

Development of portable XRF, XRD and XRT, and introduction of 2-dimensional detectors with small pixel size and high energy resolution

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Abstract

Firstly, we will introduce portable hybrid of XRD and XRF, portable XRD with 2-dimensional detector and XRT with 2-dimensional detector. Secondly we will introduce sophisticated 2-dimensional detector with SOI (Silicon on insulator) structure. The purpose that we use 2-dimensional detector for X-ray analysis is to enhance measurement speed by unnecessary of scanning process and to get higher resolution using smaller pixel size and longer optics dimension.

Continuous elemental analysis and structural analysis for the ancient and precious pictures are important to understand historical background for these pictures. We have built hybrid XRD and XRF instrument for structural analysis and elemental analysis simultaneously. The feature of this instrument are hybrid system of XRF and XRD, using max. 60kV copper X-ray tube, SDD detector with high energy resolution, and embedded in storage container with dimension 400mm width, 360mm depth, 160mm height and 18kg weight.

The measurement for these ancient and precious pictures are also required to perform without scanning and traversing during measurement for safety. We have tried to build fixed goniometer XRD with 2-dimensional detector. This instrument has 2 dimensional detector with pixel size 55 x 55 micron, 256 x 256 pixels. We can have higher X-ray intensity by integrating Debye Ring with 2-dimensional detector compared to 1-dimensional detector. The dimension of this instrument are 200mm width, 200mm depth, 200 height and 5kg weight.

2-dimensional detector is also used for X-ray transmission method. The effective area of this 2-dimensional detector is 64mm x 114mm. We will show a few data for food.

Finally, we will introduce two types of 2-dimensional detectors. The first one has 12 micron pixel size and 896 x 1408 pixels. This detector is used for XRD, XRT, XAFS, XRR and WDXRF. The second 2-dimensional detector has dimension with 36 micron pixel size, 608 x 384 pixels and energy resolution 190eV for Mn-Ka (5.90keV). The feature of this 2-dimensional detector has a structure of SOI monolithic, faster data reduction time by reducing parasitic capacitance and better space resolution without bump. Detector and electronics are fabricated on same silicon device without bump.