

2nd Meeting on Future XFEL optics (23.-24. November 2006)

Summary of final discussion

1) Investigation of different amorphous materials

It has been reported on the experimental comparison of am-C and am-Si coatings. In both materials recrystallization and expansion after irradiation has been found.

F. Siewert expressed his interest to include am-metal coatings in the damage investigations, especially tungsten coatings. M. Störmer mentioned a limit for the maximum layer thickness of approximately 50nm for Tungsten.

2) Test of different thicknesses of coatings + 3) Test of bulk materials

Main conclusion is, that the different damage features for different coating thicknesses are due to absorption in the substrate.

As the attenuation length into the coating material varies with photon energy as well as incidence angle, an adequate thickness of the coating layer has to be chosen in order to enable the comparison of damage measurements. See also subject 4) .

4) Angular dependence of damage

The need for further measurements under incidence angles different from normal was emphasized. Especially, for beamline optics incidence angles below the critical angle of total external reflection are necessary to test damage issues under realistic conditions.

Nevertheless, damage measurements under normal incidence are inevitable to compare and model the damage evolution.

5) Test of SPhoDP/multi shot damage with high repetition rate source

L. Juha reported that recent experiments in his group at a plasma based laser source (pulse duration 1.7ns; wavelength=46.9nm) strongly indicate the existence of a damage process after accumulation of many irradiations, while each irradiation carries a fluence significantly smaller than the known single shot damage fluence.

The relation to “ageing” phenomena of optics known at Synchrotrons remained open.

The participants expressed their interest in further background material on this subject.

6) Interferometric measurements of the BL0M1 mirror of FLASH

The measurements have been accomplished at BESSY.

F. Siewert reported that NO damage has been found. He announced to distribute the results.

Further contributions

i) F. Bjikerk pointed out the need to investigate electronic (fast) processes using also metallic coatings.

ii) The Daresbury group has expressed their interest to provide and test further optical materials at FLASH (Rhodium, Gold, SiC, Nickel and Chromium).

iii) R. Follath and F. Siewert pointed out the importance of monochromators and therefore suggested to include grating structure in the damage investigations.

iv) Some further techniques, namely shack-hartmann sensors and compact interferometers, have been discussed, which could enable online diagnostics of coherence/wavefront properties and mirror distortions. It has been concluded that this development is especially important for the XFEL operation at high (~kHz) repetition rates.