1. The use of dielectric barrier discharge (DBD) began in European countries about 100 years ago.
2. The design of the DBD can be different, but fundamentally it consists of two electrodes that are separated by a dielectric of several millimeters.
3. The dielectric barrier can be made of glass, quartz, ceramic or polymer - materials with low dielectric losses and high strength.
4. When an alternating current (1-20 kHz) is applied, a plasma glow is formed near each electrode.
5. The discharge flows in a wide variety of gases through a large number of current filaments called microdischarges.
6. The discharge mechanism is as follows: due to the applied voltage, an electronic avalanche is created which passes into a streamer growing from the anode.
7. This phenomenon is called microdischarge.
8. Microdischarges have a memory effect. When changing the polarity of the voltage, new streamers hit the same place as the previous ones.
9. The physics of this phenomenon is explained by the fact that electrons move faster in the streamer channel than heavy ions.
10. Due to the formation of a positive charge, forbidden zones appear in which new streamers cannot hit.
11. This effect is called the regular pattern of microdischarges.
12. The main problem of the DBD is the inability to control the transition from the glow mode to the streamer mode.
13. For many industrial applications, stationary operation in the glow mode is necessary, however, when the working conditions change, the discharge switches to a more stable streamer mode.
14. There is no solution to this problem yet.
15. Despite this, DBD has a large number of applications. one of the most surviving is the control of transonic and supersonic flows. With the help of a discharge, it is possible to transfer the transition from laminar to turbulent flow.
16. This reduces the pulse effect on the object itself and reduces the noise level.
17. DBD is also used to replace mechanical drives with plasma.
18. For example, instead of a bladed vortex generator, it is possible to use a DBD that can generate longitudinal vortices.
19. DBD is also used to reduce skin friction and to increase downforce on race cars, airplanes and spaceships.
20. The theory of discharge in DBR is not complete, but a large number of research groups around the world are working on this problem.