MICROSTRIP POSITION-SENSITIVE X-RAY DETECTOR BASED ON HR GAAS:CR FOR IN SITU MATERIAL STUDIES USING X-RAY STRUCTURAL ANALYSIS METHODS

V.V. KRIVSHENKO[1], V.YA. KHRISTENKO[1], K.V. BESKONCHIN[1], S.S. KOVALSKY[1], V.V. DENISOV[1], N.N. KRIVIN[2]

[1]Institute of High Current Electronics of the Siberian Branch of the Russian Academy of Sciences, Tomsk, Russia
[2]Tomsk State University of Control Systems and Radioelectronics, Tomsk, Russia

The modern requirements in the field of research on the synthesis processes of new materials include not only the necessity of precise analysis of the composition and structure of the material but also monitoring its changes in real-time during the material synthesis process or under the influence of various conditions. To achieve this goal, the in situ method is applied – diffractometry, which allows conducting X-ray phase analysis (XRD) of the surface under the influence of conditions such as elevated/reduced temperature, pressure, exposure to aggressive environments, and others.

For effective application of this research method, the use of a detector with high sensitivity and resolution is required, capable of providing precise data on the phase composition and structure of the material under various conditions. In this context, microstrip position-sensitive X-ray detectors based on HR GaAs:Cr serve as essential tools for implementing X-ray structural analysis in situ. HR GaAs:Cr are highly sensitive crystals of gallium arsenide compensated with chromium, which possess unique properties for X-ray analysis. Using them as the basis for microstrip detectors ensures high spatial resolution and sensitivity when measuring X-ray diffraction patterns.

Synchrotron radiation has greater intensity and monochromaticity compared to laboratory X-ray sources, allowing for more accurate and reliable data on material structure. Characteristics of fourth-generation synchrotron sources, combined with modern microstrip position-sensitive X-ray detectors, enable information gathering on the current state of the sample at frequencies of up to several measurements per second. This makes it possible to assess structural changes and analyze the speed of formation and disappearance processes of defects in the internal structure of materials during their operation. [1].

This report presents the results of the development of a microstrip position-sensitive detector based on HR GaAs:Cr for Experimental Station 1-2 «Structural Diagnostics» of the Synchrotron Radiation Facility - Siberian Circular Photon Source (SRF «SKIF»).

REFERENCES

[1] Emurlaev, K.I., Application of synchrotron X-ray diffraction for analysis of structure evolution in carbon and alloy steels under conditions of dry sliding friction: Abstract of the dissertation for the degree of Candidate of Technical Sciences. – Novosibirsk. – 2022. – 19 p