

CASE STUDY

"Bruker has supplied a truly exquisite X-ray machine, which we took to completely new levels. I think there has never been a lab-based high-pressure diffractometer before that is so similar to, and compatible with synchrotron technology."

Dr. Przemyslaw Dera
University of Hawai'i at Manoa (UHM)



Case Study 4 My Little Synchrotron-at-home for High-Pressure Crystallography

All the bells and whistles

The D8 VENTURE has been outfitted with all the typical synchrotron high-pressure solutions, while preserving all of the original crystallographic functionality.

- Optical system for visual observation orthogonal to incident beam and ruby fluorescence measurement
- Heavy duty, motorized sample platform that can easily accommodate larger megabar-type DACs
- Automated, motorized X-ray beam intensity scanning
- Control via the robust EPICS protocol

From the beamline to the home-lab

Over the last two decades the great majority of high-profile crystallographic studies in mineral physics have been performed at synchrotron facilities. Besides the most obvious advantages of much higher incident beam intensity, small focal spot size, and adjustable energy, synchrotron instruments were the only ones to provide the accuracy of motorized sample positioning, the ability to monitor the intensity of the X-ray beam passing through the diamond anvil cell and the availability of online pressure measurements based on ruby fluorescence. All of these components make the experiments with minuscule mineral crystals enclosed in diamond anvil cells more reliable and dramatically increase the data quality.

Now some of these features have been made available for the home-lab.

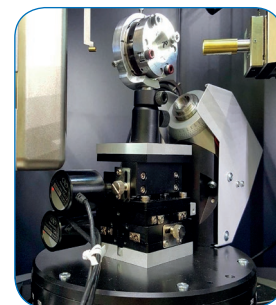
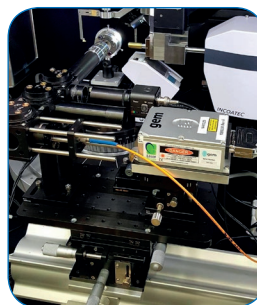


Figure 1 and 2. Left: Optical system for visual observation orthogonal to incident beam and ruby fluorescence. Right: Motorized heavy-duty XYZ sample stage with 5 kg load capacity.

Higher efficiency and better compatibility

The added functionality brings the D8 VENTURE up to par with synchrotron facilities for high-pressure work in many aspects and makes the transition from home-lab to synchrotron experiments much more efficient. With these custom solutions, the University of Hawai'i's D8 VENTURE system is still fully compatible with Bruker's APEX3 data analysis software, and allows taking advantage of all the advanced structure determination features, including innovative structure solution algorithms, processing of twinned, multi-crystal and modulated structure data, etc. Lab-based experiments up to 50 GPa with synchrotron-sized high-pressure single-crystal samples of even triclinic symmetry have now been successfully performed with this system.