Fluorescence Suppression with POLLUX – A Hybrid Photon Counting Detector for X-ray Powder Diffraction

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Energy-discriminating detectors are becoming increasingly important in laboratory powder diffraction, as they enable effective background suppression and improved data quality across a wide range of sample compositions and radiation sources. A major limitation in conventional laboratory diffraction experiments is X-ray fluorescence originating from the sample, which can severely degrade the signal-to-noise ratio and obscure weak diffraction features.

POLLUX is a new-generation hybrid photon counting detector [1] featuring an optimized energy resolution of better than 600 eV, representing a substantial improvement over DECTRIS' previous detector systems. The enhanced energy resolution allows to detect the diffracted photons within a narrow energy bandwidth centred on a characteristic emission line, while suppressing the fluorescence photons of lower energy. A particularly important application is the investigation of Fe-containing samples using standard Cu-Kα radiation. In conventional laboratory setups, the strong excitation of Fe K-fluorescence by Cu radiation leads to a pronounced background contribution, which is typically mitigated by switching to a cobalt X-ray source coupled with an iron filter, an option seldom within reach of small and medium laboratories for economic and practical reasons.

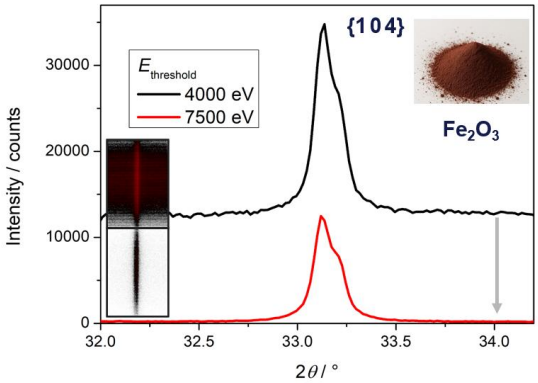


Figure 1. *Excerpt of the PXRD pattern of Hematite measured at two different energy thresholds, showing the reduced background and noise.*

The good energy resolution allows for effective suppression of Fe K-fluorescence while preserving a strong diffraction signal, resulting in a significantly reduced background, improved signal-to-noise ratio, and enhanced data quality. This capability is particularly beneficial for the detection of very weak diffraction features, such as minor or trace side phases, which would otherwise be concealed by fluorescence background.

POLLUX therefore provides a flexible solution for laboratory powder diffraction, extending the applicability of standard Cu-based diffractometer configurations to challenging material systems without the need for alternative radiation sources or specialized instrumentation.

[1] C. Brönnimann, P. Trüb (2016). In Synchrotron Light Sources and Free-Electron Lasers, 995–1027.