MS08-1-1 Sample-delivery techniques to perform serial crystallography at the XFEL Hub of Diamond Light Source
#MS08-1-1

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Abstract
Serial crystallography experiments have been continuously performed and developed at X-ray free-electron lasers (XFELs) and synchrotron beamlines over the last decade. In this method, a complete diffraction dataset is collected from a large number of microcrystals serially delivered and exposed to an X-ray beam in random orientations at room-temperature. Short X-ray exposure minimizes radiation damage, and data collection at room-temperature provides more biologically reliable data on structural dynamics in proteins compared to the data collection at cryo-temperatures.
Serial crystallography experiments at XFELs have inspired novel sample delivery techniques, which are now also being used at synchrotrons. The XFEL Hub at Diamond is developing several techniques to enable time-resolved serial crystallography experiments at synchrotrons and XFELs. This development relies on a growing variety of sample presentation methods each with unique requirements, including different fixed target supports (1), injection methods using high-viscosity extrusion injectors, and on-demand acoustic droplet ejection or piezoelectric injection of nanolitre to picolitre (2,3) droplets either into the X-ray beam or onto a tape drive. Some of the drop-on-demand methods are also compatible with complementary X-ray emission spectroscopy measurements from the same sample and X-ray pulse. This allows to follow the oxidation/spin states changes of biologically relevant metals during catalysis. Our goals include promoting the efficient use of samples and accessibility of serial crystallography experiments for academic and industry users, in part, by transferring/ adapting appropriate technology between different facilities.

References
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