# PLASMA MODULE FOR NONTHERMAL ACTIVATION OF VACUUM-PLASMA PROCESSES

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The purpose of this paper is to study the impact of plasma-forming gas preionization in a pulsed E-type discharge on the removal rate of the photoresist film from the surface of a silicon wafer in the afterglow of plasma discharge with the hollow cathode effect.

One of the most interesting phenomena in physics of gas discharge is discharge in system with a hollow cathode. A great number of features of this type of discharge determine its wide application in spectroscopy, microwave techniques, various ionic devices for welding and fusing of metals. Hollow cathodes are also used in aerospace engineering as electron emitters in advanced ion thrusters, where they exhibit longer lifetime and greater reliability than oxide-coated or liquid metal cathodes.

Using the developed plasma module (Figure 1) impact of plasma-forming gas preionization in a pulsed E-type discharge on the removal rate of the photoresist film from the surface of a silicon wafer in the afterglow of plasma discharge with the hollow cathode effect are studied. Experiments were conducted with films deposited and treated in accordance with the standard mode of positive photoresists AZ-1350J and S1813G2SP15 trademarks on 76 mm diameter substrates. The plasma-forming gas is air. The removing process of the photoresist are controlled by spectral method.

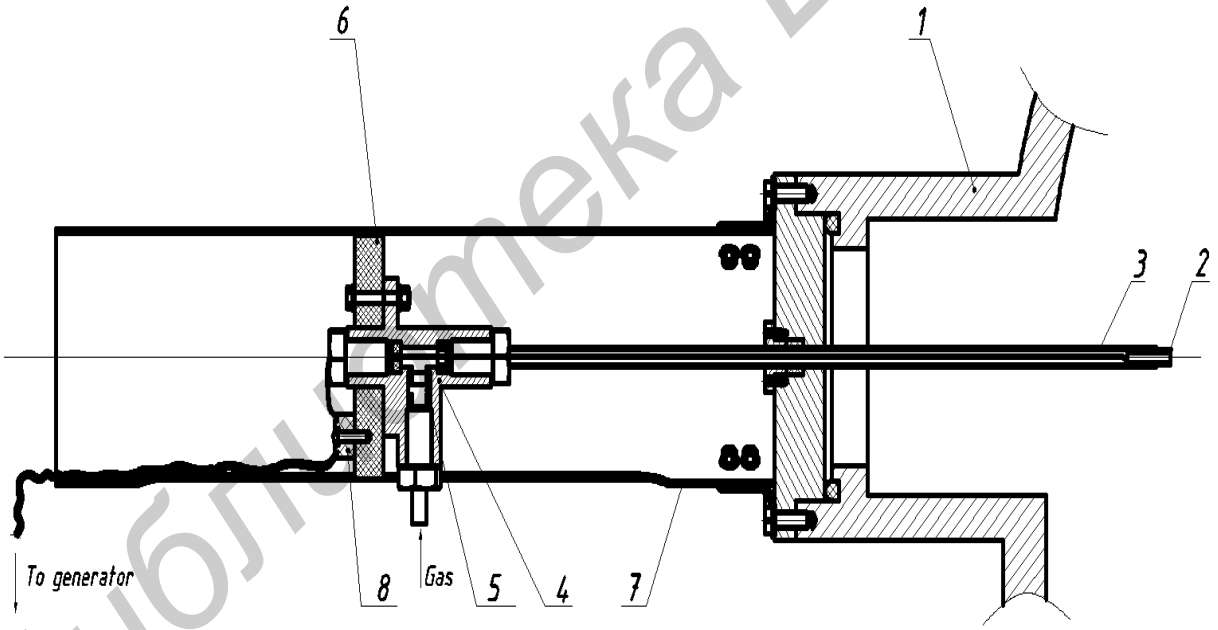


Figure 1. “Schematic cross section of the plasma module for nonthermal activation of vacuum-plasma processes”

1. Vacuum post URM –3.279.029
2. Hollow cathode
3. Quartz tube
4. Tee
5. Connecting pipe
6. Round support
7. Protective casing
8. Connector block

Dependence of the removal rate of the photoresist films from the surface of a silicon wafer in the afterglow of plasma discharge with hollow cathode effect from the pressure in the discharge chamber during the discharge capacities of 85 and 95 W, with preionization of plasma-forming gas is presented on figure 2.

During the investigations it was established that under the conditions of plasma gas preionization removal rate of photoresist film from the surface of the silicon wafer is higher in 3 - 4 times than in its absence. When the discharge capacity of 85 and 95 Watts, maximum removal rate of photoresist film was observed at pressures in the discharge chamber about 150 - 170 Pa.

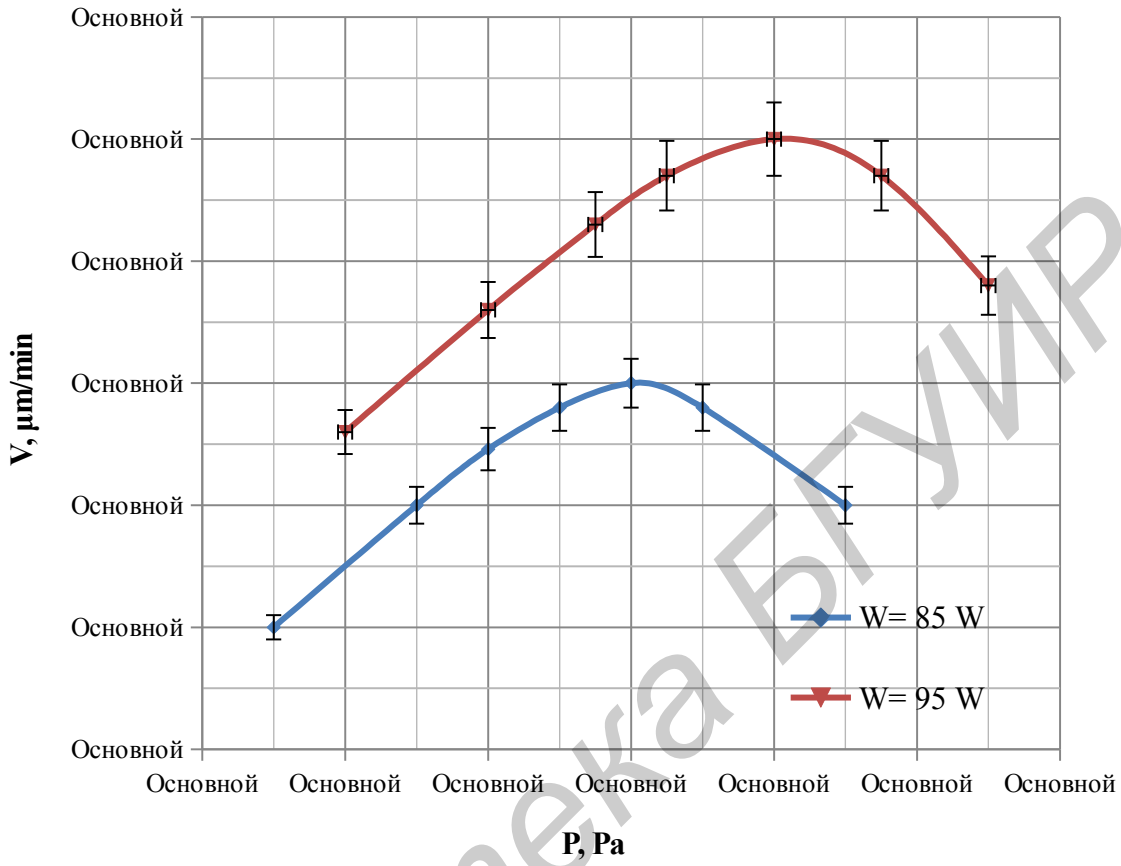


Figure 2. “Dependence of the removal rate of the photoresist films from the surface of a silicon wafer in the afterglow of plasma discharge with hollow cathode effect from the pressure in the discharge chamber at different power of discharge”

Thus, in the unit process of photoresist films removing in the manufacture of integrated electronics, the preionization of plasma-forming gas allows to accelerate significantly the etching process, compared with the etching process in a pulsed E-type discharge without preionization, while maintaining the durability of a photoresist masking coatings in the treatment process.

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