P. G. Borzyak, G. A. Katrich, Yu. A. Kulyupin, and P. M. Tomchuk, *Electronic Processes in Metal Island Films*. The individual metal islands on a dielectric substrate of which the "film" consists are combined into a single system through electron transfer between them (in our cases, this is usually transfer by tunneling). The result of this is that the system as a whole exhibits electrical conductivity as if it were a real film. We have now clearly demonstrated that the electrical properties of such films reflect their structure. By specifying particular structural inhomogeneities, we can produce films in which the potential barriers near electrodes depend on the polarity of the applied voltage, while, in others, the resistance of the film depends on this polarity. In the third group of films, we can produce *N*- or *S*-type switching effects, and, in the fourth group, negative differential resistance. All these phenomena are of undoubted physical and practical interest.

However, even when the films are structurally homogeneous, the current-voltage characteristics are nonlinear, and this is thought to be due to the heating of electrons in the islands. Because of the reduction in the electron-phonon interaction in small particles of the metal, the heating of electrons in the island films can be very considerable and may lead to cold electron emission from the islands. This is already being used in practical cold cathodes.

A whole series of experiments has been carried out, including some relatively refined observations. The results show that the observed cold electron emission cannot be explained in terms of the usual field emission me-

chanism but is satisfactorily interpreted in terms of the electron heating process. Some of these experiments have led to very promising practical applications.

The idea of inelastic tunneling of hot electrons, or their inelastic reflection from the potential barriers on the islands, also suggests that electron emission should be accompanied by cold luminescence from the islands. This effect has, in fact, been observed. If this is so, it should also be observed during the generation of hot electrons under the electron bombardment of any metal target, both film and bulk. This phenomenon has also been observed and is being investigated. In the case of bismuth, for example, a correlation has been found between the emission spectra obtained by passing a current through an island film and when the film is bombarded by electrons.

The emission spectrum produced by bombarding copper has been found to contain a well-defined maximum which corresponds to an equally sharp maximum on the curve representing the distribution of the density of electron states. It reflects the density of states at 2 eV below the Fermi level. This result shows that studies of the emission produced by the bombarded metals can serve as an additional source of information on the electron energy structure of solids.

Electron bombardment has also been found to produce radiation connected with the radiative decay of collective plasma excited states. When the islands are very small, a size-dependent shift of the plasma resonance has been found to take place toward shorter wavelengths.

Size-dependent changes in band structure have been investigated in gold. When the island size is sufficiently reduced, the *s* band begins to "disintegrate" and becomes insignificant for islands consisting of a few tens of atoms. The *d* band remains stable under these conditions.