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&
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Field emission from a pointed emitter based on graphene films on SiC

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Field-emission cathodes is promising sources of free electrons. You need to create a high electric field strength at the surface for the start of emissions. Application of the tip field emission cathodes with nanometer rounding-off radius of the top allow to achieve high values of the field strength at low voltages [1].

Material of a field emission cathode has great influence on the field emission. Graphene on silicon carbide is applied in our work. Graphene is one of nanocarbon materials, has unique electrical, mechanical and temperature properties. Silicon carbide is a chemical and radiation resistant high-temperature material. As a result cathodes based on silicon carbide with graphene films are promising elements for vacuum electronics.

In this paper we study field emission cathodes cathodes based on silicon carbide with a graphene film on the surface. The samples of silicon carbide doped with nitrogen were prepared to study the electron emission. Then, a point field emission cathodes height of 1 μm and rounding-off radius of 10-40 nm was formed from silicon carbide. Field emission cathodes was formed without lithography method by using a focused ion beams on a pre-designed graphic templates [2]. It is possible to reduce the number of operations in the manufacture of cathodes and reduce the complexity of the process Graphene on the silicon carbide surface was formed by thermal degradation of silicon carbide in a vacuum [3]. This method allows to obtain a graphene on the entire surface of the sample with good adhesive properties to the substrate. Current-voltage characteristics were measured after field emission cathodes manufacturing. The interelectrode gap was 1-5 nm. I-V characteristics showed that the emission from cathodes based on graphene begins at 2 volts. We received currents degree of 10^{-8} A at voltages up to 10 V. I-V characteristics in the Fowler-Nordheim coordinates was built based on the experimental I-V characteristics. The results of theoretical calculations showed that the work function is about 0.75 eV.

Thus, studies have shown that a low work function and low threshold voltage are typical for field emission structures of silicon carbide with graphene films. This confirmed the promising of applications of these materials in micro- and nanoelectronics devices.

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