PREPARATION OF A COPPER SURFACE FOR THE CVD SYNTHESIS OF MONOLAYER GRAPHENE.*

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Modern CVD methods are developing in two main directions. The first is mass synthesis technologies, which include continuous synthesis systems based on various types of roll technologies, where copper foil is stretched through the hot zone of the reactor. The second direction is the synthesis of a large area graphene single crystal. In this case, it is assumed that the most suitable catalytic substrates are the precious metals like gold or platinum, on which it is possible to obtain large-sized metal grains. However, a number of recent studies have shown that by pre-heat treatment of copper, it is possible to obtain oriented grains on copper foil [1]. Graphene crystals formed on grains with the same crystallographic orientation form a graphene film with properties close to that of a single crystal. Thus, an important task today for the development of large-scale CVD technologies for graphene synthesis, which today are focused only on the use of a copper catalytic substrate, is to develop a method for forming a given copper surface texture.

In this paper, the influence of pretreatment stages of copper foil on the formation of its texture during graphene synthesis is studied. Preparation of the copper foil consisted of washing in water, in water and acetone, processing with acid (30% HNO3), followed by annealing for 0.5-10 hours, after which the graphene layer was grown in a mixture of Ar/H2/C2H2, the synthesis conditions are presented in detail in [2].

As a result of experiments, it is shown that the surface texture of copper is determined mainly by the annealing atmosphere and duration. Annealing regimes are obtained in the atmosphere of hydrogen, in which a surface of copper with an orientation (111) and a grain size of 5-10 mm is formed. The formation of a surface with orientation (111) occurs when the oxide layer is etched, which, as shown in [3], can stabilize the surface (001). Experimentally obtained conditions in which the copper texture is formed with the orientation (001), during annealing in an argon atmosphere and during short-term treatment with hydrogen, while the characteristic scale of copper grains is up to 0.2. Analysis of synthesized graphene on various surfaces showed that under identical conditions, a monolayer with a small number of defects is formed on the surface of 001, and a monolayer coating with inclusions of two and three-layer graphene is formed on the surface of 111.

REFERENCES

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