Investigations in recent years [1-6] make it clear beyond any doubt that the rupture resistance of friction surfaces is largely governed by the condition of the so-called secondary structures generated and evolved during the actual loading process. The condition of the working layer in these circumstances is determined by a number of structural and phase changes induced by the simultaneous action of a wide variety of factors, among which plastic flow of the surface layer and temperature are of particular importance. Naturally, of the investigations concerned with evaluating the structure of surface friction layers, of chief interest are those devoted to examining the generation and kinetic characteristics of such structural and phase transformations [3-5]. The research techniques employed up to now, x-ray diffraction (in some cases...
electron diffraction) and metallography, are incapable of evaluating with sufficient objectivity and reliability the phase composition and structure of extremely thin surface layers.

Totally new possibilities in this field have been opened up by special techniques of using modern electron microscopes of high resolving power [7-10]. It is now possible to study simultaneously the phase composition and structure of thin metallic films (up to a thickness of about 1000 Å), the size and shape of individual grains, and various crystal lattice defects (grain boundaries, dislocations, etc.) during the heating or deformation of a specimen in the actual electron microscope. This means that it is possible to study the propagation of such structural processes as morphological changes and allotropic transformations, solid-phase reactions, and reactions between a gas (operating environment) and a solid phase.

It should be noted that the development and application of this technique may prove to be of decisive significance also for assessment of structures and phases in the manufacture of new antifriction and friction powder metallurgy materials.