

SINGLE-CRYSTAL X-RAY DIFFRACTION

The D8 VENTURE METALJET MC

Taking home-source intensity to the next level – the METALJET MC breaks the 10^{12} barrier

Introduction

As both chemical and biological research, address increasingly challenging problems, crystallographers are confronted with solving complex structures from ever smaller samples. To address this need, Bruker has introduced a new system aimed specifically at getting quality structures from tiny crystals: the D8 VENTURE METALJET MC.

The METALJET is well-established as the most brilliant X-ray source for the home laboratory. Now, the introduction of the D8 VENTURE METALJET MC takes METALJET technology to the next level:

- Electron beam technology with Dynamic Beam Adaptation (DBA) greatly improves the source uptime and reduces maintenance needs to one time per year.
- Combining the latest electron beam technology with newly developed X-ray optics, unprecedented intensities are achieved (Fig 1). For many years an intensity of 10^{12} X-rays $\text{sec}^{-1}\cdot\text{mm}^{-2}$ has been available at the best third generation synchrotrons only. For the first time the D8 VENTURE METALJET MC breaks the 10^{12} X-rays $\text{sec}^{-1}\cdot\text{mm}^{-2}$ intensity barrier and brings synchrotron performance into your home lab.

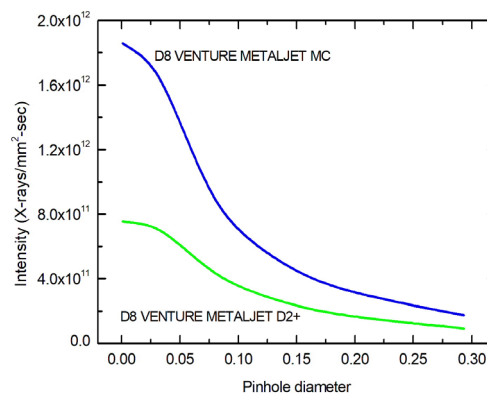


Figure 1

The new D8 VENTURE METALJET MC features more than twice the intensity of the previous version of the D8 VENTURE METALJET, for the first time delivering an intensity above 10^{12} in the home laboratory.

Table 1

A comparison of data from a small ascorbic acid crystal collected on the METALJET D2 PLUS and the METALJET MC. The METALJET MC achieves up to three times higher raw average intensity compared to the METALJET D2 PLUS.

	METALJET D2+	METALJET MC
Resolution [Å]	0.75	0.75
Raw average $\ \sigma$	2.65	5.86
$\ \sigma$ (all, 0.85-0.75 Å)	5.58, 1.03	8.07, 3.26
R_{int} (all, 0.85-0.75 Å)[%]	19.36, 72.16	9.46, 3.26
$R1$ (obs, all)[%]	7.71, 16.65	5.32, 7.92
$wR2$ [%]	19.20	12.45
Bond precision [Å]	0.0123	0.0056
Flack/Parson's Q	0.144(999)/ 0.524(667)	0.461(544), 0.157(335)
Residual density [e-/Å ³]	0.33/-0.42	0.25/-0.29

METALJET MC Specifications

Power (W)	250
Cooling	Air
Beam size (µm)	50
Maximum divergence (mRad)	13.0
Intensity (X-rays·sec ⁻¹ ·mm ⁻²)	1.8×10^{12}
Typical maintenance interval (months)	12

Higher performance – smaller samples

With a new, brighter X-ray source and new, optimized X-ray optics, the D8 VENTURE METALJET MC achieves truly synchrotron-like X-ray intensities. For the first time, intensities above 10^{12} X-rays sec⁻¹·mm⁻² are possible in the home laboratory. Thus the D8 VENTURE METALJET MC is the ideal solution for investigating your smallest, micron-sized samples.

Higher intensity stability – brighter today, brighter tomorrow

Rotating anodes typically lose up to 40% of their intensity over a year of operation due to ablation of the anode surface, also known as anode roughening. Because the METALJET always has a fresh, clean liquid metal anode surface, the intensity is stable. After years of operation the anode delivers an intensity equal to the intensity on the first day of operation.

Higher uptime – more productivity

The D8 VENTURE METALJET MC features improved source technology with longer service intervals giving typically a full year of operation between maintenance.

Great X-ray power comes with great environmental responsibility

The D8 VENTURE METALJET MC delivers more than ten times the intensity of a typical rotating anode but uses only a fraction of the electrical power; only 250 W compared to 1200 W for a typical rotating anode. This means that the D8 VENTURE METALJET MC is not only the most brilliant source available, but has a vastly lower carbon footprint and significant savings on electricity costs.

What it means for your sample

Table 1 shows a comparison of complete data collected to 0.75 Å with the same total exposure time from a small ($13 \times 22 \times 23 \mu\text{m}^3$) ascorbic acid crystal run on the D8 VENTURE METALJET with D2 PLUS and the D8 VENTURE METALJET MC. The higher intensity of the METALJET MC results in over two times the raw average intensity, 2.2 times higher raw average $\| \sigma$, and three times higher $\| \sigma$ for the highest resolution shell. This in turn drives significant improvements in merging statistics, bond accuracy and the Flack parameter.

Conclusion

The new D8 VENTURE METALJET MC combines the latest generation of METALJET source technology and also the latest optimized X-ray optics to product up to three times the intensity for small samples.

For many years X-ray intensities beyond 10^{12} X-rays sec⁻¹·mm⁻¹ have only been available at synchrotron beamlines. The D8 VENTURE MC is the first system bringing that performance into your home lab.

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