Ion tieatment influence on operation of field emitters with nanostructured fullerene coatings

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Field emitters are attractive for use in many types of electron devices. But now, these emitters are applied mainly in ultrahigh vacuum, low-voltage and low-current systems. Only in such circumstances, it is possible to minimize destructive influence of ion bombardment on the field emitters operation and so secure required durability. There is point of view, that carbon and carbon containing emitters, as well as emitters with special protective coatings from theese materials, have high stability to the ion bombardment action in high voltage devices operating at the technical vacuum conditions. However, the ion bombardment influence on such emitter functioning in high voltage facilities was insufficiently investigated.

Authors of this report worked out and investigated [1] practically prominent protective fullerene coatings for field emitters. These coatings, activated by low energy (40 -100 eV) potassium ion flow, differ from coverage of another type as they secure high current take-off (some tenth of microampere from submicron tip) at reduced operating voltages. The aim of recent work was to receive data of the mechanism and basic rules of ion bombardment effect on the activated fullerene coating characteristics.

Operation of field emitters with activated fullerene coating was studied in wide range of emission currents. It was shown that the treatment by potassium ion flow might be used not only for decrease of its work function value but also for increase of distributed protrusion structure uniformity on the coverage surface. Besides, important information was obtained about emitter functioning at heightened pressures and intense bombardment by the residual gas ions. Investigations in technical vacuum (10^{-6}–10^{-7} Torr) revealed the unknown earlier phenomena of self-reproducibility of distributed nanostructures on the activated fullerene coatings at intense ion bombardment conditions. Thanks to this mechanism, it became possible to obtain considerably more maximal currents at intense residual gas ion bombardment than at high vacuum conditions.

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[1] T.A. Tumareva, G.G. Sominski, I.A. Svetlov, A.N. Morozov, *Technical Physics* **53**(11), 1504 (2008).