

MetalJet Source for Time Resolved X- ray Diffraction and Scattering

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High-end X-ray diffraction and scattering techniques such as small and macromolecular molecule crystallography, SAXS, BioSAXS non-ambient SAXS 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 puts an additional requirement on even brighter sources. With bright enough compact sources, time resolved studies could be achieved even 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 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 is now possible. We report brightness of 6.5×10^{10} photons/(s·mm²·mrad²·line) over a spot size of 10 μm FWHM.

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 70 labs over the world. X-ray crystallography and Small Angle X-ray Scattering (SAXS) have been identified as key applications, since these applications benefit from small spot-sizes, high-brightness in combination with a need for a stable output. To achieve a single-crystal-diffraction (SCD) platform addressing the needs of the most demanding crystallographers, the system manufacturer and multiple users have since installed the MetalJet X-ray source into their SCD set-ups with successful results [4]. With the high brightness from the liquid-metal-jet X-ray source, *in-situ* SAXS studies can be performed – even in the home laboratory [5,6].

This contribution reviews the evolution of the MetalJet technology specifically in terms of stability, lifetime, flux and brightness and its applicability for pushing boundaries of high-end SCD and SAXS supported by recent user data. We also present recent possibilities to achieve cost effective solutions attainable for a wider application range.

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