to construct the phase ring as a combination of two or more materials in order to choose the phase shift and the absorption in a suitable manner for the desired contrast. The phase ring can also be constructed such that only an attenuation, combined with a phase shift of 180°, is achieved. The phase shifting properties of the object structures are used by means of the phase shift of, for example, 90° or 270° to increase the image contrast. The phase shifted and attenuated zero order radiation components of the radiation coming from the object interfere in the image plane with the higher order radiation components which are not affected by the phase ring, and thus produce a high contrast, enlarged image of the object. This image of the object can, for example, be detected with a CCD detector in the image plane (**6**) and displayed on a monitor. In addition, the image can be further processed by known methods of image processing.

We claim:

1. Phase contrast X-ray microscope comprising:

a pulsed X-ray source for generating an intense line radiation,

an annular condenser for focusing radiation from said X-ray source on an object to be investigated,

an X-ray detector

X-ray optics constructed as a micro zone plate with a rear focal plane, for imaging said object at high resolution on said X-ray detector, and

a phase ring in said rear focal plane of said micro zone plate, for applying to zero order X-ray radiation coming from said object a phase shift with respect to higher order radiation deflected by said object, which phase shift is determined by thickness and material of said phase ring.

2. Phase contrast X-ray microscope according to claim **1**, wherein said condenser comprises an annular mirror for grazing incidence.

3. Phase contrast X-ray microscope according to claim **1**, wherein said condenser comprises an annular zone plate.

4. Phase contrast X-ray microscope according to claim **1**, wherein said condenser comprises a combination of an annular mirror for grazing incidence with an annular zone plate.

5. Phase contrast X-ray microscope according to claim **1**, wherein said condenser comprises an annular mirror coated with a multiple layer.

6. Phase contrast X-ray microscope according to claim **1**, wherein said condenser comprises a combination of a mirror coated with a multiple layer and an annular zone plate.

7. Phase contrast X-ray microscope according to claim **1**, wherein said phase ring is located on a carrier foil that is sufficiently transparent to X-ray radiation used.

8. Phase contrast X-ray microscope according to claim **7**, wherein said carrier foil comprises a silicon foil.

9. Phase contrast x-ray microscope according to claim **1**, wherein said phase ring comprises a copper ring, 0.46 μm in thickness, located on a silicon foil about 0.1–0.3 μm in thickness.

10. Phase contrast X-ray microscope according to claim **1**, wherein said phase ring comprises a combination of at least two different materials.

11. Phase contrast X-ray microscope according to claim **1**, wherein said phase ring is arranged to phase shift said zero order X-ray radiation by 90°.

12. Phase contrast X-ray microscope according to claim **1**, wherein said phase ring is arranged to phase shift said zero order X-ray radiation by 270°.

13. Phase contrast X-ray microscope according to claim **1**, wherein said phase ring is arranged to apply a combination of absorption and phase shift to said zero order X-ray radiation to minimize radiation dosage to which said object is exposed to produce an image.

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