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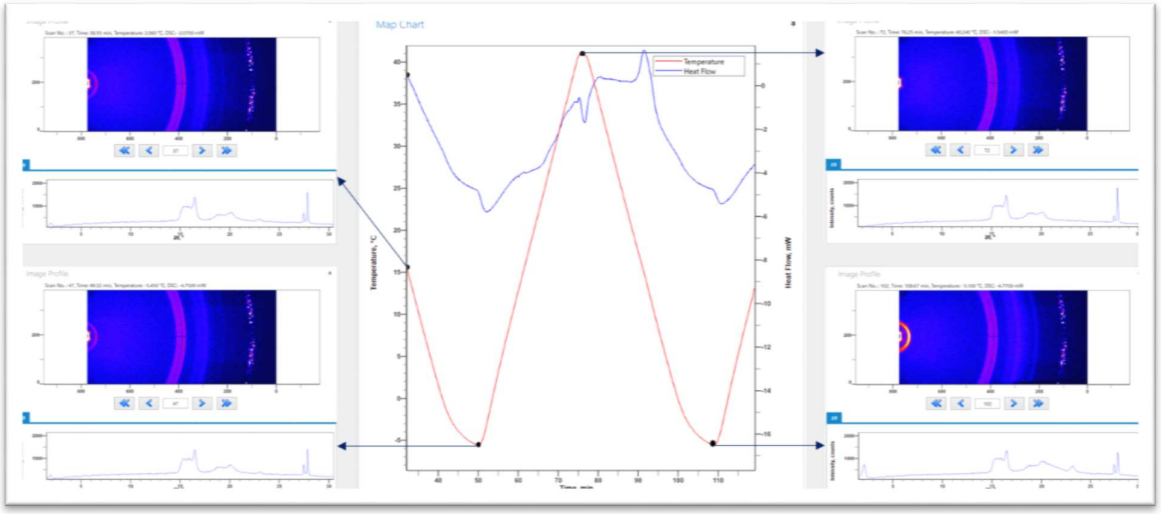

SmartLab Studio II:
Data Visualization plugin #2 — *In-situ* measurements

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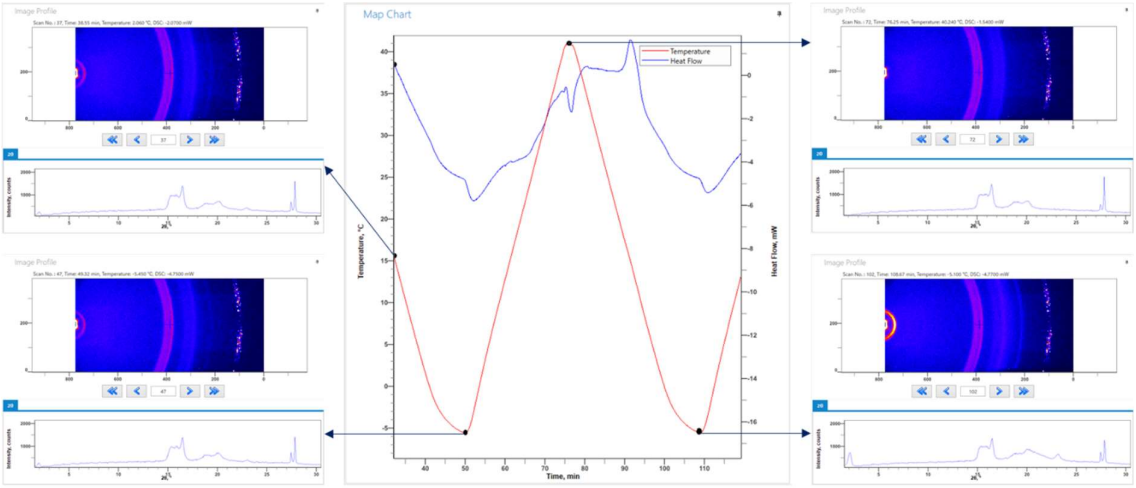
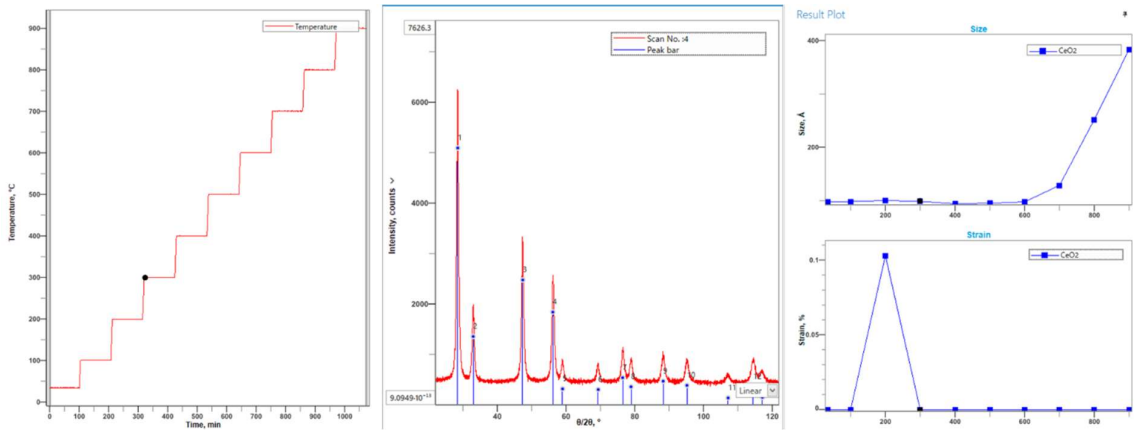
It is very important for researchers and engineers involved in materials development to understand structural changes of a material associated with an external environment. Until recently, there were no good tools to display charts of changing temperature or humidity data coupled to X-ray diffraction (XRD) measurements of a sample other than for a few types of data. The Data Visualization plugin of SmartLab Studio II displays both a chart of temperature and/or humidity and that of XRD data sets in one window. You can easily select one or more XRD data sets that you want to display in the XRD chart even if a lot of data sets are loaded. Using the bars to select a temperature/humidity range on the temperature/humidity chart will display the corresponding XRD data sets included in the specified range. Slideshows of 1D/2D XRD data sets are also available. Changes in XRD data sets associated with changes in external environment can be followed visually with the slideshow feature.

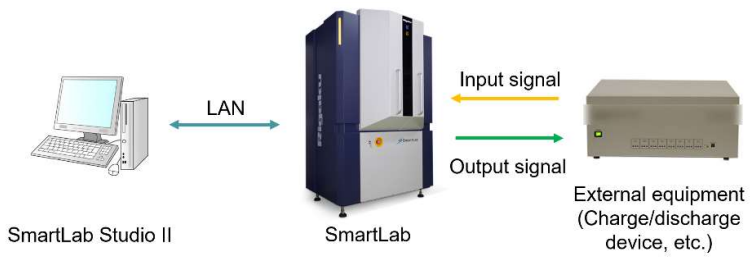


Sample: Fresh cream

All the loaded data sets can be analyzed simultaneously under the same conditions. Operations such as peak search, phase identification and quantitative analysis, crystallite size analysis, %crystallinity, etc. are all available. After peak search, you can plot changes in positions, intensities, etc. of selected peaks. If you perform other analyses, you can also plot the changes of parameters included in those analysis results.

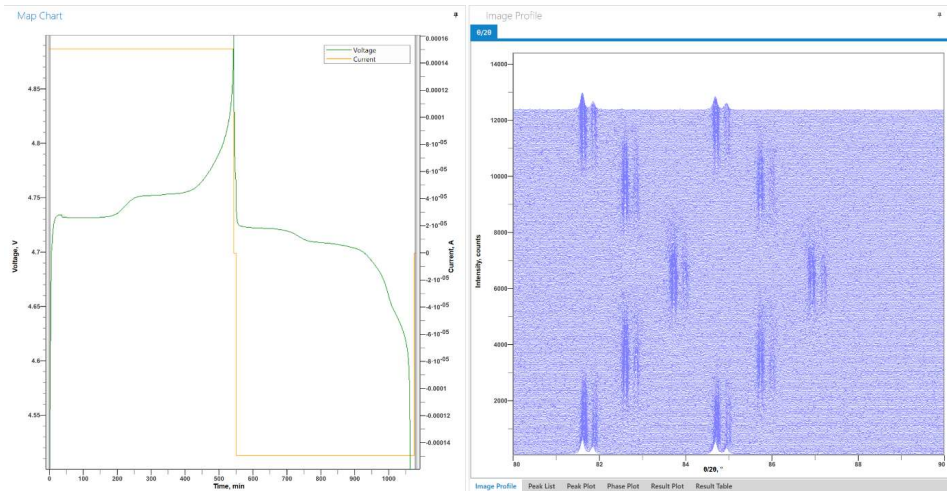


The new SmartLab system can connect to some third-party and original devices. The starting time of the measurements for both SmartLab and the external device can be synchronized using a new digital signal input/output feature. (A dedicated digital cable between your SmartLab and the device is required to use this feature.)



Recently, requests for very fast measurements are increasing because the speed of structural changes of a material associated with changes in external environment can be very high. For example, XRD measurements need to be made every few seconds for 10 to 20 minutes to observe the charging/discharging process of a Li-ion battery. Using a new SmartLab system equipped with a 2D HyPix-3000 detector, 2θ measurements can be made in as little as every 0.1 seconds, covering more than 25° along the 2θ axis at one time.

If a measurement is made every second for 20 minutes, no fewer than 1200 images will be created! After the measurements, load all the created images into the Data Visualization plugin. Then, all the features, such as the slideshow, are available as when loading data sets created when the temperature has been varied. The only difference is that the Data Visualization plugin cannot directly read the parameter values from external devices (here, the conditions of voltage and current of a charge/discharge system). Instead, if the external device exports a text file containing time versus parameter values, the Data Visualization plugin will read the text file and can display the XRD data sets associated with the loaded parameter values.



279 data sets were collected using a HyPix detector every five seconds.
The 1D profiles shown on the right were converted from the 2D data sets.