

Total-reflection X-ray fluorescence with a brilliant undulator X-ray source

Kenji Sakurai, Chiya Numako,^{*} Hiromi Eba, Motohiro Suzuki,^{**} Katsuaki Inoue^{**} and
Naoto Yagi^{**}

National Research Institute for Metals, 1-2-1, Sengen, Tsukuba, Ibaraki 305-0047, Japan

^{}University of Tokushima, 1-1, Minami-Josanjima, Tokushima 770-8502, Japan*

*^{**}SPring-8, 1-1-1, Kouto, Mikazuki, Sayo-gun, Hyogo 679-5198, Japan*

Total-reflection X-ray fluorescence (TXRF) is a highly sensitive technique for analyzing trace elements, because of the very low background from the sample support [1]. Use of 3rd-generation synchrotron X-ray source could further enhance the detection power [2, 3]. However, while such high sensitivity permits the detection of signals from trace elements of interest, it also means that one can observe weak parasitic X-rays as well. If the sample surface becomes even slightly contaminated, owing to air particulates near the beamline, X-ray fluorescence lines of iron, zinc, copper, nickel, chromium, and titanium can be observed even for a blank sample. Another critical problem is the low-energy-side tail of the scattering X-rays, which ultimately restricts the detection capability of the technique using a TXRF spectrometer based on a Si(Li) detector.

The present paper describes our experiments with brilliant undulator X-ray beams at BL39XU and BL40XU, at the SPring-8, Harima, Japan. The emphasis is on the development of instruments to analyze a drop let of 0.1 μl containing trace elements of ppb level. Although the beamline is not a clean room, we have employed equipment for preparing a clean sample and also for avoiding contamination during transferring the sample into the spectrometer. We will report on the successful detection of the peak from 0.8 ppb selenium in a droplet (absolute amount 80 fg). We will also present the results of recent experiments obtained from a Johansson spectrometer rather than a Si(Li) detector.

References

- [1] R.Klockenkamper, "Total-Reflection X-ray Fluorescence Analysis", John Wiley & Sons, New York (1997); P.Wobrauschek et al., Spectrochim. Acta, B52, 901 (1997).
- [2] L.Ortega, F.Comin, V.Formoso and A.Stierle, J. Synchrotron Rad. 5, 1064 (1998).
- [3] K.Sakurai, H.Eba and S.Goto, Jpn. J. Appl. Phys. Suppl. 38-1, 332 (1999).