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DEVELOPMENT AND TESTS of HF RECTANGULAR ION SOURCE FOR TECHNOLOGICAL APPLICATIONS

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Application of modern plasma technologies to industry requires the development of the ion sources which can generate uniform beams of inert and chemically reactive ions for processing of large scale samples. One of the approaches to solution of this problem is the development of the long linear ion sources. Nowadays only linear ion sources based on the dc discharge with filament cathode can be offered to the customers. It is well known that filament cathodes have limited lifetime especially when using reactive gases and can be used only in the limited number of plasma technologies. From this point of view HF ion sources look much more attractive because they provide the possibility to obtain ions of inert and reactive ions with small amount of impurities with resource limited only by the lifetime of the ion extraction system. Different modes of HF discharge are utilized nowadays in the family of common cylindrical ion sources. Literature survey shows that in the range of relatively low HF power input one of the most prospective schemes of HF ion sources is based on the excitation of electrostatic waves in plasma volume located in the external magnetic field. Really, large potential drops available in the capacitive discharges arises the problem of ion beam pollution due to the sputtering of electrodes or walls of the plasma volume while in order to obtain pure inductive mode of HF discharge it is necessary to apply high values of HF power. The developed model of linear HF ion source based on the excitation of the electrostatic waves consists of the quartz or pyrex gas discharge chamber (GDC), copper antenna, magnetic system based on permanent magnets and magnetic poles, ion optic system (IOS).

GDC represents parallelepiped with internal dimensions 300x50x50mm opened from the bottom side. On the top side of the GDC the glass distributor is mounted. On the external lateral surface of the GDC the copper zigzag antenna is assembled. In construction IOS presents one assembly unit. The grids are made of titanium alloy OT40-1. The emission, acceleration and deceleration electrodes are slit type grids, the width of the slit is 2 mm, the distance between slits 3 mm. The gap between electrodes of IOS is about 1mm. The voltage supply for feeding emission electrode gave the opportunity to change the ion beam energy from 0 to 1700 eV, the potential of acceleration electrode could be changed from 0 to 1000V, the deceleration electrode was grounded.