Status and recent developments of microfocusing optics in IMT RAS

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In this report a summary is given giving light on recent achievements of X-ray optic with submicron resolution in IMT RAS. Main topics of microfocusing optics that have get a significant evolution, namely phase zone plates, refractive X-ray planar lenses, X-ray waveguides are reviewed. A majority of developed devices is based as firstly proposed Bragg-Fresnel zone plates on silicon and associated high aspect ratio deep etching techniques.

Planar refractive lenses formed from silicon and mentioned above etching technique become well suited for synchrotron radiation sources. Real planar lenses suffer from undercut of refracting profile edges. Now this bottleneck is overcome by computer simulation methods giving feasibility to calculate necessary precorrections. Demands for profile precision have been stated allow reaching perfect parabolic profile.

Minimized absorption and kinoform lenses have been developed firstly by this planar approach. At last time they are reproduced in some works in different versions verifying this direction in refractive optic. Nickel kinoform lenses for hard X-ray 212 keV focusing may be mentioned as a most exciting example.

Recent experimental results of lenses and zone plates testing on ESRF (Grenoble, France), Spring8 (Japan) and Kurchatov synchrotron source (Moscow, Russia) are overviewed. Step from single lens toward many lens systems is illustrated for planar refractive lenses and phase zone plates. Combined focusing system consisted from X-ray planar refractive lens and planar X-ray waveguide is considered.

An overview of applications of developed microfocusing devices is given including next topics:

- Achievements of planar silicon lenses as refractive collimators;
- Holographic imaging using phase zone plates;
- Microfluorescence tomography.

The main problems and goals of X-ray microfocusing optics are considered in connection with future applications for nanotechnologies and life science.

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