APPLICATIONS OF FULL FIELD MICRO-XRF ANALYSIS USING A PROTOTYPE X-RAY COLOUR CAMERA

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Scanning X-ray fluorescence (XRF) microanalysis is a well-established technique to provide two- or three-dimensional information on the elemental distributions in the probed sample volume down to trace level detection limits. The method is based on the use of an X-ray micro/nanobeam to perform 2D/3D raster scans on the investigated samples, typically collecting the XRF point spectra using single-element energy-dispersive detectors.

During the last two decades there has been a considerable effort to move from compact single element X-ray detectors to spatially resolving area detectors. Most of these detection systems can measure spatial information, i.e. the intensity at a pixel, only. The advantage of the tested X-ray CCD camera prototype (IFG X-ray Colour Camera) lies in its ability to record spatially and spectrally resolved images simultaneously by measuring the position of single photons and their energy in the energy range of 3-40 keV [1,2]. The combination offers new applications in X-ray microanalysis, especially with respect to 2D/3D elemental imaging, including X-ray fluorescence microtomography.

Applications of a novel full-field X-ray fluorescence (XRF) imaging approach is presented using the above mentioned unique two-dimensional energy-dispersive detection system for non-destructive elemental microanalysis. The approach will likely represent a new stage of development in 2D/3D elemental imaging with a broad range of applications in life and environmental science, geo-, cosmochemistry, archaeology, etc. Preliminary experiments using the IFG X-ray Colour Camera prototype at the synchrotron radiation source BESSY-II BAM-line demonstrated that trace element detection limits can be achieved in imaging mode for transition metals using a 25 μm pinhole detector optics in case of biological samples. These results are extremely encouraging with respect to applying this novel imaging detector for sensitive 2D/3D elemental analysis in biological model organisms, which is the main application presented.

References

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