Precision Photo-Fabrication R&D

DESCRIPTION:
We have established the feasibility of utilizing hard x-ray radiation from the NSLS x-ray ring to lithographically produce patterned resist over a length scale of centimeters while maintaining
micrometer tolerance and finish. Analysis of these experiments has verified that the parameters of the NSLS x-ray ring are optimal for this process (small source size, optimum ring and photon energy, dose proximity to the source, high photon flux). Our program has developed along two major directions. One aspect is to provide reliable access to the specialized equipment required for making planar exposures to what has become a growing community of outside users. We have already made our X-27B station available to outside users, and will complete implementation of the X-14B scanner station this year. In parallel, we will continue to pursue our program of research to provide a sound base for the design and fabrication of masks that can be used for this technology. With these tools in hand, the routine use of this technology *in production will be possible. Both aspects of the program are important to encourage growth in utilization of this sustainable technology.

IMPACT:
We have completed the development of a turn-key hydraalic scanner system at X-27B. The control system has been used (and is well liked) by several outside user groups. This system has allowed us to include a systematic study of dose rate in our exposure experiments. This has turned out to be very important, since the quality of exposed and developed resist seems to be sensitive not only to the integrated dose, but to the dose rate as well. The hydraulic scanner readily facilitates systematic control of this parameter, and its long stroke provides a viable strategy for exposure of multiple substrates with minimal lost time from overscan time at the end of the samples. Our user groups have already taken advantage of these developments and have started fabricating prototype devices where the exposure at NSLS was an important element. Most striking of these was the work by the JPL group on the HESI (High Energy Solar Imager) grid systems. Their research at BNL (and other DOE synchrotrons) allowed them to reduce the cost of the nuission by a factor of three (from 150300 M$ reduced to 50 -80 M$) due to the precision and miniaturization made possible by the process.

R,TTERACITONS:
Overlap with programs and users at JPL, SNL, and the University of Wisconsin Madison. We also communicate and share results with programs at SSRL, ALS and APS.

PERSONNEL:
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RECOGNITION:
Patent Issued (US 5679502) Method and Apparatus for Micromachining using Hard X-rays. Invitm presentations at HARMST Meeting Madison) and West Coast LIGA Meeting (TPL).

BUDGET: $200K