power. The source includes an x-ray tube with reflection anode and electro-magnetic electron beam control. The minimum focal spot size is of the order of 20 micron. Cu Ka X-ray flux at 50 W is 2×10^{13} ph/sec. For various solutions, the source can be equipped with different types of X-ray optical systems forming quasi-parallel or convergent beam. X-ray optical systems mounted onto the source provide for quasi-parallel X-rays of the order of 10^{10} ph/sec/mm^2 in the ∅ 200 micron beam.

Keywords: microdiffraction, X-ray source, protein X-ray crystallography

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BL-17: New Structural Biology Beam Line at the Photon Factory

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The high brilliance beam derived from the mini-pole (mini-gap) undulator which is newly designed for the short straight section, U17, at the Photon Factory (PF) offers unique possibilities for structural biology. We propose two frontiers in this area, micro-crystal structure analysis and structure determination using softer X-rays. The extremely small beam size of the mini-pole undulator source, together with advances in X-ray optics allows that even with 2[nd] generation synchrotron facility, outstanding performance can be obtained at modest cost.

The main optical elements are the double crystal monochromator and the K-B mirror system for fine focusing. The monochromator consists of flat Si(111) crystals which are cooled with liquid nitrogen. The K-B mirror system after the monochromator focuses the synchrotron beam on the sample position. It consists of a flat-bent mirror for vertical focusing and an elliptical-bent mirror for horizontal focusing which is achieved by the "Arm Method" mirror bender. The BL-17 will deliver the first beam in September, 2005.

We describe the beam line optical design, the performance characteristics and the current status of the construction.

Keywords: macromolecular synchrotron X-ray crystallography, diffraction synchrotron radiation microcrystals, low energy SAD phasing

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Portable X-ray Complex for Micro-diffration and Micro-analysis of Element Composition of Poly-crystal Materials

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At present diffractometers with powerful X-ray tubes are used to carry out phase analysis of crystal objects with linear sizes, not more than 0.1mm. Developed at the IRO, an X-ray tube with electro-magnetic focusing of electronic beam, provided with an X-ray collimator on the basis of mono-capillary optics, allows - if radiation power is 3.5W and exposition time do not exceed 5 min - to receive X-ray diffractogram of poly-crystals using position-sensitive detector. Experiments were carried out with poly-crystal Al_2O_3 material of a 30mcm diam., when X-ray radiation power was 3.5W and exposition time was 5min., using a linear position-sensitive detector and 30mcm mono-capillary. Flux density of quasi-parallel X-rays was 10^{10} ph/mm^{2}sec. As experiments show, diffractogram of a micro-object does not differ from usual powder diffractograms, that proves the possibility to carry out express-phase analysis of micro-objects on new small-size roentgen sets of low power.

The portable diffractometer construction allows, using Mo – $K_{\alpha,\beta}$-radiation, to bring into coincidence a diffractional channel and an X-ray fluorescent spectrometric channel to receive information about phase and element composition of one and the same local area of a specimen.

Keywords: micro-diffraction, poly-crystal, mono-capillary source

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X-ray Back-diffraction Wavefields Self-imaged with a CCD Detector

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Self-detection of X-ray diffraction [1,2] has been measured by a decreasing in the photocurrent or photocounting of a detector when its crystal is in diffraction condition. The x-ray self-detection image with the diffraction of a single crystal CCD detector and conventional x-ray sources at diffraction angles far from 90º [3] was recently reported. In the present work the self-detection of x-ray diffraction was imaged using a CCD detector (EEV 05 30) diffracting Si (800) with Bragg angle around 90º (back-diffraction). The measurements were carried out in the XRD2 beamline at LNLS (Brazilian synchrotron). The depletion layer of this CCD (30 μm thick) makes it a finite crystal for the used energy (9.14keV). Self-back-diffraction topographies and back-diffraction topographies of the CCD, taken at different back-diffraction angular positions, show the crystal structure strain, i.e., only parts of the CCD are diffracting at each diffraction angular positions. A phase effect of the wavefield inside the CCD chip due to the interference of the **o** and **h** beam was also detected. This interference effect open the possibility to exploit phase contrast images obtained from the different **o** beams, those crossed a sample, and the **h** beam leaving the CCD chip. The use of the CCD being, simultaneously, detector and analyzer crystal in an analyzer-based x-ray back-diffraction phase contrast imaging setup was also exploited.

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Keywords: X-ray imaging, X-ray back-diffraction, instrumentation

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A High Quality Bent Crystal Monochromator based on Asymmetric Laue Geometry

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Using the Monte-Carlo program recently developed by the author, it was found that the rocking curves of neutron and X-ray from a bent mosaic crystal are better in agreement with experiment than those calculated from the one-dimensional layer-coupling model [1], used by Alianelli et al [2]. Moreover, our calculations show that a 67% reflectivity at the peak and 30% larger integrated reflectivity with much better focusing would be achieved if Laue geometry with asymmetric parameter $b < 1$ and optimum thickness [3] were used instead of the symmetric Bragg geometry for the bent neutron monochromator described by [2]. Our program takes into account all the complicate factors during the multiple reflection process and is appropriate for any crystal size, beam width, incident and exit beam angular divergence. It also provides the evaluation of the current density distribution curve under a given rocking angle.

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Keywords: monochromators, neutron X-ray diffraction, diffraction profile simulation