SX700 STYLE MONOCHROMATORS FOR HIGH POWER SOFT XRAY UNDULATOR BEAMLINES AT THE ALS

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SX700 style monochromators, developed at BESSY [1], have been adopted for high resolution soft x-ray spectroscopy at several synchrotron sources. In this paper we analyze the special problems of their implementation for simultaneous operation at high resolution and high efficiency at the highest possible flux, on an undulator beamline at a third generation source.

The installation of this monochromator in parallel light [2] allows it to be operated over a range of focussing conditions. High resolution operation can be assured by increasing the value of Cff (= cos?/cos?) [3]. The resolution then becomes less sensitive to optical slope errors, whether they are from polishing or from beam heating. Values as high as Cff=20 have been used.

However, for high flux operation a value around Cff=2 is preferred. Here the grating efficiency can be maximized, and the optics are not overfilled. On a high power undulator the cooling of the monochromator pre-mirror then becomes a challenge[4].

A further important advantage of the parallel light SX700 implementation is the ability to select a particular wavelength from different density gratings, with widely different dispersion. This is particularly important for instruments (like scanning x-ray microscopes) with a limited phase space acceptance. Here, if the highest resolution is not required, low resolution operation with reduced dispersion fills the experiment phase space most effectively. Varying the dispersion (by a factor of two or three) in this way requires an extended energy range from each grating and leads one to operate with finer gratings at smaller values of the included angle where the power loading problems cannot be avoided.

We will present analysis of a beam line designed to perform in all of these modes at the Advanced Light Source. The variation of efficiency with Cff and the performance at high and low dispersion will be presented. Thermal loads will be given for the collimating mirror and monochromator plane pre-mirror. Some pre-mirror designs making use of internal cooling of novel low expansion materials will be discussed.

References

[1] H. Petersen, Optics Comm. **40** (1982) 402.
[2] R. Follath and F. Senf, Nucl. Instr. Methods Phys. Res. **A390**(1997) 388
[3] K.J.S.Sawhney *et al*, Nucl. Instr. Methods Phys. Res. **A390** (1997) 395
[4] V.V. Martynov *et al*, Proc. SPIE 2856 (1996) 289

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