Dual Energy Band Excitation for High Z and Low Z Elements by one Multilayer as Spectral Modifier

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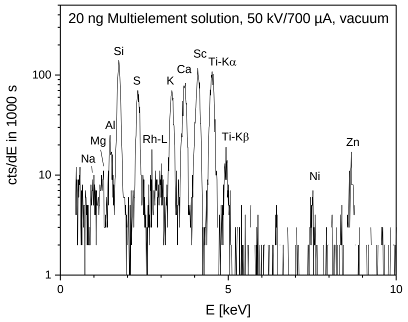
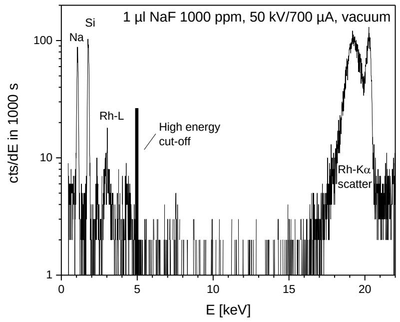
To efficiently excite a large number of elements ranging from carbon to uranium two different excitation energies are favorable, e.g. Cr-Kα for the light element range and Rh-Kα for higher Z elements. A TXRF vacuum chamber offering these two excitation conditions using two separate X-ray tubes is described in [1]. The spectrometer employs a silicon drift detector (SDD) with a 300 nm ultra-thin polymer window (UTW) including a magnetic trap, which acts as electron catcher. The setup allows the detection of both light and heavy elements. Monochromatization is done by an individual multilayer (ML) for each X-ray tube. The ML serves in both cases for the Rh and Cr anode tube as Bragg reflector adjusted to a fixed angle according to the desired energy and the 2d of the ML. Additionally, the ML always acts as a totally reflecting mirror due to its perfect surface quality. This means the reflected beam shows both the characteristic Kα line of the anode material and a low energy spectral distribution caused by the high energy cut-off effect. This idea to modify the spectrum is well-known and described in e.g. [2, 3]. So by intention, it is possible to create a dual energy band for the excitation of both low and high Z elements at a fixed angle of the ML. The Rh-L line series together with the low energy continuum is used for the low Z elements and the Rh-Kα line for the higher Z. The result is that one single X-ray source at one fixed angle can be applied for the excitation of two elemental regions. However, technical precautions have to be made: The beam path from the tube exit window to the sample inside the vacuum chamber must be evacuated to avoid air absorption. Results are shown for the technical solution of the design including beam path and vacuum chamber. Using an SDD with 8 µm Be window excellent results down to Na (Z = 11) were obtained. Measurements were performed in total reflection geometry (TXRF). Detection limits and sensitivities, calculated from SRMs and multielement standards, will be shown.





[1] P. Wobrauschek et. al., Rev Sci Instr 86, 2015, 083105.

[2] J. Knoth, H. Schwenke, Fresenius Z Anal Chem 301, 1980, 7-9.

[3] P. Wobrauschek, H. Aiginger, Fresenius Z Anal Chem 324, 1986, 865-874.