

Feasibility Study on Microimaging with Phase Zone Plates at 6.5keV

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In recent days, more attention has been paid to micro-imaging at hard x-ray region. Particularly, potential capability of showing high contrast by phase contrast in this energy region is demonstrated. Most difficult task to realize the micro-imaging at this energy region is how to fabricate optical elements. We have been long working in realizing x-ray microscopy in soft x-ray region. On the process of fabricating zone plates (ZP), we found ZP fabricated with Ta could give sufficient groove efficiency even at 8keV, as described below. Then we started doing R&D of ZP optics at 6-10keV energy region.

In Table1 groove efficiencies of ZP. Clearly, Ta and Au can give sufficient efficiency even at 8keV. We used Ta as the material of ZP (thickness:650nm, diameter:1mm, outermost width:100nm). All tests were done at 6.5keV, as less higher order harmonics were contaminated.

(i)*Focussing test* The first test was done to investigate focussing performance. The scheme of the experiment is shown in Fig.1. A slit was scanned at various distances from the ZP. Obtained photons are plotted and shown in Fig.2. Because of the mechanical difficulty, we could not shorten the distance anymore, but qualitatively, the figure clearly demonstrates the beam becomes focusing, as the distance becomes shorter.

(ii)*Imaging test* As the second test, we monitored the image of a mesh put 4mm upstream of the ZP. Actually this mesh was the support of the mask of the 0th-order light. Images were taken at 730mm downstream from the zone plate, which is shown in Fig.3. Dental x-ray films (Hanshin Technical Lab. Ltd., Japan) were used. As clearly seen, several different kinds of mesh images were observed

with magnification of 5.1 and 3.3, respectively. It is interesting some images are phase-contrasted. A set of mesh images, sharp and tilted, is also observed.

Table1 Groove efficiencies of zone plates

Material	Energy (keV)	Groove efficiency (%)
Ta (650nm)	6.5 / 8.0	24.0 / 19.0
Au (650nm)	6.5 / 8.0	25.2 / 21.2

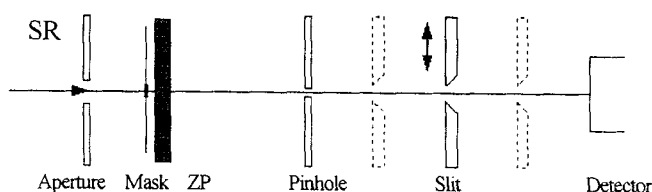


Fig.1 The scheme of the experiment

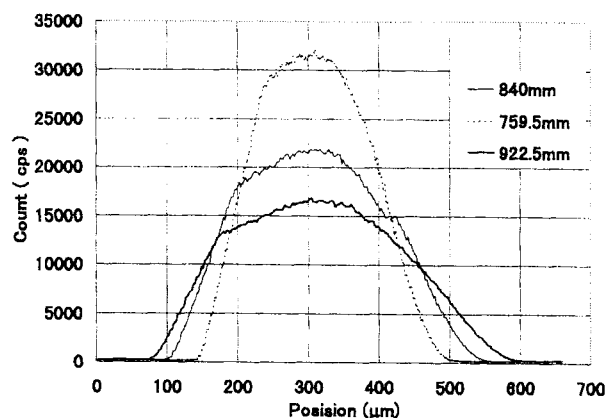


Fig.2 Photon counts at 3 distances from the ZP.

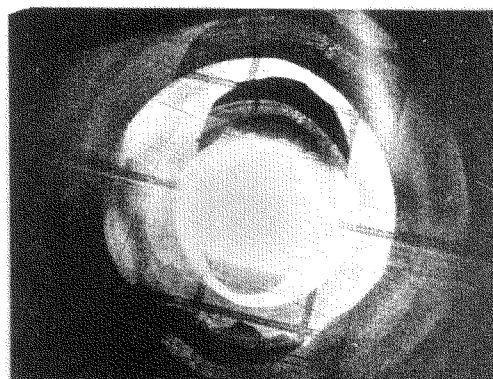


Fig.3 Mesh image.(×7)