MICRO X-RAY FLUORESCENCE SPECTROMETER FOR LIGHT ELEMENT ANALYSIS WITH LOW POWER TUBE EXCITATION

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Micro X-ray Fluorescence (Micro-XRF) is a well established tool to determine the spatial distribution of major, minor and trace elements in a sample. It is widely used to investigate samples from different fields (biology, geology, life science, etc.). The method is non-destructive, requires little sample preparation and allows simultaneous multi-element detection.

Most available Micro-XRF spectrometers operate in air which does not allow the analysis of low-Z elements ($Z \leq 14$). To extend the analytical range down to light elements ($Z \geq 6$) a special micro-XRF spectrometer has been designed.

This system consists of an air cooled low power x-ray tube (50W) with molybdenum anode and a thin (70µm) exit window. An optional beam filter can be inserted to reduce spectral background. The beam is focused onto the sample using a polycapillary x-ray optics, offering a focal spot of about 30µm FWHM. Characteristic X-rays from the sample are detected by means of a Si(Li) detector with ultra thin window. An optical microscope attached to a high resolution CCD camera is used to control the measurement position. Sample positioning and scanning is performed using a motorised xyz sample stage.

The new spectrometer offers improved excitation and detection conditions, necessary for light element analysis. The thin window of the x-ray tube allows both, the molybdenum L-lines and K-lines to sufficiently excite the sample over a wide energy range. Detection of the low energetic characteristic radiation is possible due to the ultra thin window of the detector. To eliminate absorption of the exciting and fluorescent radiation in air the system operates under vacuum condition. Sample scanning is automated and controlled by specialized computer software developed for this spectrometer. Access to the spectrometer will be available for external users through the transnational programme of a running EC project (ANNA, www.i3-anna.org).

In this work the spectrometer design as well as first test measurements on different samples, such as artificially created elemental patterns of light elements and human bone will be presented.