Innovations in EDS microanalysis: New options for mineralogical applications using liquid nitrogen-free silicon drift detectors (SDD)

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Within the last decade, silicon drift detectors (SDD) have become more and more popular in the field of X-ray detection and microanalysis. The main characteristic of the SDDs is their extremely high pulse load capacity of up to one million counts per second at good or reasonable energy resolution. These properties make a range of innovative analysis options possible, not only high speed mapping but also high performance quantitative analysis.

Ultra-fast element mappings in the megapixel range can be performed up to 10 times faster compared to conventional Si(Li) detectors. HyperMap (PTS: position tagged spectroscopy) creates a database that contains an EDS spectrum for each pixel in addition to the image. This supports offline evaluation and quantification of regions of interest (point and area analyses, line scans) any time after the mapping acquisition. In addition, next to intensity elemental maps, the QMap function displays the element distribution based on the standardless or standards-based quantification results. This mapping option is useful when a correct element distribution can't be displayed either through the presence of elements with overlapping peaks or through different background intensities of heterogeneous matrixes. The Maximum Pixel Spectrum function (Bright and Newbury, 2004) synthesizes a spectrum out of the Hypermap data, consisting of the highest count level found in each spectrum channel. Here, trace elements which occur in only one pixel can be detected qualitatively. Areas of similar composition can easily be made visible with Autophase, an automatic or user-controlled phase detection system.

This paper presents mineralogical applications of the QUANTAX EDS system with SDD using the options described above: (1) Fast detection of mineral phases and discrimination between quartz, dolomite and sodium feldspar as well as calcite and potassium feldspar with high-speed elemental maps. (2) Drill core analysis using high resolution (4096x3072 pixel) elemental maps. (3) Detection of trace elements and quantification of the mineral phase monazite in granite. (4) Phase analysis of granite based on the spectroscopic composition.

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References

Bright DS, Newbury DE (2004) Maximum pixel spectrum: a new tool for detecting and recovering rare, unanticipated features from spectrum image data cubes. J Microsc 216: 186-193.

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