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X-RAY COMPLEX FOR PHASE PLUS ELEMENTAL ANALYSIS OF INORGANIC MATTER

C. Likhoushina N.S. Ibraimov S.V. Nikitina E.M. Burova D. Malagodi S. Srinivasan
Institute For Roentgen Optics 1st Volokolamsky Pr. 10, PMZR MOSCOW 123060 RUSSIA

This paper presents a layout of research mini-complex comprising a diffractometer and a spectrometer combined together into a single piece of equipment wherein the collimating system is made based on Kumakhov's polycapillary optics. Kumakhov's half- and full lenses are used within the suggested X-ray optic layout so as to enable selection of the sample area for the analysis and assure required X-ray characteristics. Such collimating system permits to produce spatially collimated quasi-parallel X-ray beam with ~10^{-3} radian divergence, raise more than by order the optic effectiveness of the instrument and reduce 3-5 fold undesirable background, enabling use of low-power (5 to 10 W) X-ray tube, which simultaneously considerably simplify the issue of radiation safety. Diffractometer's design features possible concurrent use of two X-ray tubes with different anodes fitted with capillary half-lenses working as a collimator to provide information required for identification of phase composition of complex poly-crystal structures. Goniometer-free method of taking diffractograms, applied here and including fixed positions of X-ray tube, position-sensitive detector and the sample considerably simplified the process of alignment enabling instrument industrial use or for investigation of ambiguous items. Phase analysis is done with the help of search software containing a wide selection of identification parameters oriented towards use of different databases on poly-crystal materials. Along with the diffraction unit, the suggested X-ray complex includes a spectrometry channel providing for a qualitative analysis of the chemical composition of the analyzed sample area.

Keywords: OPTICS, PORTABLE DIFFRACTOMETER

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USE OF KUMAKHOV'S OPTICS IN PORTABLE DIFFRACTOMETER FOR STRESS-STRAIN PLUS ELEMENTAL ANALYSIS

A.V. Lutsau A.D. Zvonkov A.V. Kotyolkin D.B. Matveev S.V. Nikitina N.S. Ibraimov D. Malagodi S. Srinivasan
Institute For Roentgen Optics 1st Volokolamsky Pr. 10, PMZR MOSCOW 123060 RUSSIA

One of the most important features of the developed portable diffractometer equipped with Kumakhov's half-lens is its capability of determining stress strain condition in various places of the object under analysis with the help of an X-ray tube rigidly coupled with an X-ray half-lens producing low-divergent (~10-3 radian) X-ray beam. The results of studying effectiveness of Kumnakhov's half-lens with regard to lowering noise, reducing width and increasing intensity of diffraction maximums and higher accuracy in determining their angular shift are given. The X-ray capillary half-lens used to form spatially collimated quasi-parallel beam and the full capillary lens used for X-ray focusing enabled functionality combination of diffraction and spectrometry units with linear-coordinate and energy-dispersion semi-conductor detectors to read simultaneously the information on stress-strain condition and element composition, respectively. The above parameters were quantitatively assessed based on the developed programs. Element analysis together with establishment of elastic lattice deformations carried out in real products permits to make a difference between deformations that occurred in the course of manufacture and acquired during their service (fatigue), and elastic deformations due to local changes in the element composition (aging, weld seams), which constitutes a vital criteria in respect of their reliability. Information on the changes in the percentage content of chemical composition in products at the localities featuring deformations and stresses provides an additional tool in expertise evaluation of the reasons for metal structures failures.

Keywords: **STRESS ANALYSIS, KUMAKHOV OPTICS**

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EXPERIMENTAL STUDY OF PROTEIN CRYSTALLOGRAPHY SYSTEMS BASED ON CURRENT LABORATORY GENERATORS AND OPTIMIZED CMF OPTICS

K. Tesh[1] A. Criswell[1] A. Courville[1] C. Yang[1] J. Ferrara[1] M. Kuribayashi[2] B. Verman[3] L. Jiang[3]
[1]RigakuMSC, Inc., 9009 New Trails Drive, The Woodlands, TX, USA [2]Rigaku Corp., 3-9-12 Matsubara-Cho, Akisima-Shi, Tokyo, Japan [3]Osmic, Inc., 1900 Taylor Rd., Auburn Hills, MI, USA

A new generation of home laboratory X-ray sources has extended the range of protein structures that can be solved and refined without going to synchrotron sources. A high brilliance, low maintenance generator has been developed which combines existing rotating anode technology and state-of-the-art microfocus X-ray generation technology.
Comparisons of intensity and data quality will be explored using the current available generators: the standard RUH2/3R series, the microfocus-sealed source MicroMax002, and the microfocus-rotating anode MicroMax007. We will present the results of experimental data to establish the utility of each generator.
Additionally, advances in Confocal Max-Flux optics[1] have increased the usable flux adding to the ability to study smaller and smaller crystals. A detailed set of experiments comparing several optics will be presented including crystallographic data collection and statistics.
References
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Keywords: **GENERATORS, OPTICS, HOME LABORATORY**

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DESY PLANS FOR THE UPGRADE OF STORAGE RING BASED SOURCES FOR SYNCHROTRON RADIATION

E. Weckert K. Balewski W. Brefeld F. Brinker W. Decking W. Drube H. Franz P. Guertler U. Hahn O. Kaul J. Pflueger H. Schulte-Schrepping M. Tischer J. Schneider
DESY HASYLAB Notkestrasse 85 HAMBURG D-22603 GERMANY

DESY's main future project is TESLA a 33 km long linear collider in combination with a X-ray free electron laser. Despite this large project DESY will try to provide state of the art synchrotron radiation from storage rings as well. After a comparative study on possible options it has been decided to use the 2.3 km long PETRA tunnel for a third generation synchrotron radiation source from 2007 on.
The storage ring will operate in the 6 GeV range with a design current of 200 mA. It's nominal emittance will be 4 nmrad without insertion devices. However, it is envisaged to further reduce the emittance to about 1 nmrad by damping wigglers, that can easily be installed in the long straight sections of PETRA. Nine straight sections will be designed for either one 5 m long undulator or two shorter ones inclined towards each other by 5mrad. Three additional straight sections will be available for 20 m long insertion devices. The brilliance will be in the 10^{21} ph/s/mm^2/mrad^2/0.1%BW range for the normal devices and significant above this value for the 20 m long ones. The minimal electron beam source size will be in 3 x 30 μm^2 range. In total about 13-15 undulator beamlines are planned, the definition of which is under way at present. In addition there exists the option to use also the very hard radiation from the damping wigglers and bending magnet radiation.

Keywords: **SYNCHROTRON RADIATION UPGRADE**