Issue: Summer 2019

NanoScope Services
FIB Technology Made Easy

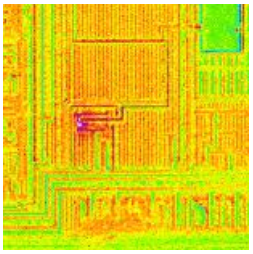
New AFM and Thermal imaging, complementing our inspection and analysis options

Here are some examples of our new services, and how they complement our existing imaging and non-destructive analysis. There is a quick guide to the specific advantages of each technique to show how your FA, NPI or development project can benefit.

New AFM capability for rapid turn, high resolution surface analysis with repeatable calibration protocols. Ideal for uncoated devices and samples with very shallow features, or for high precision layer/feature size qualification - can be extended with FIB engineered tips and surfaces too.

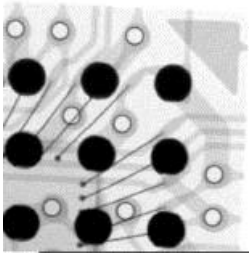
Image of an SRAM structure. Image courtesy of Dr Filip Gucmann, University of Bristol

New high resolution thermal imaging allows specific locations using higher than expected current to be quickly located. Extreme temperature sensitivity can be coupled with FIB nano-surgery to add/remove node branches and localise abnormal circuit symptoms. Power rails and tiles can be removed using FIB in some cases also.



Delta R image of a voltage regulator using <0.5uA more current than expected (fail state).

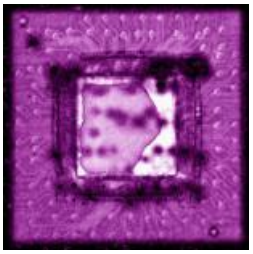
These new techniques compliment our existing surface and 3D imaging/non destructuve analysis too...



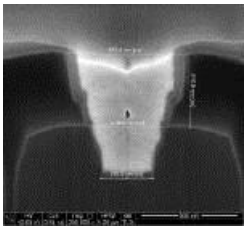
X-ray imaging - normal or tilted, gives terrific non-destructive data about the internal structure of a device, its bonding, leads and connections. Very effective on board structures and solder connections.

Top down (normal) X-ray image of the corner of a BGA packaged plastic part showing Al bonding and copper pillars.

Acoustic Microscopy (CSAM) shows up post-reliability-test die surface voiding changes, and die attach fails. Can also be used to detect/ review adhesive thickness and other packaging parameters and failure modes. Used to best effect as a 'before and after' check.



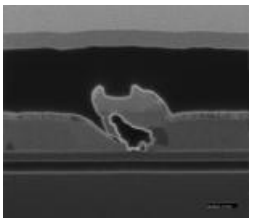
Acoustic microscopy scan of a BGA packaged part with die attach delamination visible.



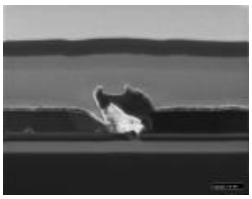
XHR FEG SEM - Sub 1nm imaging at <15kV with advanced Scanning Electron Microscopy. High resolution imaging without needing (S)TEM or advanced sample prep. A range of detectors can be used to optimise sample data and when combined with FIB sections is very effective for small geometry metrology.

Secondary electron image of a Tungsten plug with metrology

SIM SE- scanning ion microscopy (w/secondary electron imaging) - sub 5nm imaging without coating - true surface imaging with strong materials contrast, ion channelling (grains) and voltage contrast included (track continuity). SIM can be rapidly used where SEM struggles, and can remove carbon/oxide/contaminant coatings at the same time. Has a huge depth of field for 3D structures as well.



Ion beam secondary electron image of a FIB microsection through an embedded insulative defect.

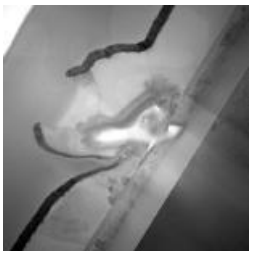


SIM SI (w/secondary ion imaging) - all the benefits of SIM SE imaging but with less sample charge sensitivity, more materials information and no voltage contrast. Great for understanding insulative defects and can be used with charge neutralisation on fully insultive samples.

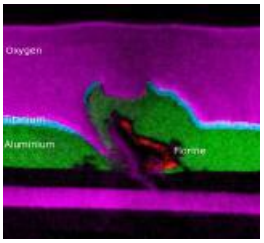
Very fast compared to SEM BSE imaging and has a huge depth of field too.

Ion beam secondary ion image of the same FIB micro-section through an embedded insulative defect.

200kV FEG (S)TEM bright field, dark field and transmission electron images. These can reveal the best (highest magnification/resolution even lattice fringes) metrology data whatever imaging contrast your materials offer. If using our customised FIBxTEM sections, this can be applied at the exact location, with a large viewing area and with the least preparation artefacts.



TEM SE image of a FIB prepared TEM section through the same embedded insulative defect.



200kV TEM EDS Mapping gives high resolution elemental maps with a low interaction volume providing an optimised pixel size. The exact placement and custom orientation of our FIBxTEM sections produces the clearest picture of which-material-is-where at the smallest geometries. In this case from below the surface of the sample.

TEM EDS elemental map of the same FIB micro-section through an embedded insulative defect.

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