Potential of highly annealed graphite crystal analyzers for von Hamos spectrometers

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Currently perfect crystals in the form of silicon or germanium are almost exclusively used as wavelength dispersive optics in synchrotron facilities. Efficient collection is realized by using Johann, Johansson or von Hamos geometries. The advantage of the energy dispersive von Hamos geometry is the simultaneous collection of the entire spectrum without scanning but with the disadvantage of a reduced effective solid angle compared to the point-to-point focusing geometries. Here highly annealed pyrolytic graphite crystals (HAPG) with their higher integral reflectivity could help to offset the reduced solid angle making the von Hamos geometry as efficient as the Johann or Johansson geometries.

The HAPG crystal can be described as a composition of small perfect crystal blocks called crystallites with an angular orientation distribution of 0.1°. Small means that the mosaic crystal model assumes negligible multiple scattering inside a single crystallite and is therefore within the kinematical approximation compared to perfect crystals. As a result of the crystallite distribution the resolving power is decreased but the integrated intensity of a mosaic crystal is at least one order of magnitude higher compared to a perfect crystal.

In this presentation the use of HAPG crystal analyzers in synchrotron applications is explored. A comparison to established perfect crystal analyzers is done with the focus on efficiency, resolving power and alignment procedures.