Development of procedures for refurbishing x-ray optics at the Advanced Light Source

Valeriy V. Yashchuk, Nikolay A. Artemiev, Frank Zucca, Richard Celestre, Wayne R. McKinney, Daniel J. Merthe, Dmitry L. Voronov, and Howard A. Padmore

Lawrence Berkeley National Laboratory, One Cyclotron Road, Berkeley, CA 94720, U.S.A.

ABSTRACT

At the Advanced Light Source (ALS), plans for re-manufacture of many of the original beamlines, some of which are now almost 20 years old, are developing. Replacement of a beamline is a costly enterprise, and hence it takes considerable time to raise the necessary funds.

In parallel with this long term program, we are developing ideas for a short term program to improve the performance of the ALS beamlines with modest improvements of the optical systems, leaving the basic beamline structure and design intact. The cost of this program that we call Light Source Upgrade of X-ray Optics for Research (LUXOR) is estimated to be on average 10% of the cost of a new beamline, and in some cases, performance increases of several orders of magnitude can be gained [1].

In the scope the LUXOR initiative, we have started at the ALS an experimental program to develop practical and robust procedures for refurbishing x-ray optics.

First, we work to optimize regimes for Ultraviolet Ozone (UVO) cleaning [2] of carbon contaminated x-ray optics. Based on comprehensive surface metrology data, we provide details of the UVO cleaning process that has allowed us to refurbish highly contaminated super polished mirror substrates. With Kirkpatrick-Baez mirrors using the refurbished substrates, we are able to reach two dimensional diffraction limited focusing [3].

Second, we investigate the possibility of in situ cleaning of contaminated x-ray optics using a cold low pressure plasma [4,5]. Recent progress in development of a test set-up based on an Evactron® De-Contaminator [6] is reported.

This work was supported by the U.S. Department of Energy under contract number DE-AC02-05CH11231.

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