

Palm-sized TXRF by 3D printer

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In our laboratory, a portable total reflection X-ray fluorescence(TXRF) spectrometer using a low-power X-ray tube was developed, which achieved a detection limit comparable to spectrometers' using high-power sources [1, 2]. In this study, A palm-sized TXRF spectrometer was assembled by attaching an X-ray tube(Moxtek, 4 watts, tungsten target) and a detector X-123(Amptek) into the holder made by a 3D printer, not by machining. Several spectrometers with different designs were prototyped and the detection limit was evaluated by measuring dilute liquid samples.

Figure 1 shows the computer-aided design(CAD) data of the prototype TXRF spectrometer(115 mm in height, 95 mm in length and 65 mm in width). A 10 μ L aqueous solution of vanadium(10 ppm) was dropped on a quartz optical flat, dried and used as a sample. The measurement was performed by changing the glancing angle, tube voltage, and tube current. Figure 2 shows the spectrum of a dilute liquid sample. By measuring the sample at the optimum glancing angle, tube voltage, and tube current, the detection limit of 175 pg was achieved with the 3D-printed TXRF spectrometer.

[1] S.Kunimura, J.Kawai, *Anal. Chem.* 79, 2007, 2593.

[2] S.Kunimura, D.Watanabe, J.Kawai, *Spectrochim. Acta B.* 64, 2009, 288.

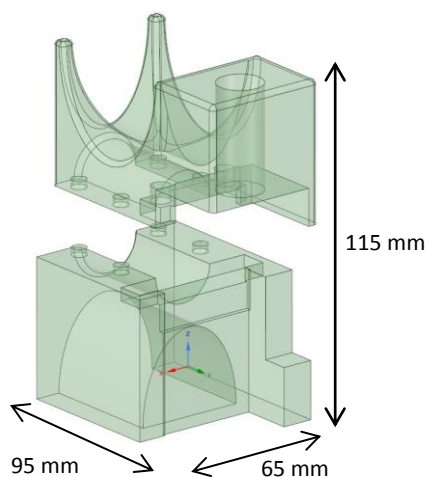


Figure 1:CAD data of TXRF spectrometer

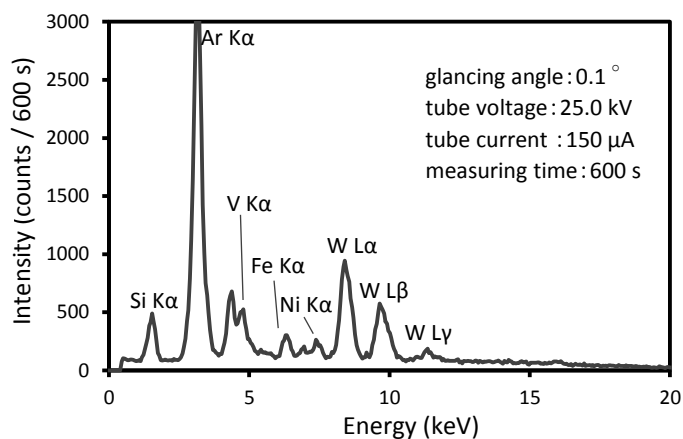


Figure 2:Spectrum of vanadium aqueous solution