New developments in microfocus sources for X-ray diffractometry

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Many applications in the field of X-ray analytics require an X-ray beam with high flux density at the sample position. Since the introduction of the Incoatec Microfocus Source IμS in 2006, the IμS has become the gold standard for low power low maintenance home-lab X-ray sources. The IμS combines a low power microfocus X-ray sealed tube with dedicated Montel multilayer mirrors and delivers intensities beyond those of traditional rotating anode sources and more.

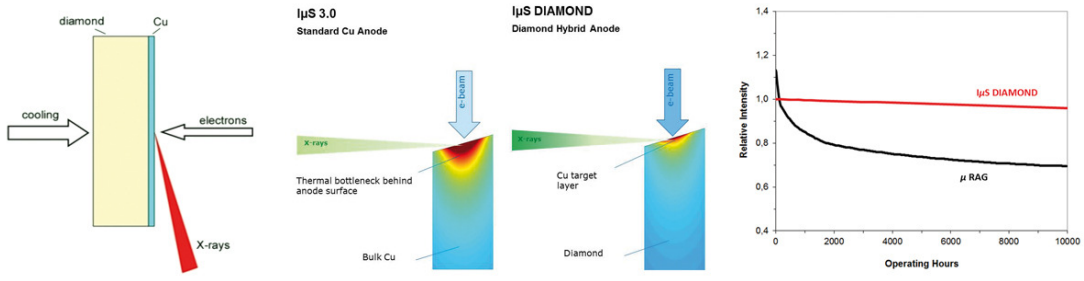
With more than 1000 sources sold world-wide, the IμS is the market-leading microfocus source for X-ray diffraction applications, such as single crystal diffraction on small molecule and protein crystals as well as small angle scattering.

The ideal source for diffractometry combines a device that produces a microfocus X-ray beam of a size of below 50 µm, with perfectly shaped high-reflectivity X-ray optics like multilayer mirrors that are able to focus or collimate the beam to the sample or detector position. Our family of air-cooled Incoatec Microfocus Sources deliver collimated beams with a divergence of below 0.5 mrad or focused beams with sizes down to about 100 µm with a flux of up to 1x10^9 ph/s.

We will be showing some examples in the field of X-ray diffractometry that were not long ago only possible with synchrotron or rotating anode sources and customized set ups for in-situ measurements of crystal and thin film growth.

Last but not least we be presenting the latest developments of our microfocus sources - the IμS DIAMOND - the microfocus X-ray tube with a diamond hybrid anode. The diamond hybrid anode comprises an industrial diamond as substrate that is coated with a layer of the target material (e.g. Cu). It takes advantage of the exceptional high thermal conductivity of diamond, which is about 5 times higher than that of copper and the highest known conductivity of all bulk materials. The thin copper layer produces the X-rays while the underlying diamond substrate dissipates the heat load more efficiently than a conventional bulk copper anode. Consequently, the IμS DIAMOND can accept a higher power density in the focal spot on the anode without damaging the surface of the target layer.

Another advantage of the diamond hybrid anode is that it is much more stable and long-lived than onventional rotating anodes. The balanced heat management in the IμS DIAMOND assures that the intensity loss over time is only a few percent over 10,000 h of full power operation, which is significantly lower than in microfocus rotating anode sources. Therefore, the intensity of the IμS DIAMOND is about 20% higher than the average intensity output of a modern microfocus rotating anode. The IμS DIAMOND combines the performance of a low power microfocus rotating anode but with the reliability, low maintenance, low cost of ownership and high uptime of a conventional microfocus sealed tube source with a bulk copper anode.



Principle of the diamond hybrid anode (left), simulation of the heat dissipation (middle) and comparison of the decay of intensity (right).