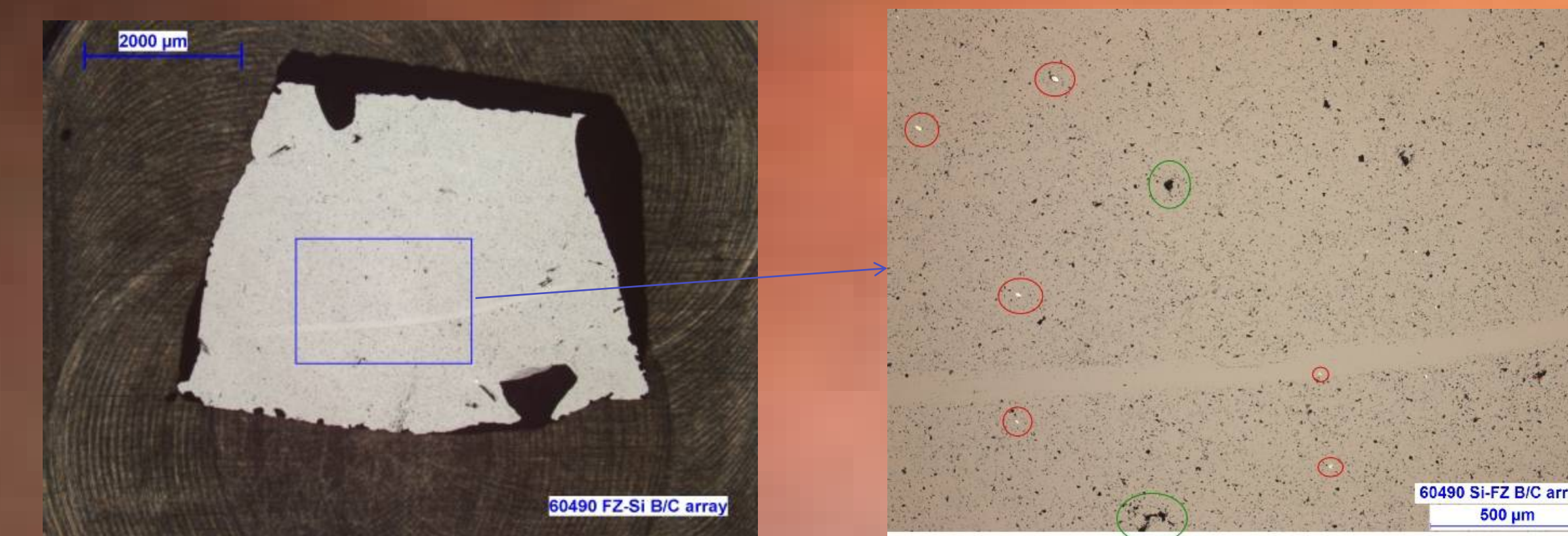


Inset of sample 61052 Position 1. The sizes (in µm) of detected features are displayed. Objects outlined in red were present before PI return (these do not have measurements displayed). The field of view is ~0.1mm<sup>2</sup>.

## White Ovals

From comparing the before and after pictures: Green circles show same features and red circles indicate white ovals.

### 60490 Si-FZ B/C array

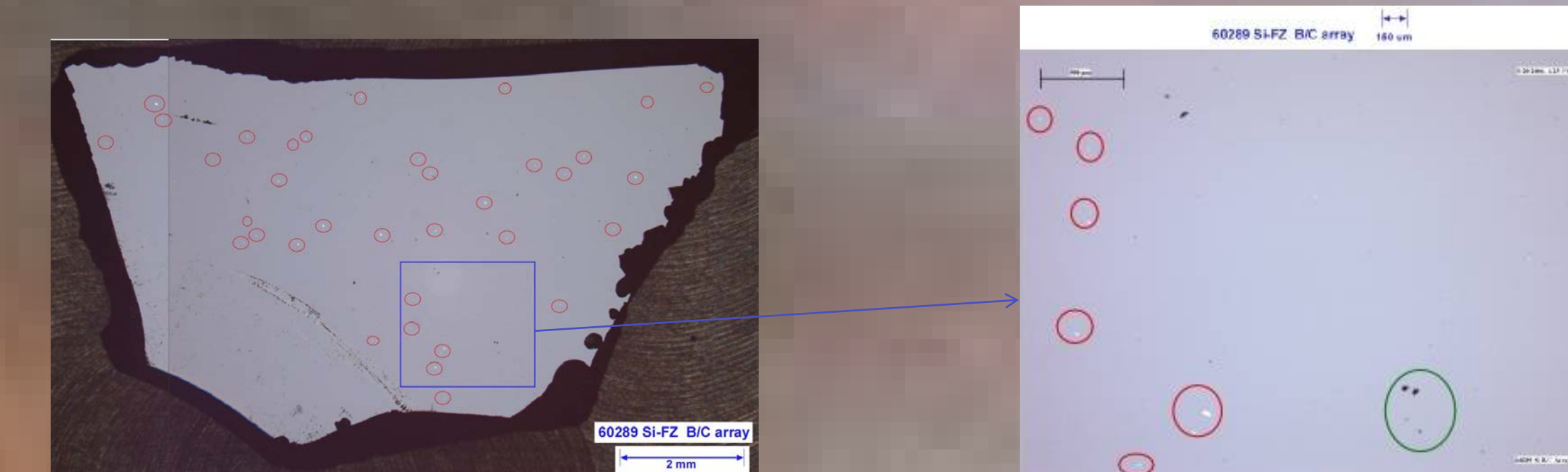


Before allocation: Images were taken before the sample had any exposure to cleaning treatments. White ovals can be seen in the image to the right.

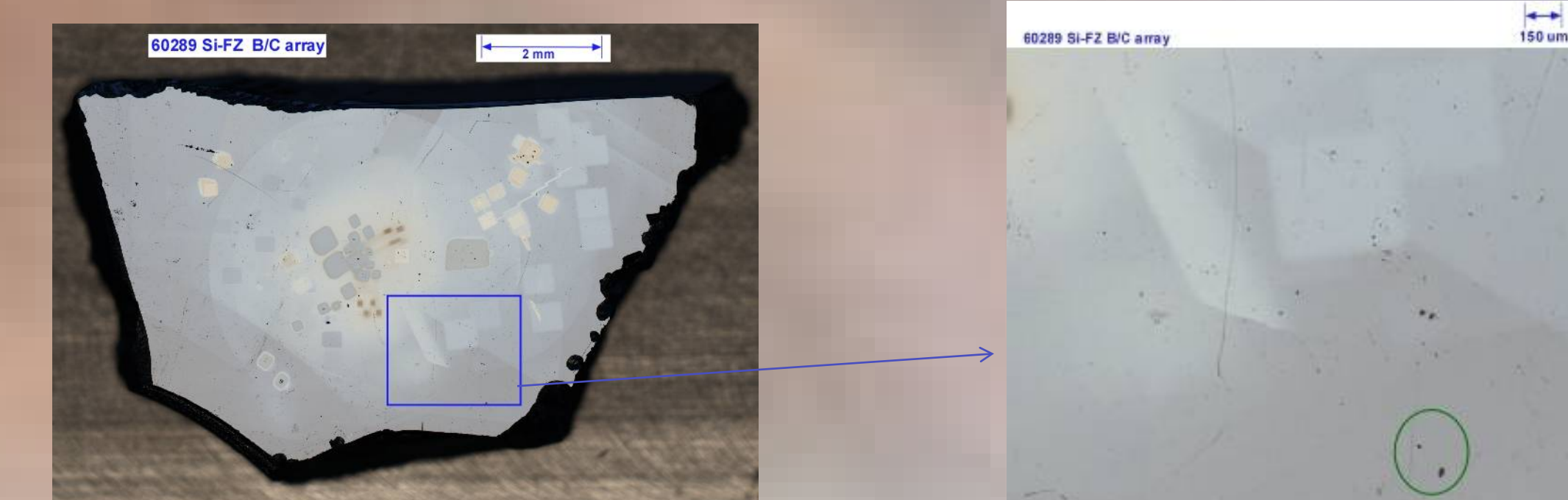


After allocation: Images were taken after 80 hours of aqua regia cleaning plus RCA cleaning. No white ovals can be seen.

### 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.



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.

## Brown Stains

### 60491 Si-FZ B/C array

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.



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

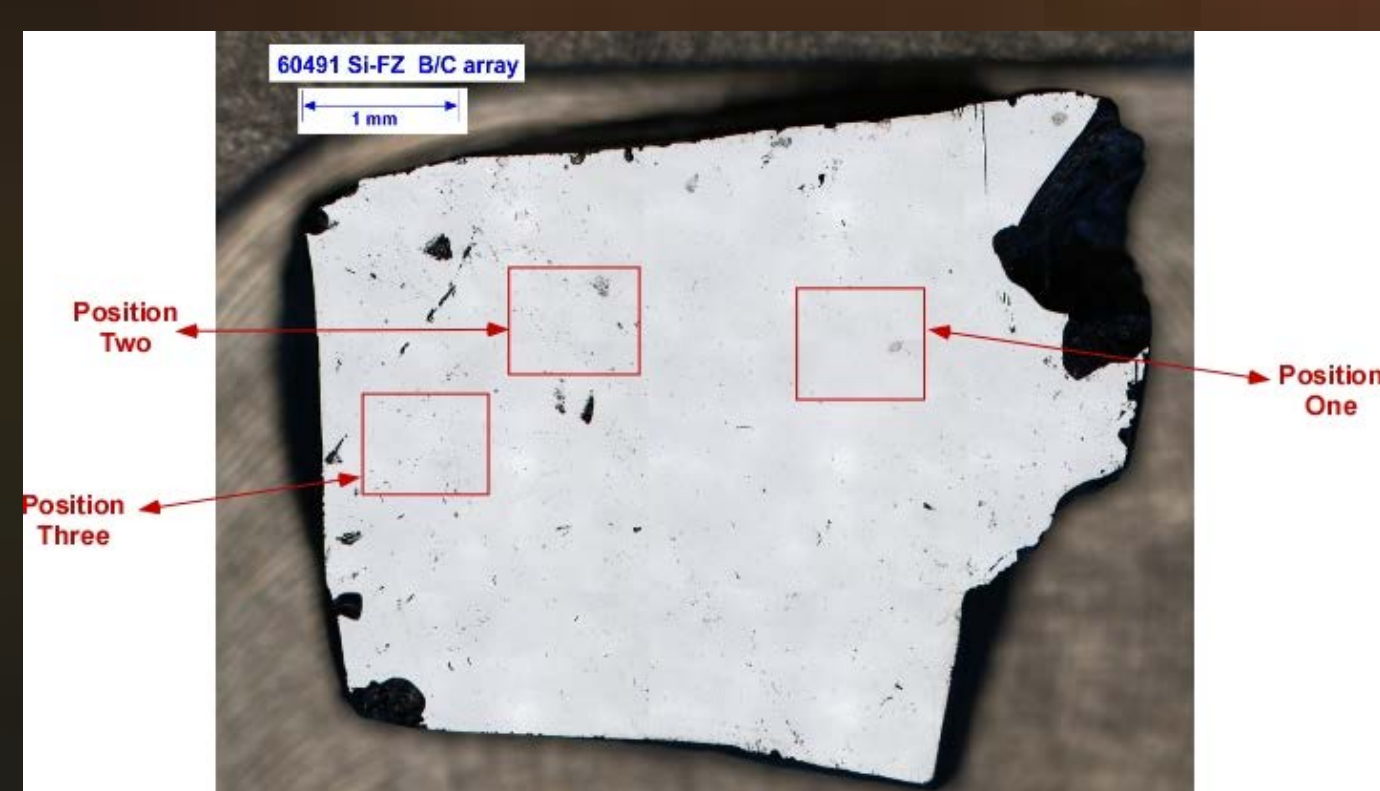


Fig. 3. A 5X magnification of mosaic scan of the sample 60491. The areas bounded by the squares were imaged at higher magnification.

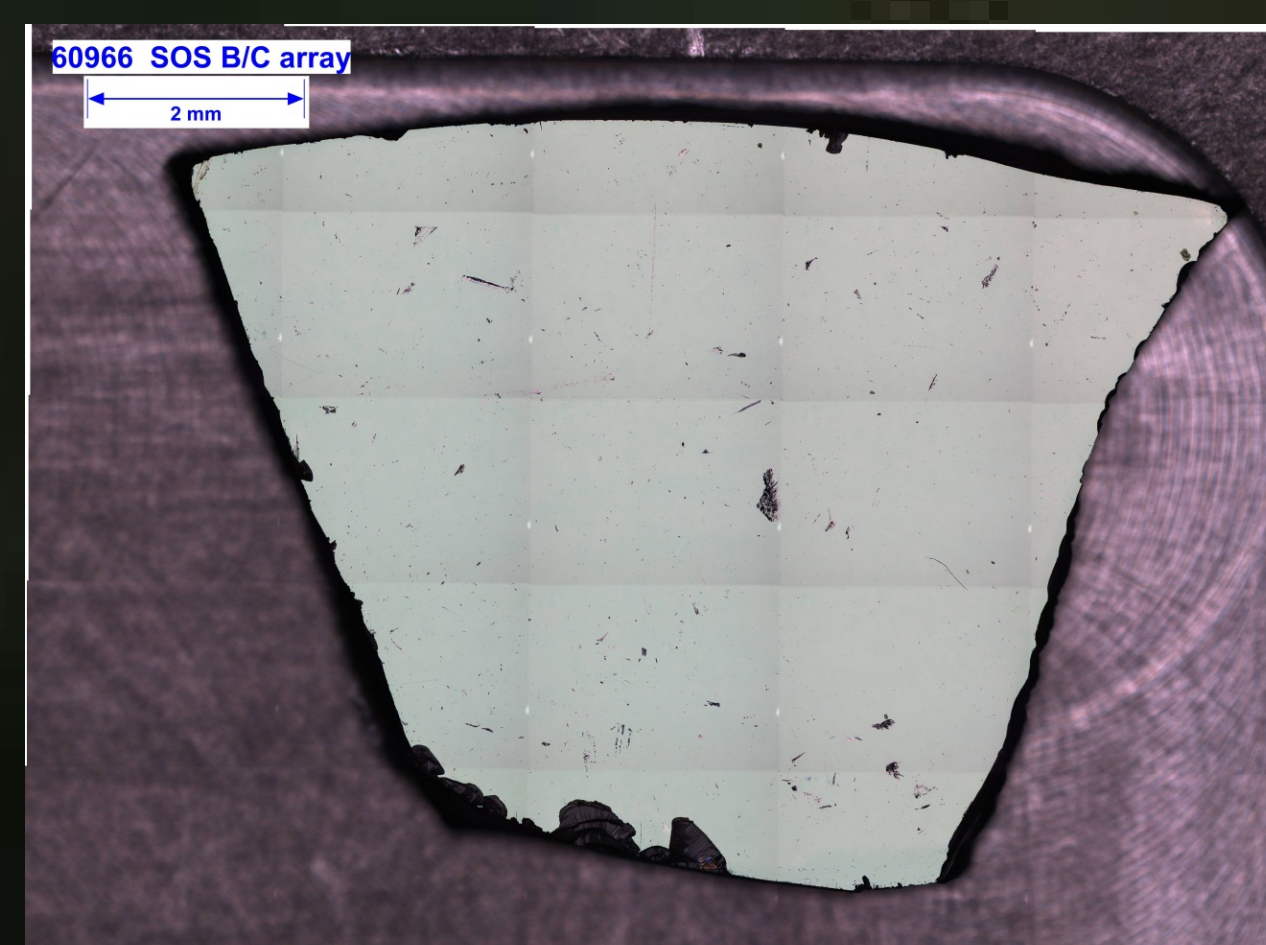


Position 1, Position 2, and Position 3 are 50X magnification of mosaic scans from selected areas in Fig. 3. Brown stains can be seen in several parts of the sample.

## Acetone Residue

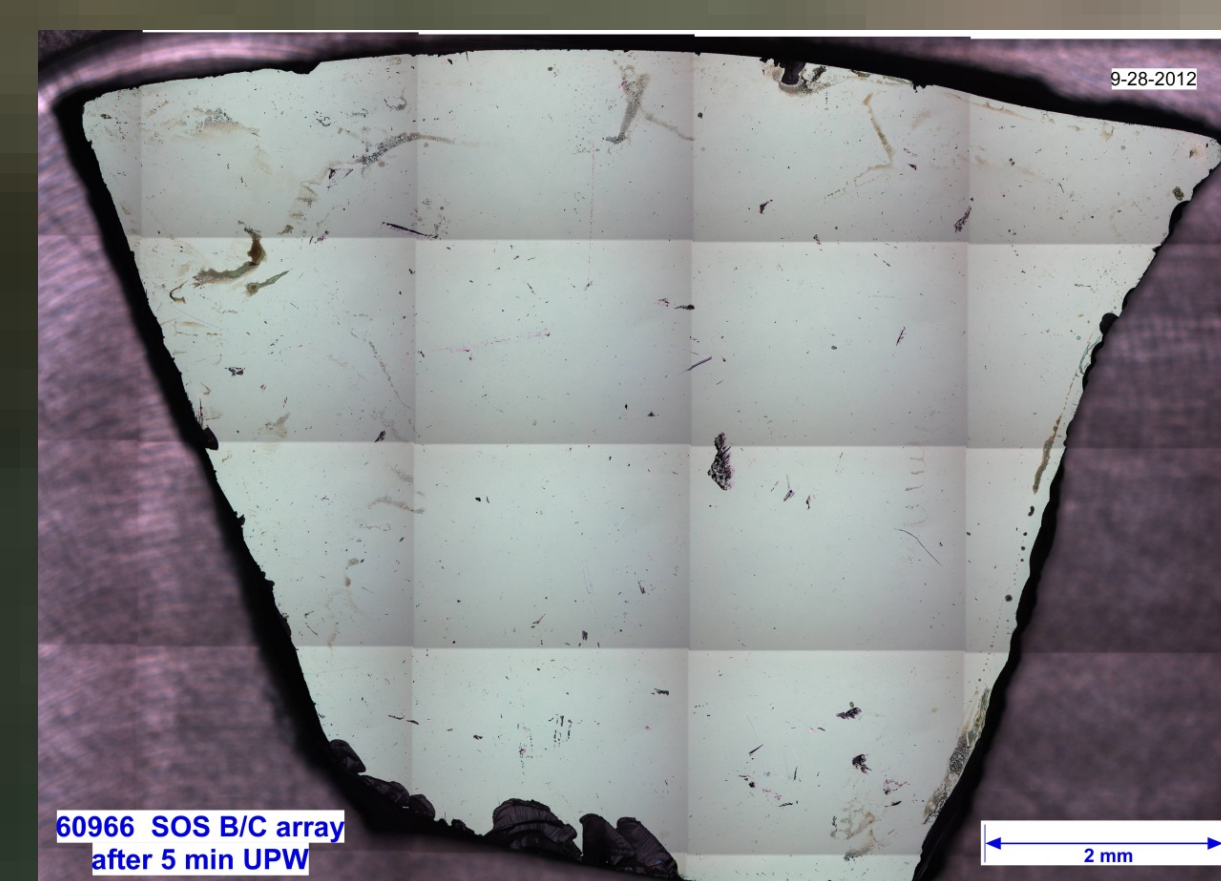
### 60966 Si-FZ B/C array

First image: Sample was exposed to UPW cleaning, CO<sub>2</sub> snow cleaning, HCL/HF cleaning, HNO<sub>3</sub> cleaning, and TRXRF analyses.



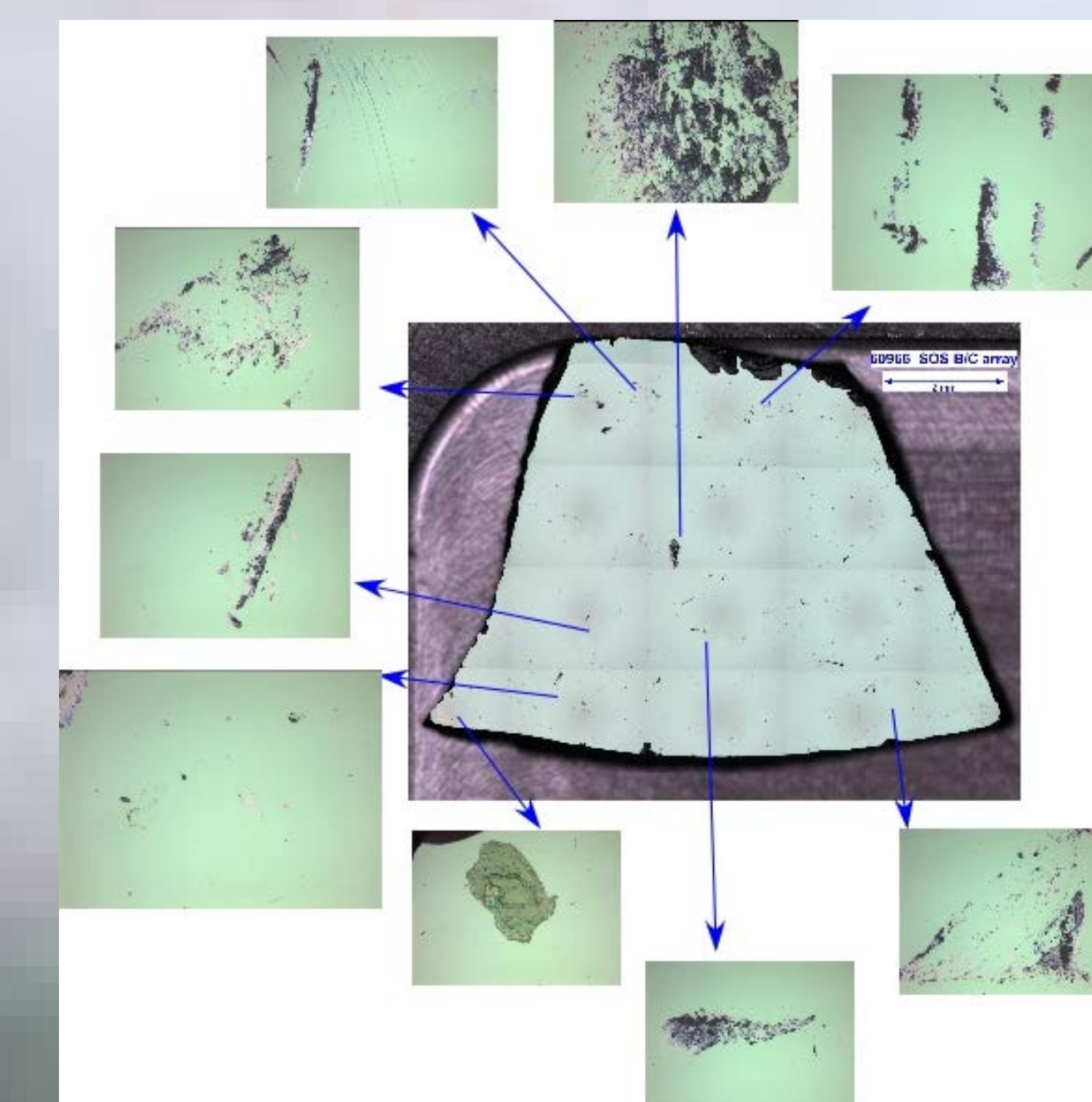
First

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



Then

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.



Final