DEVELOPMENT OF A PALM-SIZED ELECTRON PROBE X-RAY ANALYZER

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E. Hiro *et al.* developed a palm-top high-energy X-ray source using two single crystals of lithium tantalite ($LiTaO_3$), which is a pyroelectric crystal, as an electron source [1]. The apparatus is consisted of a holed glass tube, two single crystalline $LiTaO_3$ facing to each other, and two Peltier devices. The window on the glass tube is covered with Kapton film, which allows us to observe X-ray through it. The apparatus works in a vacuum of approximately 10^{-2} Torr. The pyroelectric crystals generate voltage as the temperature changes, because of the volume change. Peltier devices are utilized to heat and cool the single crystals of $LiTaO_3$.

From Hiro's report, we in this study have developed a palm-sized electron probe X-ray analyzer by modifying the apparatus. One single crystal of $LiTaO_3$ was replaced with a sample holder which is tilted towards the window to get higher intensity X-ray.

It was shown that the highest X-ray energy of the modified apparatus was 45keV with the power supply of 3V and 0.4A. Characteristic X-rays of copper and zinc were detected when brass was measured. Ti Kα characteristic X-ray was also detected when titanic iron sample was measured. The measuring time was 600 second, and we used a silicon drift detector in both experiments.

The spot size of the modified apparatus is approximately 3mm x 3mm, because of the size of the single crystalline $LiTaO_3$. To do area analysis or elemental mapping in microscopic region, just like commercially available Electron Probe Micro Analyzer (EPMA), the size of the electron probe must be several micrometer diameter. In this study, we tried to set a needle on the single pyroelectric crystal and evaluate the electron spot size.

[1] E. Hiro, T. Yamamoto, J. Kawai: Adv. X-Ray. Chem. Anal., Japan **41**, 195 (2010)

Fig. 1 Modified apparatus.

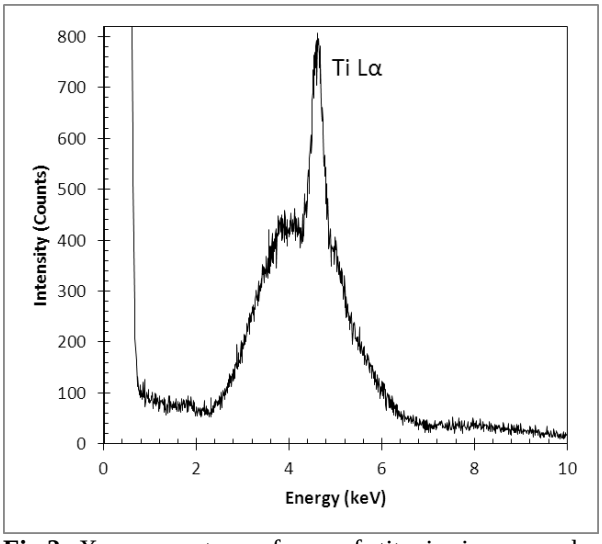

Fig.2 X-ray spectrum from of titanic iron ore by exciting the sample with electrons.