High Heat Load X-ray Optics Design & Fabrication

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The high-energy wigglers at CHESS A-/G- and F-lines are among the most powerful insertion devices in the world, producing x-ray beams with high total power and moderate power densities. How to design and fabricate better-cooled x-ray optics for these beam lines remains to be an engineering challenge at CHESS. In this talk we summarize the current status in x-ray optics design and practical fabrication, and outline the future directions we would like to pursue. In particular, we would like to improve the performance of our in-house fabricated, internally water-cooled mini-channel Si monochromator crystals, with the development of a reliable, strain-free Si-Si bonding technique. Our plan is to investigate using both high-temperature silver-brazing, and lower-temperature bonding techniques such as gold-diffusion, soldering, or radiation-resistant adhesives to minimize fabrication strains. We also plan to utilize below-room-temperature coolants such as ice-water mixture or ethanol-water mixture to improve heat conduction and reduce thermal expansion in Si. We describe the tools and the methods that have been acquired or developed in order to fabricate and evaluate the performance of our fabricated internally-cooled Si crystals.
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