MS20-P07

The benefits of K_β radiation

Michael Bodensteiner[1], Tobias Mayr[2]

1, X-ray Crystallography, Faculty of Chemistry and Pharmacy, University of Regensburg, Regensburg, Germany
2. Faculty of Chemistry and Pharmacy, University of Regensburg, Regensburg, Germany

email: michael.bodensteiner@ur.de

K_β is much weaker in intensity than K_α and therefore practically not used for single crystal diffraction experiments. Most X-ray labs are equipped with Mo-K_α and Cu-K_α sources, but in some cases an intermediate wavelength would be desirable. Such a compromise can be provided by Cu-K_β radiation (λ = 1.39 Å). Compared to Cu-K_α (λ = 1.54 Å) the amount of available data is increased by more than 35 per cent and the absorption significantly lowered. This can also be achieved with Mo-K_α (λ = 0.71 Å), but the quantum efficiency of the diffraction is much higher for Cu-K_β. Another general advantage of K_β radiation compared to K_α is the absence of α_1/α_2 splitting at higher diffraction angles. This leads to a relative improvement of the I/σ(I) at higher resolution. Our investigations have shown that in many cases almost identical or even better quality structures could be obtained by using the Cu-K_β wavelength compared to either Mo-K_α or Cu-K_α. We even encountered some structures that could only be refined properly when Cu-K $_\beta$ data was applied.[1]

References:

[1] Marquardt, C., Kahoun, T., Stauber, A., Balázs, G., Bodensteiner, M., Timoshkin, A. Y. &
[2]Scheer, M. (2016). Angew. Chem. Int. Ed., 55, 14828–14832.

Keywords: K-beta radiation, wavelength, data quality

MS20-P08

EuPRAXIA – a compact, cost-efficient XFEL source

Maria Weikum[1], Paul Andreas Walker[1], Ralph Assmann[1]

1. Accelerator R&D, Deutsches Elektronensynchrotron (DESY), Hamburg, Germany

email: maria.weikum@desy.de

(on behalf of the EuPRAXIA collaboration)

One of the main limitations for crystallographic studies – whether it be in structural biology, chemical analysis or material science – is the availability of suitable diagnostic instruments which are to-date typically found in the form of large accelerator-based facilities, such as Free-Electron Lasers (FELs), synchrotron storage rings or accelerator-based neutron sources.

With the Horizon 2020 project EuPRAXIA ("European Plasma Research Accelerator with eXcellence In Applications") we want to present a possible approach towards solving this research bottleneck through the use of novel compact accelerator technology. Currently in its conceptual design phase, the future EuPRAXIA facility will centre around a multi-gigaelectronvolt plasma-based electron accelerator delivering industrial-grade beam quality. Radiation sources will be available in the form of a Free-Electron Laser in the single nanometre to sub-nanometre wavelength range as well as more compact radiation generation schemes tunable in the UV to gamma-ray regime. Compact positron and neutron sources are foreseen as possible additional features. Thanks to the utilized plasma accelerator technology, the generated beams will be intrinsically ultrashort – on the order of single to tens of femtoseconds in duration – as well as small in transverse size – down to single micrometres. This makes them highly suitable as probe beams for various applications, including time-resolved studies and pump-probe experiments.

One of the main aspects that will set EuPRAXIA apart from conventional instruments of the same class is a considerable reduction in size and cost due to its smaller design. It will thus not only provide a novel analytical instrument, but will also present, beyond that, a first European prototype facility paving the way towards future cost-effective, compact light and particle sources.

Keywords: X-ray source; particle beam source; compact XFEL