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STUDY OF THE DIAMOND AND DIAMOND LIKE FILMS FORMATION AND TECHNOLOGY DEVELOPMENT FOR THE FILMS PRECIPITATION ON SOLID SURFACE FOR WEAR RESISTANCE INCREASING OF TOOLS, MACHINE AND MECHANISM PARTS

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The laboratory and the authors of the report carried out tests of electrogenerating thermoemission thermionic fuel elements of thermionic reactor of space nuclear power plant, studied emission-adsorption properties of thermionic converter electrodes, studied processes on a surface of refractory metals (desorption, segregation, surface diffusion). At present time the laboratory efforts are directed on studying of the diamond and diamond like films formation and growth processes for further development of a technology of the films precipitation on a surface of solid.

Purpose of the project: The purpose of the project is a development and a creation of an effective technology of the diamond and diamondlike films precipitation on materials, including refractory metals, semiconductors and composite on the carbon fibers base. The study method includes the experimental investigation of the base surface structure and properties, preparation of the surface for diamond and diamond like coats growing. The precipitation of above mentioned films will be carried out from the plasma being formed from carbon gas medium at low pressure.

The main purposes of the project are:

- development of the technology for obtaining the films with specified properties; provision of required rate of the precipitation;
- decreasing of temperature;
- manufacturing of the functioning laboratory stand with further developing of a pilot-
- commercial plant for diamond and diamond like coating.

It is supposed to develop a method of the monocrystal diamond films growing, that are useful for semiconductor devices manufacturing.

Essence of the problem : Valuable physical properties (high hardness, high heat conduction and strength; the corrosion and thermal resistance; low specific heat; unique optical properties and so on) of diamond, make it widely used in engineering industry, the electronic and medical industries, mining and construction industries, in optical and other systems.

Tools manufacturing becomes considerably easier and cheaper with use of diamond films compared with use of nature diamonds. Details of complicate construction and configuration can be easy coated during diamond synthesis from a gas medium. Implementation of diamond and diamond like films coating technology can be made cheaper and easier.

The main purposes: Research team of NNC of RK IAE will modernize the available plants for investigation of base surfaces that will be used for diamond films growing manufacture and adjust the plant for diamond films application with use of the

thermo-emission method; develop and put into operation a plant that use SHF radiation power; organize the research groups for study of the diamond films structure and quality with use of Ramanov and Auger-electron spectroscopy, X-ray crystal analysis, and with microhardness control and adhesion methods.

The methods: A thermo-emission and ECR methods will be used for investigation of the diamond and diamond like films formation and growth processes. The plant that will be used for the first method is a twoelectrode construction. Refractory metals (W,Re) being heated up to 2500 Kelvin degrees, are usually used as an actuating electrode. The second one is a base on which the precipitation is carrying out. Refractory metals, steel, silicon can be used as the base. Actuating medium is a mixture of carbon and inert gases. The second method is based on a principle of a plasma formation with use of 2.45 GHz SHF radiation power. An ECR-plasma is formed in conjunction with magnetic field in the actuating chamber. This method allows to precipitate high quality films at lower pressure.

Expected results: The main purpose of the project is to assimilate the high effective technology of the diamond and diamond like films precipitation on different materials, including refractory metals and alloys, semiconductors and composites based on carbon fibers. After the developing of the technology that provides to obtain the films with specified properties and required rate of precipitation, it is supposed to create a pilot-commercial plant for machine and mechanism parts coating and wear resistance tools manufacturing.

Partnership: It is supposed to co-operate with ASI corporation (USA) which supplies with the technique of the diamond films growing for carbon fibers coating and render an assistance to get necessary equipment for our laboratory, carries out necessary investigations of the diamond films obtained by your laboratory.