Element characterization of mineralogical micro samples by means of total reflection X-ray fluorescence (TXRF) spectroscopy

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Total reflection X-ray fluorescence (TXRF) TXRF spectroscopy is a special type of energy dispersive XRF spectroscopy. In TXRF the samples are prepared as a thin film on a reflective carrier and excited under a flat angle with the detector placed closely above the sample at a very short distance. The major benefits of this optics are that due to the thin film preparation matrix effects are negligible and, thus, quantification can be performed by simple internal standardization without the need for complicated calibration procedures. The flat angle excitation and close coupling of the detector lead to extremely low background signals and a high fluorescence yield. With this, TXRF is an analytical method for the element determination in the concentration range of wt.-% down to the sub-mg/kg, respectively mg/l range, which becomes increasingly established in medicine (1), environmental research (2) and numerous other application fields (3).

However, in the field of geochemical and mineralogical analysis no applications were known so far, in which TXRF offers benefits compared to established methods like common XRF or atomic spectroscopy methods.

In this presentation an application is presented, which takes advantage of the fact that by means of TXRF spectroscopy micro samples in the μg-range can be analyzed without the need for external calibration procedures.

Two application examples will be presented: The determination of the element distribution (Mg – U) in meteorite chondrules and heavy mineral separates. The first one was applied for the characterization and classification of chondrule samples. The non-destructive determination of the element distribution in the mineral separates was found to be an ideal tool for choosing the right samples with regard to further investigations, e.g. by means of laser-ablation coupled spectroscopy methods.

References

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