Automated acquisition of large areas at high resolution with SEM/TEM/STEM/EDS correlative imaging

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The need for large area correlative imaging at high resolution has increased over the recent years, not only to retrieve statistically meaningful data in nanoparticles/catalysis samples, but also to analyze large lamellas, for example from aerospace and aviation components [1]. Acquiring images and chemical information from large field-of-views at high resolution, until recently, required ***manual*** tiling and stitching which is tedious and time-consuming.

In this contribution we present ***automated*** large area (Scanning) Transmission Electron Microscope (S/TEM) imaging and Energy Dispersive X-ray (EDX) Spectrum Imaging results by using automated software (MAPS^{TM}) that is not only able to acquire this data fully automated but also provides correlation between imaging platforms or any imported reference images (from e.g. Light Microscope, SEM, MicroCT, DualBeam, S/TEM).

The automated software acquires multiple images from the sample automatically by means of shifting the compustage, changing magnification and subsequently, focusing, aligning and stitching all the images to create one final image, in which users can, with a single mouse roll, zoom in and out to regions of interests.

One of the examples we will show is the analysis of 30-micron superficial layer of shot-peened, aerospace grade Aluminum alloy (A7075-T651) (fig. 1a). The very large 30 x 70 µm lamellae was prepared using a Plasma Xe+ Focused Ion Beam - Scanning Electron Microscope (PFIB-SEM). The imaging and chemical analysis was done on a Talos^{TM} F200X S/TEM (fig. 1b). The short-peening greatly improves the fatigue life of aerospace and aviation components by introducing compressive residual stress into the materials surface. Image correlation between large (micro)cracks and dislocations is essential to understand the materials properties.

Additionally the so-called Avizo Bridge software can be used to do online processing on the S/TEM for on-the-fly processing results & statistics.

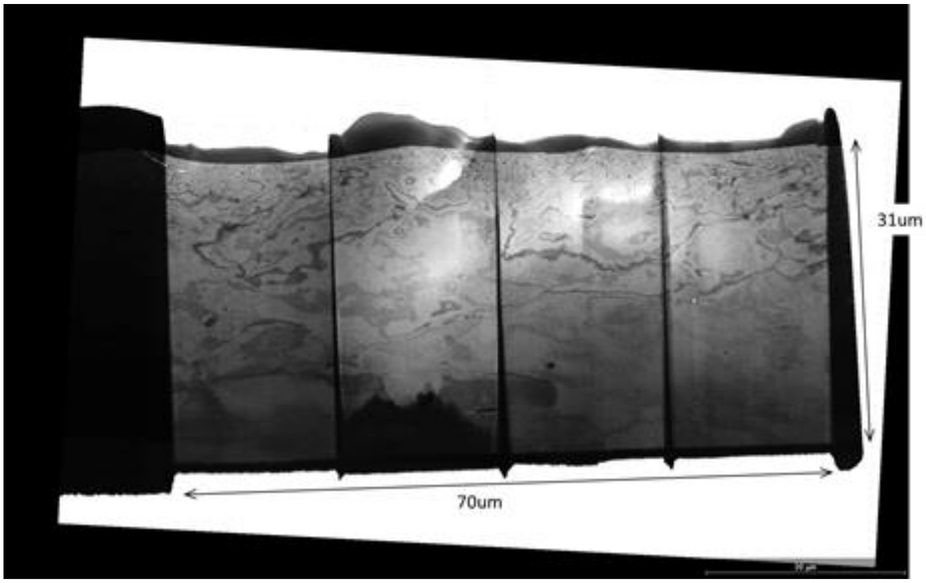

Figure 1a: Large area Transmission Electron Microscope image of 30-micron superficial layer of shot-peened, aerospace grade Aluminum alloy (A7075-T651).) Sample courtesy: The University of Manchester, UK and University of Trento, Italy.

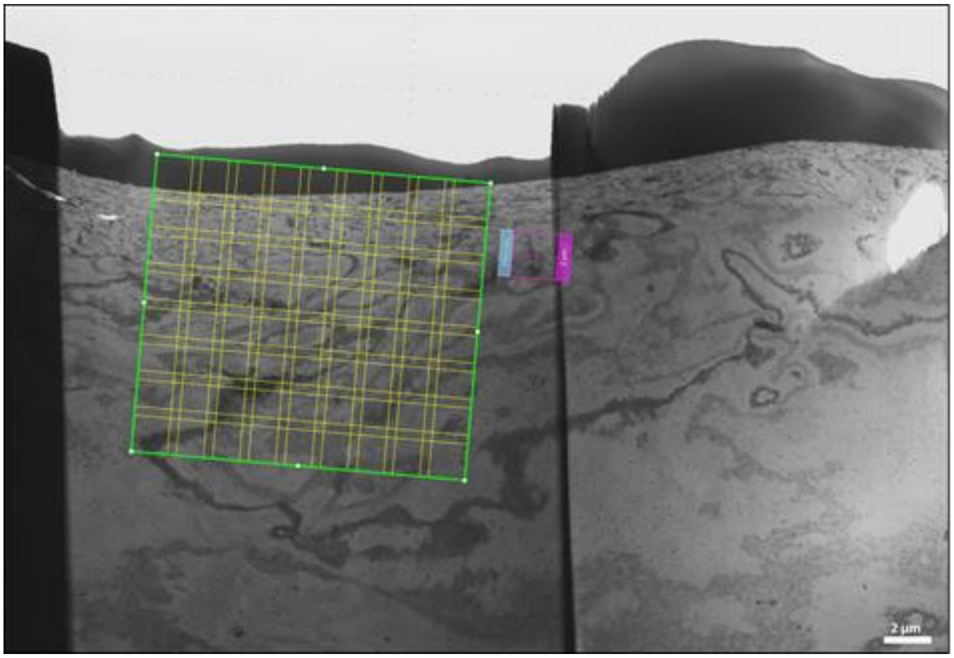

Figure 1b: higher magnification image of figure 1a, showing an example of overlaid tiles for automated high resolution acquisition. Individual tiles can be setup to contain even more tiles at higher magnifications to increase the resolution.

Reference: [1] Cover story, November 2017, Microscopy and Analysis, Nanotechnology and Electron Microscopy, issue 152.