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Review of Complete Reflection X-Ray Fluorescence Spectroscopy

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Abstract

Total contemplation Due to its low detection limit and low energy spectrum background count, X-ray fluorescence (TXRF) is frequently employed in trace element, ultra-trace element, and multi-element analysis. This article examines the creation and use of TXRF. Three stages can be identified in the development of TXRF. Total reflection was first introduced in 1971, and from that point until the publication of the first monograph on TXRF in 1997, it was primarily used for single element analysis and theoretical research. From 1998 to 2017, TXRF underwent rapid development, going from single element analysis to multi-element simultaneous analysis, with its primary applications being in the fields of geology, environment, chemistry, and medicine. The third stage is based on extensive application. On its fundamental principles, enhance the instrument's functionality, and produce more precise analysis findings.

Keywords: Elemental analysis; Critical angle; X-ray total reflection

Introduction

The detector records very few primary rays, which significantly lowers the background count in the energy spectrum and boosts detection effectiveness. To accomplish the goal of trace element analysis, the characteristic peaks in the analysis of ultra-trace elements [1-3] will not be obscured by the background count because of the extremely low background count. The XRF and TXRF spectrum are displayed in Table 1. The background interference of XRF is seen in the figure to be substantially stronger than that of TXRF. As a result, TXRF has the following qualities [4].

High sensitivity; low detection limit; lack of matrix effect; simplicity of the internal standard method's quantitative analysis; small sample size (as low as ng to ug depending on sample preparation); and high sensitivity.

The interaction of primary X-rays with substances to produce distinctive X-rays and evaluate the characteristic X-rays is the basis of the TXRF X-ray fluorescence analysis principle [3]. Table 1 illustrates the process used to produce distinctive X-rays. Quantizing the energy state of electrons in atoms, characteristic X-rays produced by ionisation or excitation correspond to particular atoms based on their energy [5]. Both a qualitative and a quantitative analysis of the elements is possible using Moseley's law [6] and the Sheman equation. Total reflection reduces the background count significantly because the primary rays are released in the incident direction and can rarely be detected by the detector. Wide incident and wide reflected waves interfere [3], creating a standing wave that can arise in thin samples on the sample stage and the sample stage's total reflection surface. The schematic of total reflection and the field creation of standing waves is shown in Table 1.

Materials and Methods

TXRF development and application

TXRF's early development

Since Yoneda [1-3] used total reflection technique to XRF for the first time in 1971, they have been able to identify uranium in saltwater, iron in blood, and rare earth elements in hot spring water. Theoretical underpinnings and experimental settings were later examined. Wobrauschek conducted a doctoral thesis on the issue in Vienna, Austria [14], and he and Aiginger reported detection limits of nanograms [1-5] [1-6]. Knoth and Schwenke discovered element evidence at the ppb level at Geesthacht, Germany, which is close to Hamburg [1-7] [1-8]. Following 1980, a wide range of uses encouraged a burgeoning interest, leading to a rise in the number of instruments in use to about 200 globally. The first total reflection X-ray fluorescence spectrometer for commercial use was successfully created in 1981 by the West German Rich Seifer Corporation. The TXRF instrument has since been rapidly developed and enhanced in both development and application. Several TXRF lectures have been held abroad since 1984 [1-9]. The Institute of High Energy Physics [1], the Institute of Modern Physics [2], and the Chinese Academy of Atomic Energy have led China in the creation of TXRF analysis equipment as well as the study and promotion of analysis techniques since the 1990s.

Table 1: TXRF early development goes through numerous significant phases.

Time	Representatives	Main work
1971	Yoneda Y, Horiuchi T	First proposed to apply total reflection technology to XRF
1978	Knoth, J. and Schwenke, H	Found element traces on the ppb-level
1981	Rich Seifer West Germany	Successfully developed the first commercial total reflection X-ray fluorescence spectrometer
1983	Becker	Studied the relationship between fluorescence intensity and angle below the critical angle
1986	Iida, A., Yoshinaga, A	Apply synchrotron radiation to TXRF
1991	Wobrauschek, Aiginger, Schwenke, and Knoth	Won the distinguished Bunsen?Kirchhoff Prize for the development of TXRF
1997	Klockenkamper	Publication of the first monograph on TXRF

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Conclusion

With the initial use of total reflection technology for XRF in 1971, 50 years have passed. In this time, TXRF has advanced quickly. The background brought on by scattering has been eliminated using XRF, allowing for the analysis of ultra-trace components. It addresses the issue of multiple measurements.

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We can successfully complete the paper with the aid of our peers and professors.

Competing Interest

According to the authors, they have no competing interests that would prevent this study from being published.

References

1. Bosso ST, Enzweiler J (2002) Evaluation of heavy metal removal from aqueous solution onto scolecite. Water research 36:4795-4800.
2. Lipschutz ME, Wolf SF, Hanchar JM, Culp FB (2003) Geochemical and cosmochemical materials. Analytical chemistry 75:2797-2811.
3. Abdelgadir E (2012) Exploring Barriers to the Utilization of Mental Health Services at the Policy and Facility Levels in Khartoum State Sudan. University of Washington.
4. Abbo C (2011) Profiles and outcome of traditional healing practices for severe mental illnesses in two districts of Eastern Uganda. Global health action 4:7117.
5. Farzaei MH, Bayrami Z, Farzaei F, Aneva I, Das SK, et al. (2020) Poisoning by Medical Plants. Arch Iran Med 23:117-127.
6. Bnouham M, Merhfour FZ, Elachoui M, Legssyer A, Mekhfi H, et al. (2006) Toxic effects of some medicinal plants used in Moroccan traditional medicine. Moroccan J Biol 2: 21-30.
7. Kane JA, Kane SP, Jain S (1995) Hepatitis induced by traditional Chinese herbs; possible toxic components. Gut 36:146-7.
8. Woo CSJ, Lau JSH El-Nezami (2012) Herbal Medicine: Toxicity and Recent Trends in Assessing Their Potential Toxic Effects. Advances in Botanical Research 62: 365-384.
9. Hettipathirana TD, Grey NA, Naidu R (2004) Analysis of silicates using wavelength-dispersive X-ray fluorescence spectrometry for major elements: effects of loss elimination and catch-weights. X-ray Spectrometry 33:117-123.