Faster turnaround of macromolecular crystallography research

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High-end x-ray diffraction techniques such as macromolecular crystallography rely heavily on the x-ray source brightness for resolution and exposure time. As boundaries of technology are pushed forward samples are becoming smaller, weaker diffracting and less stable which put additional requirements on ever brighter sources. With bright enough compact sources, even the toughest challenges can be solved in the home laboratory. Traditional solid or rotating anode x-ray tubes are typically limited in brightness by when the e-beam power density melts the anode. The liquid-metal-jet technology (MetalJet) has overcome this limitation by using an anode that is already in the molten state thus e-beam power loading above several megawatts per mm are now feasible.

Over a decade ago the first prototypes of liquid-metal-jet x-ray sources were demonstrated. These immediately demonstrated unprecedented brightness in the range of one order of magnitude above current state-of-the art sources. Over the last years, the liquid-metal-jet technology has developed from prototypes into fully operational and stable X-ray tubes running in more than 100 labs over the world. X-ray crystallography is naturally considered a key application for the x-ray tube technology, since this application benefits greatly from small spot-sizes, high-brightness in combination with a need for stable output. To achieve a single-crystal-diffraction (SCD) platform addressing the needs of the most demanding crystallographers, multiple users and system manufacturers has since installed the MetalJet x-ray source into their SCD set-ups with successful results.

This contribution reviews the evolvement of the MetalJet technology specifically in terms of flux and brightness and its applicability for pushing boundaries of what is possible in the home lab. Recent user examples will illustrate how the MetalJet has enabled faster turnaround time of research and also enabled easy and convenient 24/7 access to the highest quality of crystallography data.

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