

(Nanoobjects microscopy)

The analyze of nano-size inhomogeneities of substrate by surface electrons over superfluid helium film

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The surface quality of the substrate is a crucial factor at creating of a "clean" low-dimensional system. There are a number of methods of analysis of surface quality including the method of scanning tunneling microscopy. The system of surface electrons (SE) over substrate with small permittivity is good "tool" to analyze substrate. The mobility of SE over superfluid helium film on substrate is restricted by interactions with the helium atoms in gas, with ripplons and with roughnesses of surface: , where μ_c and μ_{im} are mobilities of SE over ideal and non-ideal substrate, correspondently. The level of liquid helium beneath substrate H defines film thickness as $d = k_v / H^{1/3}$ ($k_v = 2.88 * 10^{-6} \text{ cm}^{4/3}$). In [1, 2] the dependence of value as function of d was considered (see figure). The potential of interaction with roughness is (Z is distance from electron to substrate, A – effective amplitude and lateral size of inhomogeneities, correspondently). At $A \sim z \sim d \sim 10^{-5} - 10^{-6} \text{ cm}$ (here z is distance to liquid) the transport of SE no sensitive practically to the inhomogeneities with magnitude $\sim 10^{-3} \text{ K}$. But at $z \sim d \sim A/2$ the magnitude $\sim 1 \text{ K}$ leading to localization of SE and to decreasing conductivity. The thermal activation energy of electron on film obtained from is of order of. The new method was applied providing a uniformity of the film on substrate by accurate horizon of cell. We use plunger with electro - mechanic driver into helium chamber for adjust of level liquid.

1. Coimbra D., Sokolov S. S., Rino J. P., Studart N. Surface electron mobility over a helium film //Phys. Rev., - 2006.- B, **74**. - P.1-7.
2. Mende F. F., Kovdrya Yu. Z., Nikolaenko V. A. Localization of electrons in 2D system over helium film //Fiz. Nizk. Temp., -1985- **11**. - P.646-651.