Polychromatic Simultaneous WDXRF system for in-house Oxidation State Evaluation

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SHIMADZU Corporation launched a new-type WDXRF system in Japan. The performance of the system and an application will be presented. We have developed a high-stability X-ray fluorescence system using a laboratory-type X-ray tube called "polychromatic simultaneous wavelength dispersive X-ray fluorescence (PS-WDXRF)"[1,2].

In industrial fields, X-ray fluorescence analysis systems are widely used for both quantitative and qualitative analysis because sample preparation is easy and ultra-high vacuum is not required. XRF is a powerful tool for quality control of materials, detection of hazardous materials, and other applications. On the other hand, X-ray fluorescence analysis is limited in terms of chemical state determination because energy shifts are too small (around sub eV) to be detected by conventional wavelength dispersive X-ray fluorescence spectrometers.

SHIMADZU Corporation has developed a powerful system that has a resolution capable of identifying and measuring materials on a chemical state basis; we call this system PS-WDXRF.

The system consists of simple components; an X-ray tube, slit, flat analyzing crystal, and silicon strip detector (SSD). The X-ray dispersed by the crystal is detected by the SSD (The Mythen2 1K detector from DECTRIS), and the detected signals at each channel provide intensity information at different energies. This means that the system simultaneously acquires the X-ray spectra in a certain energy range without the use of a moving goniometer. The absence of moving parts ensures high stability. The optical geometry allows one to clearly distinguish between the Kα1 line and the Kα2 line. We will show that the PS-WDXRF system has a high enough energy resolution and precision to detect X-ray fluorescent chemical shifts.

We will display the capabilities of PS-WDXRF by measuring iron, manganese, cobalt and nickel in cathode materials for Lithium Ion Batteries. This high-stability spectrometer is capable of obtaining chemical state information by resolving chemical shifts. [3,4].

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