

Novel spectrometer for investigating nanostructure field emission: adjusting, test spectra and first results

Davydov S.N., Bondarenko V.B., Gabdullin P.G., Gnuchev N.M.

St.-Petersburg State Polytechnic University, St.-Petersburg, Russia

To study physical nature of low voltage field emission of carbon nanostructures, a new electron spectrometer has been elaborated [1]. The very first spectra recorded from carbon structures deposited on silicon monocrystal (100) surface had rather a complicated shape of two or three peaks definitely separated by 1–2 eV gaps. It was so unexpected that the only reasonable decision that could be accepted was to carry out a series of verifying experiments using some well known emitters with predictable emission energy spectra.

Two types of test samples were chosen. The first group was just classical pointed cathodes prepared, by means of electro-chemical etching in alkali solution, from 150mkM tungsten wire. The reason for that choice was actually similarity in electron extraction processes of the test samples and the samples under investigation.

Then the spectra were recorded from plane thermo-emitters because their geometry was similar to the geometry of the investigated units.

To get comprehensive and detailed knowledge of spectrometer parameters and capabilities, spectra recording was conducted under variable conditions, such as temperature, emission field strength, current intensity, focusing or defocusing lens regimes, different correcting currents in Helmholtz coils etc. This was combined with introducing some modifying elements into the spectrometer construction and scheme. Finally, energy resolution of approximately 30–40 meV was achieved and some energy spectra were recorded from nanostructured emitters.

- [1] Davydov S.N., Gabdullin P.G., Ryumin M.A. 9-th Biennial International Workshop “Fullerenes and Atomic Clusters”, Book of abstracts. P.165