QUANTITATIVE ANALYSIS OF NANO-PARTICLE BY XRF

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Recently, μ-area analysis by the XRF technique has gained popularity. The synchrotron radiation source is responsible for the increase in the popularity of μ-XRF analysis. However, most people find it difficult to gain access to the synchrotron radiation facility. On the other hand, the laboratory μ-XRF spectrometers with the capillary lens optics had been developed [1]. The capillary lens can focused X-rays but it cannot monochromatize. Then the background of measurement spectra is higher than using monochromatic X-rays as excitation source.

In this study, a sub μ-XRF spectrometer for the quantitative analysis of nano-particle has been developed for use in laboratories. To enable the use of this system, it is necessary to satisfy the following two conditions: (1) the excitation source must be optional for efficient excitation of the sample and (2) the X-rays must be focused on the sample. An X-ray tube with multi excitation sources has also been developed [2]. In the tube, there are three metals as target, namely, Cr, W, and Rh, on the anode, and each target can be excited sequentially without changing focal spot position. An Einzel lens is applied to the X-ray tube as the electron gun. The operating power of the tube is set to 50 watts (50 kV, 1 mA), and it is cooled by forced. The diameter of the focal spot is 10 μm. As the optics for focusing of X-rays, Johansson type Doubly Curved Crystal (DCC) which is Si(111) and Si(110) crystal have been made according to the monochromatic condition of Cr-Kα, W-Lβ, Rh-Lα and Rh–Kα respectively. A DCC has Johansson focusing geometry along horizontal direction and Von Hamos geometry along vertical direction. Then the effective area of diffraction is almost all surface of crystal. In addition, the focusing efficiency is quite good as compared with Johann geometry. Therefore, the focus size becomes smaller and intensity gain becomes higher. Silicon drift detector (SDD) and superconducting tunnel junctions (STJs) are selected and developed as X-ray detector.

A system composed of an X-ray tube and DCC optics and detectors is used to perform the small particle analysis. In this report, some estimation results of the sub μ-XRF system and capabilities of the system are discussed.

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