Hard X-ray interferometers fabricated by Si planar technologies.

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The modern microfabrication technologies allowed profiling of Si crystals to a significant depth with a high quality of vertical sidewalls offering unique opportunities such manufacturing of X-ray optical elements such planar compound refractive lenses (CRL) or interferometers [1-3]. Recently proposed CRL based bilens interferometer [2] consists of two parallel lens arrays which under coherent illumination generates set of diffraction limited focal spots. Overlapping of beams from those spots produces the interference pattern i.e. standing wave with a variable period ranging from tens of nanometers to tens of micrometers, depending on the observation distance.

In order to expand bilens beam acceptance, recently, we have proposed a multilens interferometer [4]. The interference field produced by the multilens system may be described by the Talbot imaging formalism. The large interferometer "aperture" gives higher sensitivity and precision for characterization of beamline optics. Moreover, as multilens system is generating a set of diffraction limited (up to tens of nm) focal spots with large period (up to tens of microns), it is possible to use for phase contrast imaging (grating like) of large objects (up to few mm) with highest spatial resolution (up to tens of nm) by placing object in the set of foci and scanning it across the beam in between two neighboring focal spots.

Another promising option offered by the microfabrication technologies is the ability to create reflection-based systems, where sidewalls of the etched structures can be used as reflecting mirrors: two parallel mirrors represent a micro-mirror interferometer [4]. Experimental tests showed that the interference pattern produced by such interferometers is sensitive to a roughness of the etched surface.

The proposed interferometers can be applied for coherence and optics characterization, surface metrology and phase contrast imaging in the energy range 5 - 100 keV. The strong advantage of Si planar technologies is the ability to create integrated optical systems on one chip consisting of refractive lenses, lens- and mirror-based interferometers.

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