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A novel X-ray Color Camera for fast chemical mapping of 3-dimensional objects

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Spatially resolved X-ray fluorescence (XRF) mappings are till now only possible by using μ-XRF setups which combine microfocus X-ray sources with polycapillary optics to decrease the spotsize down to the 10μm-range. The X-ray spectrum of each location is then analyzed by a classical EDX-detector. Therefore, a chemical mapping of a whole object is typically done measuring each point separately by moving the sample step by step and also refocusing each point if the sample is uneven which is a time consuming procedure.

But the actual development of modern detectors gives now the opportunity to overcome this limitation of spatially resolved XRF. Especially the new pnCCD detector (developed by PNSensor GmbH, Munich) with its image area of 12,7mm x 12,7mm and a 264x264 pixel resolution in the X-ray color camera "SLcam$^?$" of the IFG Institute for Scientific Instruments GmbH, Berlin allows for the first time to measure locally resolved energy spectra for each pixel [(1,2)]. A unique advantage of this novel X-ray color camera is thus the possibility to perform a direct high resolution full-field energy-resolved X-ray imaging of the sample surface (FF-XRF) if a X-ray optic is mounted in front of the detector. Using different types of such X-ray polycapillary optics with varying magnification it is also possible to simply change the magnification of the camera setup to increase or decrease the local resolution or vice versa the area, which is measured. Details regarding this setup are given in [(1,2)]. This unique advantage of the SLcam$^?$ is a big step forward for efficient chemical characterization of materials and will open completely new possibilities to analyze all kinds of samples not only from archaeological interest but also in all fields of e.g. materials sciences, raw materials and recycling materials.

In our presentation we will show chemical mappings of several kinds of archaeological and non archaeological objects.

For the first time it is now possible to directly get highly resolved "pictures" of the elemental distribution of 3-dimensional objects. Another unique advantage of the SL-cam$^?$is demonstrated by this archaeological object: the almost infinite depth of sharpness, when using a 1:1 polycapillary optic. This gives now the opportunity to analyze 3-dimensional objects without any focusing effort. On the other hand it is also possible to change the area of interest or the local resolution by simply exchanging the polycapillary optics.

Literature:

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