BL08B2
Hyogo BM

1. Introduction

BL08B2 is one of the beamlines designed by Hyogo prefecture. It is a hard X-ray contract beamline designed for industrial applications. X-ray absorption fine structure (XAFS), X-ray topography, imaging, computed tomography (CT), X-ray diffraction (XRD) and small-angle X-ray scattering (SAXS) measurements can be performed for industrial usage. Over the past few years, research to develop new materials to apply to informatics technologies (materials informatics) has been actively conducted. Since FY2018, the beamline has supported research and development by manufacturing through an integration of synchrotron radiation measurements and informatics technologies. For materials informatics with synchrotron radiation, it is important to prepare large datasets for machine learning. Operando XAFS/XRD and high-throughput SAXS measurements have been conducted with automatic data acquisition. Imaging XAFS and two-dimensional conversion electron yield XAFS (2D-CEY-XAFS) provide large datasets of XAFS spectra, which are used for analysis using machine learning. In addition, XRD and SAXS measurements in the X-ray high-energy region of 25 to 37 keV have been started to collect large datasets in the field of metal materials. In this report, we introduce a new two-dimensional detector installed for high-energy XRD (HE-XRD) and SAXS (HE-SAXS) applications.

2. New two-dimensional detector for high-energy applications

A two-dimensional semiconductor detector with a CdTe sensor (UFXC-9000-CdTe) was installed to improve the detection efficiency of HE-XRD and HE-SAXS measurements (Fig.1). This detector was developed by Rigaku Corporation and has the same sensor circuit as employed in XSPA-500k [1]. UFXC-9000-CdTe is a single-photon-counting hybrid pixel detector with 75 μm pixels with a 750-μm-thick CdTe sensor. The detection area is 1,634 x 1,031 mm^2. This detector also has two thresholds for multiple energy measurements. The specifications of UFXC-9000-CdTe are

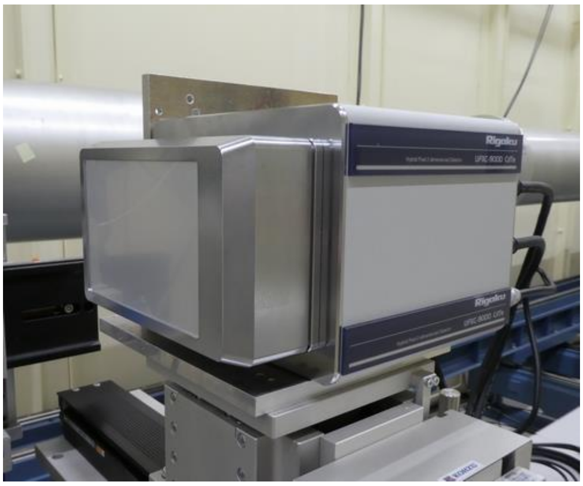

Fig. 1. UFXC-9000-CdTe detector.

Table 1. Specifications of UFXC-9000-CdTe

Active area (H x W) [mm^2]	:	122 x 77.3
Pixel array (H x W)	:	1,634 x 1,031
Pixel size (H x W) [μm^2]	:	75 x 75
Count rate (max.) [ph/s/pixel]	:	2 x 10^6
Energy range [keV]	:	10 ～ 100
Number of energy thresholds	:	2
Frame rate (max.) [Hz]*	:	30
Image bit depth [bits]	:	28
CdTe sensor thickness [μm]	:	750

*for zero dead time

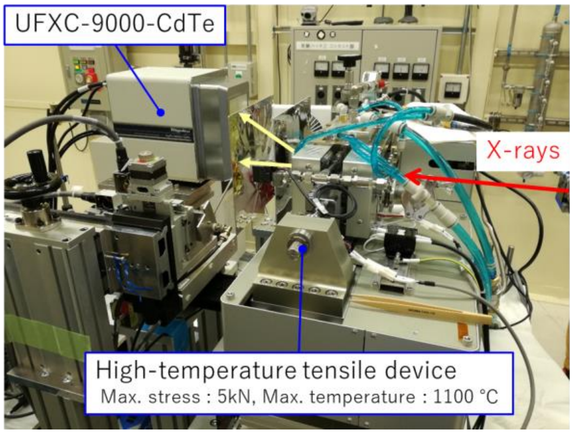

Fig. 2. High-temperature tensile HE-XRD setup at BL08B2.

summarized in Table 1. We are developing an HE-XRD measurement system comprising a combination of a UFXC-9000-CdTe detector and a high-temperature tensile device for metal materials (Fig. 2). We are also preparing high-throughput HE-SAXS measurements using the UFXC-9000-CdTe detector. In the future, large datasets of metal materials collected by HE-XRD and HE-SAXS measurements will be used for analysis using machine learning.

Shigeo Kuwamoto, Yoshimasa Urushihara, and Kazushi Yokoyama

Synchrotron Radiation Research Center, Hyogo Science and Technology Association

Reference:

[1] Nakaye, Y. et al. (2021). *J. Synchrotron Radiat.* **28**, 439–447.