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A to Z of Technology – Software for Better Results with Faster Sensors

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There has been a revolution in the capabilities of X-ray Analysis and EBSD hardware over the past 15 years. Data rates and sensitivity have changed massively over this time with the introduction of large area SDD detectors and fast/sensitive EBSD cameras. Users now can collect data to solve real problems in seconds or minutes, where hours or days were required before. These advances can also be used to collect data in much higher detail, or to investigate analysis problems and samples routinely, that were previously beyond the reach of these techniques. However, the software tools have hardly changed during this time, and may now be the limiting factor holding back development of productivity and flexibility beyond traditional microanalysis.

If we no longer consider spectrum acquisition times of 2 minutes and think instead about an acquisition that takes 2 seconds, what are the consequences? For routine analysis this means a change from a sequential approach to qualitative and quantitative analysis, with the use of manual tools such as markers, to an integrated and automated approach. Data processing must rely on automatic element identification routines that can choose from the widest range of elements possible. This needs to be combined with robust quantitative analysis algorithms that work in as many situations as possible. The result needs to produce a dependable picture of the sample, displayed to the user within the time of the acquisition, allowing the user to decide whether to investigate a surprising result further, e-mail it to a colleague, or search for new information from other areas.

New acquisition speeds mean X-ray mapping techniques can be used to give in-depth 2 dimensional views in the time that used to be needed to collect an X-ray spectrum. To be useful, over this timescale, these techniques need to identify constituent elements and clearly display the chemistry of the area studied, without the requirement for sample pre-knowledge. All necessary data must be collected using spectral mapping methods, with data reduction in real-time to produce a single picture of the data that can be used to easily report the key results to experts or non-experts alike. These approaches also promise the increased capability to investigate features and structures at differing image scales, through fast collection and processing of extremely high resolution data-sets (Fig. 1).

EBSD is now proven to be a useful microanalysis technique. The requirement now is to make it more accessible and robust for routine applications and multi-user environments. The focus therefore needs to shift from data acquisition to the result (Fig. 2), and requires the capability to repeatedly perform routine analysis with confidence. For productivity, users should be able to collect data over a full range of working distances and detector positions without changing the calibration settings and automated tools should ensure that pattern quality is always optimized. The potential applications for EBSD will continue to increase as sophisticated software tools are developed to increase the flexibility and practicability of the technique so that successful analysis can be achieved even on challenging samples and at lower kV.

The integration of EBSD and X-ray Analysis is a natural progression of these developments especially now that data can be collected using both techniques in similar time frames. To take full advantage of this requires a complete integration of the two techniques without compromise. High resolution data should be collected simultaneously with no loss of performance or speed and X-ray and EBSD maps need to be accurately processed and displayed in real time to show the correct detail in the sample. The integrated data can then be accessed for re-analysis and additional sample investigation. The combined power of large area SDDs and modern EBSD detectors can then offer a new dimension for materials characterization.

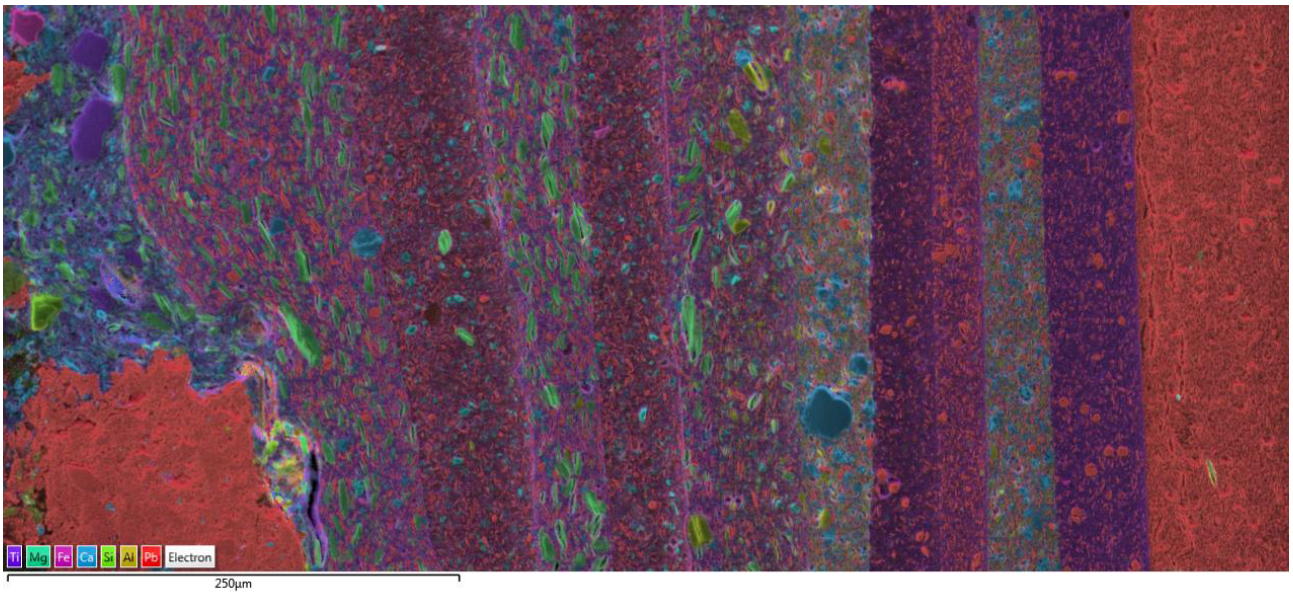

Fig. 1. Layer map of paint sample, built from ultra-high resolution "SmartMap" spectral map data

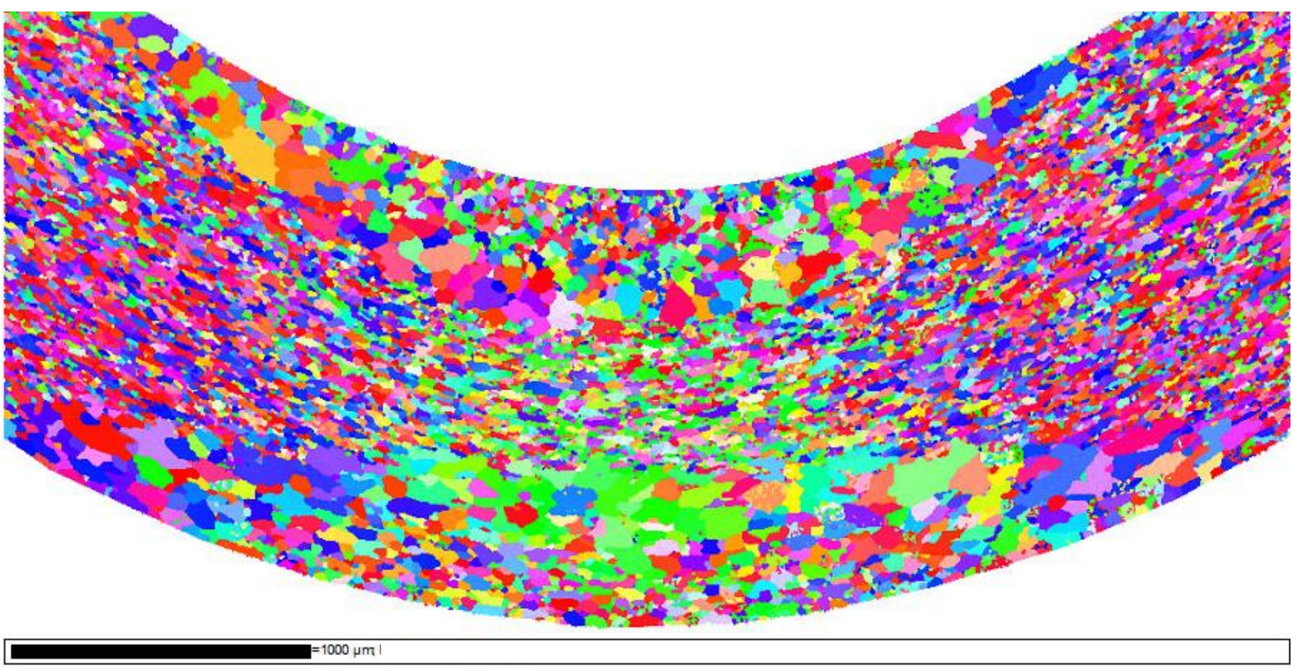

Fig. 2. Inverse pole figure map from an ultra-high resolution data set collected from a bent steel.

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