ESRF	**Experiment title:** Differential interference contrast X-ray microcopy using single zone plate as wave front divider	**Experiment number**: MI 545
Beamline:	**Date of experiment**: from: 23/10/01 to: 26/10/01	**Date of report**:
Shifts:	**Local contact(s)**: U. Neuhausler	*Received at ESRF:*

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Report:

It is demonstrated that in a zone plate based scanning X-ray microscope, used to image low absorbing, heterogeneous matter at a mesoscopic scale, differential phase contrast (DPC) can be implemented without adding *any* additional optical component to the normal scheme of the microscope. The DPC mode is simply generated by an appropriate positioning and alignment of microscope apertures. Diffraction from the apertures produces a wave front with a non-uniform intensity. The signal recorded by a pinhole photo diode located in the intensity gradient is highly sensitive to phase changes introduced by the specimen to be recorded. The feasibility of this novel DPC technique was proven with the scanning X-ray microscope at the ID21 beamline of the European Synchrotron Radiation facility (ESRF) operated at 6 keV photon energy. We observe a differential phase contrast, similar to Nomarski's differential interference contrast for the light microscope, which results in a tremendous increase in image contrast of up to 20 %when imaging low absorbing specimen.

Submitted as:

B. Kaulich, F. Polack, U. Neuhausler, J. Susini, E. Di Fabrizio, and T. Wilhein, "Diffraction aperture based differential phase contrast for scanning X-ray microscopy," Optics Express (submitted).

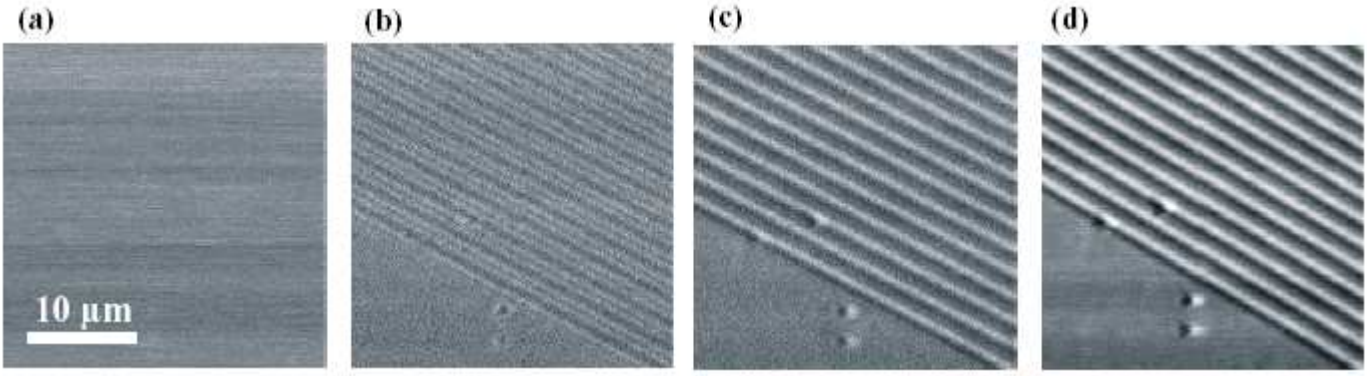

Fig. 1: Comparison of bright-field imaging with DPC X-ray imaging under different conditions. The X-ray images show 2 µm thick PMMA grating structures with a transmission of 99.6 % transmission at 6 keV photon energy. The acquisition time was in all cases 50 ms/ px. (a) is acquired in bright-field imaging mode without pinhole shaping the detector and integrating over the entire detector area. (b) DPC X-ray image with a 10 µm pinhole shaping the detector, but without central stop. (c) Is the corresponding DPC X-ray image with central stop introduced into the optical scheme. (d) DPC X-ray image, where the 10 µm pinhole in front of the detector was replaced by a 50 µm pinhole.