The concept of operation of a new microwave plasma source with peculiarities that distinguish it from setups described in literature and common in physical laboratories and modern technique has been developed. The basis for this source are two resonance phenomena realization of which leads to the drastic decrease of plasma production threshold and to the generation of dense and hot plasma in a wide pressure range of working gases.

One of these resonances can be classified as “geometrical” as it is determined by relation between plasma producing elements sizes and wavelength of microwave radiation. The second one – “plasma resonance” – is realized when cyclic microwave frequency coincides with the plasma Langmuir frequency.

Calculation of plasma producing elements that are dipoles located on the surface of dielectric substrate has been carried out in the framework of KARAT program. It has been shown that at the definite sizes of dipoles in the places of their discontinuities conditions for generation of dense plasma filling gaps and flying apart are realized.

If density of this nonuniform plasma exceeds “critical” value conditions of nonlinear absorption of microwave energy in a “plasma resonance” region with transformation of it into electron component energy are coming into existence. Flux of energetic electrons and UV-radiation from place of local absorption of microwave energy leads to the formation of plasma “halo” in the volume much grater than the microwave energy release volume.

Experimental setup in which “double resonance” conditions are manifested has been installed and put into operation. Scheme of it is shown on the Fig. 1. Microwave energy is transported by cylindrical waveguide as the mode $H_{11}$ to the cut dipole located on the quartz substrate. Microwave frequency $\approx 2.45$ GHz, pulse duration $\approx 85-90$ ms, pick power $\approx 4$ kW. Results of first experiments are presented as well as discussion of prospects for plasmachemical applications of a new microwave plasma source.

**Fig. 1**
Scheme of experiment intended to “double resonance” microwave plasma source investigation.
1-source of microwave radiation; 2-vacuum chamber with two quartz windows; 3-metal-dielectric (cut dipole on the quartz substrate) plasma source; 4-microwave interferometer; 5-optical spectrograph; 6-single Langmuir probe.