PLASMA-ASSITED DEPOSITION OF DIELECTRIC COATINGS FOR ELECTRICAL INSULATION*

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Currently, plasma polymerization of films is a rapidly developing field of plasma technology [1–4]. One of the possible applications of this method is the deposition of protective dielectric coatings on defects in the electrical insulation of a spacecraft [1, 3]. As dielectric coatings in exploitation process are subjected to temperature extremes, solar radiation, etc., special attention should be paid to the operational properties of the resulting coatings [2, 3].

In this paper, we consider the methods of plasma polymerization using the low-pressure and atmospheric-pressure discharge in argon as a plasma source. The aim of investigation is obtaining a polymer layer with both high electrical strength and good mechanical properties. In our experiments we have used a flowing type plasma chemical reactor operates with argon mass flowrate up to 0.03 g/s and the monomer mass flowrate up to 1 mg/s. The vapors of organic (Methyl methacrylate, Paracyclophane) or organosilicon (Hexamethyldisiloxane) compounds have been generated in special constructed vaporizer at temperature range from 120 ºC to 180 ºC. The monomer vapor flow is transferred via the discharge plasma region and subsequently is deposited on an aluminum, copper or glass substrate. The discharge power was adjusted to limit the temperature in the substrate area at level less than 120 ºC.

To study the stability of the obtained films, thermal cycling from -70 ºC to 120 ºC experiments was carried out. Experiments to estimation the electric strength of coatings have also been done. It was found that the operational properties of the deposited films strongly depends on the parameters of the deposition process, such as carrier-gas flowrate, precursor concentration and the discharge power. Based on the investigation results a basically principals of construction for novel system for eliminating defects in dielectric coatings using plasma-assisted deposition has been proposed.

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