Pixel Detectors and Material Science: an Opportunity or the Future for Synchrotron Experiments?

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Currently available 2D detectors do not make full use of the high flux and high brilliance of 3rd generation synchrotron X-ray sources. The development of new detectors using hybrid pixels appeared in the last decade as a promising way for detection in synchrotron material science experiments. They present interesting properties which can be used in SAXS experiments. Other experiments like powder diffraction are well suited for their characteristics. They will also be useful for reciprocal space mapping as in the study of diffuse scattering. However their place is not so obvious in data collection used for solving the atomic structure. Results obtained while developing the XPAD pixel detector [1,2] will allow to precise the progress allowed by hybrid pixel detectors in such experiments.

In material science, there is a trend to perform experiments with higher energies in order to minimize absorption effects and to reduce the curvature of the reciprocal space mapping. This modifies the detector requirements but the evolution of materials makes people more interested by surface properties which requires not too high energies. The progress in microelectronics will allow to enhance the detector characteristics but within the same time the radiation source will be improved and this will require more from the detectors. This improvement of the source will allow real progress in real time experiments concerned by the millisecond scale: chemical reactions in liquids, in metals... They are at the time limited by the available number of photons. These kinds of experiments seem to be well suited for new detectors using the hybrid pixel concept.

References

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