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Press Release

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New Application Report from Rigaku Demonstrates High-speed In-Situ Measurement of Aluminum Melting Process

2D X-ray diffraction measurement of an aluminum plate sample during rapid heating, recorded by in-situ X-ray diffraction, is presented in new report.

February 27, 2019 – The Woodlands, Texas. Rigaku Corporation has published an application report demonstrating the performance of the Rigaku HyPix-3000 hybrid pixel array multi-dimensional detector in the shutterless measurement of 2D X-ray diffraction images.

To capture the moment when materials change, such as during melting, solidification or crystal phase change, by in-situ X-ray diffraction measurement, the acquisition time of the X-ray diffraction images at each temperature needs to be as short as possible. 0D and 1D detectors take time to scan the detector and prepare for operation, while conventional 2D detectors require the X-ray shutter to be opened and closed between counting and reading the data.

Rigaku SmartLab intelligent multipurpose X-ray diffractometer

The HyPix-3000 detector in 2D mode can acquire X-ray diffraction images without scanning the detector. The HyPix-3000 detector has two counters inside. Switching between them allows measurement without dead time and enables shutterless measurement of 2D X-ray diffraction images, which makes it possible to observe rapid changes in crystalline state.

The HyPix-3000 hybrid pixel array detector is available on the new Rigaku SmartLab intelligent multipurpose X-ray diffractometer and, coupled with the new PhotonMax high-flux 9 kW rotating anode X-ray source, allows all applications to

be handled with a single detector, eliminating the need to prepare and switch individual detectors for different applications.

Rigaku Application Note B-XRD 1105 - "*High-speed in-situ measurement of Al metal melting process*" – details the recording of 2D X-ray diffraction images of an aluminum plate sample. Images were recorded every 0.5 seconds while rapidly increasing the temperature at 300˚C/min.

Continuous Debye rings - concentric diffraction rings obtained from polycrystalline thin films - from the aluminum plate were observed at room temperature, revealing that the aluminum crystal had fine grains before heating. During the increase in temperature, the Debye rings became dotted, indicating that grain growth occurred due to heating. When the temperature was increased even further, the Debye rings eventually disappeared due to the melting of the aluminum. It was confirmed that there was a temperature range where the continuity of the Debye rings increased just before melting. This was the moment when the grain boundaries of the aluminum melted and the liquid phase and minute crystal grains coexisted.

More information about X-ray diffraction (XRD) instrumentation from Rigaku is available at https://www.rigaku.com/en/products/xrd

About Rigaku
Since its inception in Japan in 1951, Rigaku has been at the forefront of analytical and industrial instrumentation technology. Rigaku and its subsidiaries form a global group focused on life sciences and general purpose analytical instrumentation. With hundreds of major innovations to its credit, Rigaku and its subsidiary companies are world leaders in the fields of small molecule and protein crystallography, X-ray spectrometry and diffraction, X-ray optics, as well as semiconductor metrology. Rigaku employs over 1,400 people in the manufacture and support of its analytical equipment. Its products are in use in more than 90 countries – supporting research, development, and quality assurance activities. Throughout the world, Rigaku continuously promotes partnerships, dialog, and innovation within the global scientific and industrial community.

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