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Rapid EDS Element Images for Image Analysis – A New Application of the XFlash® X-ray Detector Technology at the Scanning Electron Microscope

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One trend in electron microscopy is the combination of various analysis methods and techniques in one single instrument in order to obtain the most comprehensive information on the structure, composition and features of the material to be examined. The RÖNTEC XFlash® X-ray detector technology was originally developed for EDX microanalysis at the SEM, however, it also creates room for new applications. One example is the generation of extremely fast, high quality color compositional X-ray images that will complement other analysis methods and thus provide new aspects in the examination of specimens.

Until recently, EDS element maps were acquired with widely used Si(Li) detectors. These images not only lack image resolution, contrast and sharpness, moreover, their acquisition is extremely slow. While the acquisition of a 256x256 pixel size Si(Li) map often requires half an hour [1], the XFlash® technology produces 1024x768 pixel images within less than 10 minutes. The quality of these images is comparable to backscattered or secondary electron images at the SEM.

The speed and quality of X-ray element imaging is based on the high countrate capability of the XFlash® detector. With a processing capability of up to 1 million counts per second this technology is more than 10 times faster than conventional EDS mapping procedures. Furthermore, because of its integrated SDD detector chip it does not require liquid nitrogen for operation, resulting in a very compact, lightweight detector [2].

XFlash® element images allow meaningful conclusions on the structure and composition of materials. Different color gradients, for example, reveal phases within one alloy. Due to the image clarity, special sections can be singled out, measured and explored in greater detail (e.g. particle analysis). Unlike common maps acquired with Si(Li) detectors, these images allow the application of commercially available image analysis programs. The color information stems directly from the characteristic X-rays that correspond to the individual chemical elements in the specimen. Therefore these images do not require post coloring or image enhancement preceding the analysis and errors due to image editing are less likely. With good contrast, color intensity, great sharpness of edges, and the low distortion, XFlash® element images fulfil the requirements for a new imaging capability at the SEM.

XFlash® element images are particularly useful for the examination of composite materials by showing the element distribution, grain boundaries or different phases. Thus, microstructures, mechanical properties and quality of materials can be more easily determined. Commercial applications range from routine quality control procedures, to wear research or the quick investigation of material defects. Furthermore, the introduction of color into SEM applications result in easier orientation during the measurement.

The new XFlash® technology with its capability of rapid EDS element imaging holds a great promise for comprehensive microanalysis in the future

References:

[1.] M. Procop: Fast Elemental Mapping in Materials, Microscopy and Analysis 1 (2002) 17
[2.] J. Gannon et al., A new methodology for element imaging in the scanning electron microscope, Microsc. Microanal. 7 (Suppl 2: Proceedings) 884

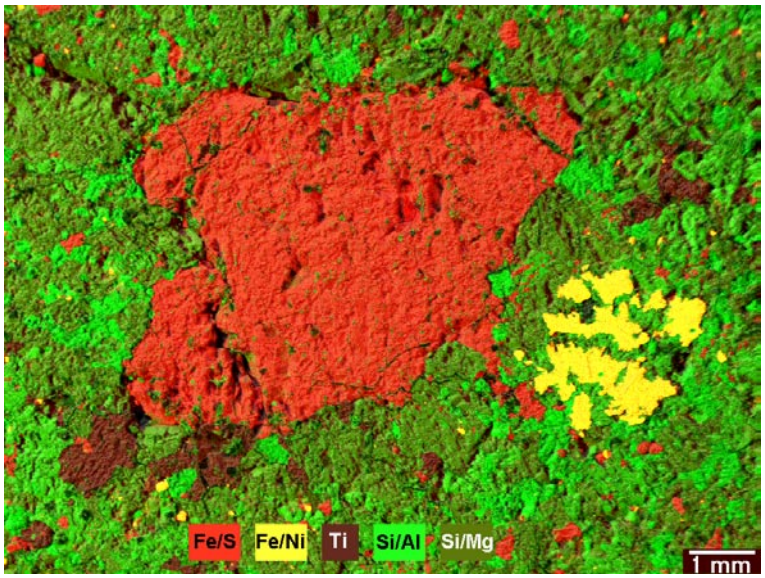
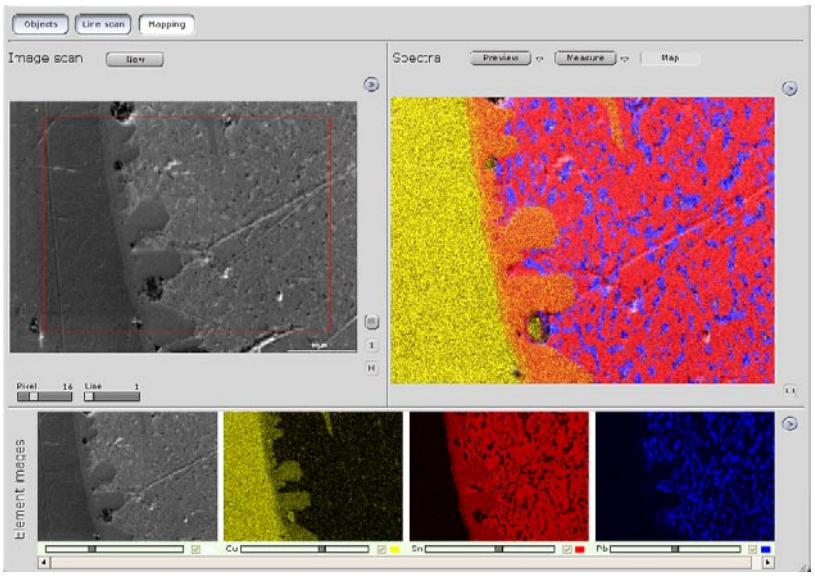


Figure1 (above). Mineral: high contrast image, clear outlines of structures, brilliant colors. Acquisition time: 15 minutes (1024x768 pixels).

All colors (here presented in grayscale) become more apparent in the original color image.

Figure 2 (below). X-ray compositional color scan image of a solder. Acquisition time for single element maps and mixed image: 15 seconds.



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