

Capture and X-ray Diffraction Studies of Protein Microcrystals in a Microfluidic Trap Array

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X-ray free-electron lasers (XFELs) promise to enable the collection of interpretable diffraction data from samples that are refractory to data collection at synchrotron sources. Here we present a chip-based sample delivery system designed for use with XFELs. Using this device, microcrystals can be captured at fixed, addressable points in a trap array from a small volume (<10 μ l) of a pre-existing slurry grown off-chip. The device can be mounted on a standard goniostat for conducting diffraction experiments at room temperature without the need for flash-cooling. Proof-of-principle tests with a model system (hen egg-white lysozyme) demonstrated the high efficiency of the microfluidic approach for crystal harvesting. This work shows that microfluidic capture devices can be readily used to facilitate data collection from protein microcrystals grown in traditional laboratory formats, enabling analysis when cryopreservation is problematic or when only small numbers of crystals are available. Such microfluidic capture devices may also be useful for data collection at synchrotron sources.