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SYNCHROTRON X-RAY DIFFRACTION ANALYSIS OF STRUCTURAL AND PHASE EVOLUTION AT THE INTERFACE OF METALS1

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Wear processes are of special interest both in scientific and practical terms. This is due to the enormous energy costs of overcoming friction forces as well as the regular failure of products and friction units as a result of wear [1, 2]. The only way to avoid wear is to eliminate direct contact between the rubbing pair. For this purpose, lubricants are usually introduced into the friction units. However, they don't always completely eliminate the problem of wear during operation, since there may appear zones working under of boundary or even dry friction conditions. Therefore, understanding the processes of structural transformations that occur directly during friction is extremely important, especially if one consider that dry friction is an inevitable and even desirable phenomenon in a number of units, for instance, in braking systems.

Synchrotron X-ray diffraction technique is a promising way to analyze structural and phase transformations in materials. High brilliance of the synchrotron radiation, many orders of magnitude more than with X-rays produced in conventional X-ray tubes, provides a high spatio-temporal resolution and makes it possible to implement *in situ* or *operando* observation of changes in the structure and analyze local areas of the material surface under friction [3-5]. Recently, an *operando* approach to control the structure of materials has been proposed at Novosibirsk State Technical University (NSTU). The scheme of the experiment is shown in Figure 1 and described in [4, 5].

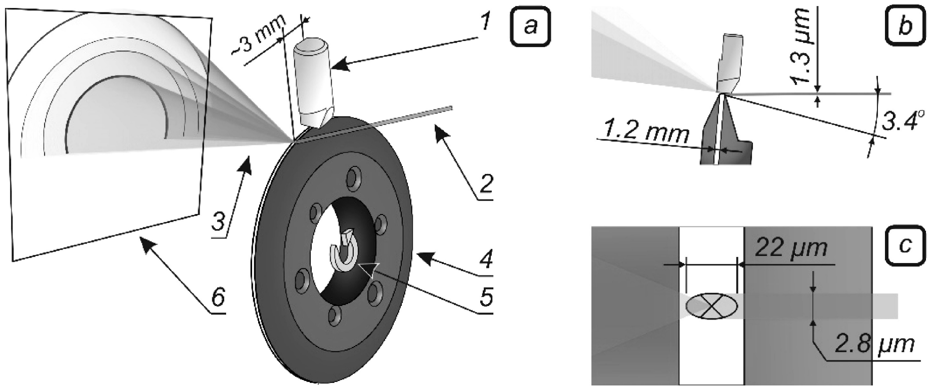

Fig.1. (a) The scheme of the *operando* observation of friction-induced structural changes using synchrotron X-ray diffraction: 1 – the pin; 2, 3 – the incident and diffracted radiation, respectively; 4 – the disk-like sample; 5 – the rotation direction; 6 – the flat detector; (b) the scheme of grazing incidence geometry; (c) the footprint of the beam on the work surface.

The results and features of the experiment will be presented during the report. The research was carried out at the ID13 beamline at the European Synchrotron Radiation Facility (France).

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