Shine Bright Like a Diamond:
Microfocus X-ray Sealed Tube Sources with Diamond Hybrid Anode Technology

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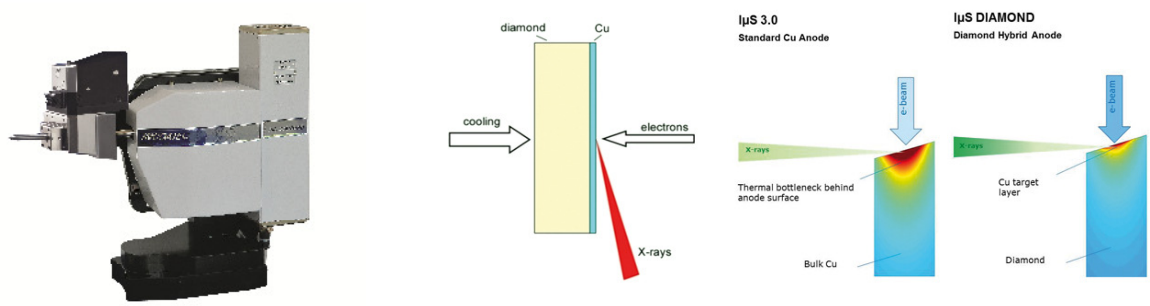
Diamond exhibits several unique properties, such as high thermal conductivity, low thermal expansion, extreme hardness, chemical inertness and a fairly high transmission coefficient for X-ray radiation. The thermal conductivity of diamond is about 5 times higher than that of copper and the highest known conductivity of all bulk materials. Therefore, diamond is increasingly replacing traditional materials for the thermal management in challenging applications where a high local heat load needs to be dissipated, such as in heat sinks for high-power microelectronic devices. In X-ray sources, diamond can be used as a transparent heat sink directly coupled to the anode material. This improves the heat dissipation considerably and allows for an increase in tube brilliance by applying a higher power load on the anode.

The IμS DIAMOND is a new type of microfocus sealed tubes using a unique anode technology, the diamond hybrid anode. It takes advantage of the exceptional high thermal conductivity of diamond by using a bulk industrial diamond as a heat sink, which is coated with a thin layer of the target material, such as Cu, Mo or Ag, making the heat dissipation in a diamond hybrid anode more efficient. Consequently, the IμS DIAMOND can accept a higher power density in the focal spot on the anode. The intensity loss over time for the IμS DIAMOND is only a few percent over 10,000 h of full power operation, which is significantly lower than the intensity degradation observed for microfocus rotating anodes. 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 establishes a new class of X-ray sources, combining an intensity output that exceeds the average intensity of a microfocus rotating anode with all the comfort and lifetime of a standard microfocus sealed tube with a bulk anode.

In our presentation we will give an overview of representative experimental setups and results demonstrating the potential of our IμS in SAXS and XRD studies. These take advantage of the brilliance and outstanding beam quality of this low-maintenance microfocus source. We will show in more detail home-lab in-situ GISAXS measurements where we investigated how a multilayer grows during thin film deposition. This kind of experiments is typically done only at synchrotrons. With an IμS it is now also feasible in the home-lab.
Furthermore we show some results in small molecule crystallography with the IμS DIAMOND in comparison with a 1 kW microfocus rotating anode. At last but not least some special applications and up-grades with the IμS.



The IμS DIAMOND (left) and principle of the diamond hybrid anode (middle) and simulation of the heat dissipation (right).