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EFFECT OF MAGNETIC FIELD ON THE PLASMA CHEMICAL PROCESS OF COMBUSTION OF LIQUID COMPOSITE BIOFUELS

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During the combustion of liquid biofuels composite external magnetic field can influence the atoms have a magnetic moment, on moving charged particles and dipoles. The magnetic field may also affect the ferromagnetic and paramagnetic additives "drawing" them in the field and by arranging the direction of the field, as well as diamagnetic additives, "pushing" them out of the field.

The purpose of research - the study of the influence of magnetic field on the plasma-chemical process of combustion of liquid composite biofuels.

Materials and methods of research. When burning biofuels in microwave fields may occur the following processes:

a) collision of plasma electrons with molecules of H_2O and biofuels, leading to ionization, dissociation, electron attachment (including dissociative), vibrational excitation of H_2O molecules and biofuels;

b) ion-molecule reactions, the processes of ion-ion and electron-ion recombination and electron attachment to small gas component;

c) the relaxation of the vibrational energy of the water molecules and chemical reactions involving these vibrationally excited molecules;

d) electron drift due to external electric field and determines the discharge current, as well as the diffusion of neutral and charged components of the plasma.

Low-temperature plasma process can be obtained by burning the composite biofuels that during the injection into the combustion chamber is a heterogeneous gas with high humidity.

The ionization of the gas is carried out using a microwave plasma torches. The degree of ionization depends on the temperature and is proportional to the number of atoms is given or absorbed electrons. Even weakly ionized gas in which less than 1% of the particles are ionized and actively interacts with the external magnetic field and has a high electrical conductivity. Microwave plasma torches,

reproducing corona discharges, provide a high electric field strength at the time of injection droplet biofuel mixture into the combustion chamber. There is an irreversible deformation of atoms, accompanied by removal of an electron.

In order to create a mathematical model of the behavior of particles in the plasma in an external electromagnetic field, we define some boundary conditions:

1. Do not consider the behavior of the plasma in the border areas, where the plasma is transferred from one physical state to another.

2. The plasma has a high conductivity, so the electric field inside the plasma can be considered equal to zero, ie, plasma tends to escape all of the electrical field.

3. The plasma itself is strongly influenced by magnetic fields. For every particle of the plasma gas in a constant magnetic field, Lorentz force /

4. The plasma particles (electrons, ions, neutral molecules) differ in the sign of the electric charge and can behave independently of each other - have a different speed, and even the temperature that causes the emergence of new phenomena such as unusual wave of instability, two-temperature distribution of the particles and electrons.

5. In a plasma possible collective interactions between particles that affect the overall state of the system far more than the two partial.

The results of research. In practice, the plasma - the open system with non-equilibrium complex chaotic structure in which there is no thermodynamic equilibrium under constant constructive screen. Therefore, to determine uniquely the function of collisions for different groups of charged particles in practice is not feasible task.

The original solution is the approach proposed by Vlasov, in which the solution is sought in the form of the distribution functions of the states of the particles that have wave properties. According Vlasov frequency plasma waves is much greater than the frequency of binary collisions of particles. Therefore, instead of describing the interaction of charged particles in the plasma through collisions,

he suggested the use of the self-consistent field produced by the charged particles of the plasma to describe the long-range potential.

In fact, the Vlasov equation - is the Boltzmann equation, which does not take into account the collision of particles. But the essential difference between the system of Vlasov equations of motion of charged particles in a magnetic field is that the self-consistent electromagnetic field is a complicated function of the distribution functions of ions and electrons. This is called self-consistent field approximation. The collisions between charged particles are taken into account, not openly, but only after they create a self-consistent field. Vlasov introduced instead of one distribution function - two parts: the distribution function for the ions and the distribution function for electrons.

We believe that the fluctuations of the distribution function with respect to the equilibrium state is small, and the system of equations can be linearized. Linearization describes the dynamics of plasma in a self-consistent magnetic field.

The presence in the space of the combustion chamber of an external magnetic field provides an additional effect on moving charges, primarily on the electrons. Moreover, the upper electron orbitals, gaining additional energy from the corona discharge generated microwave plasma torch leaves the atom, forming a plasma ions. These ions acquire the ability to form reactive radicals that initiate the branched-chain reactions during combustion, creating favorable conditions for a rapid and complete combustion of the composite fuel emulsions and suspensions.

It is known that the strongest magnetic field creates a toroidal conductor system, in which the electric current flows. This study has allowed to find out the properties of the torus, which set the microwave plasma torches is necessary so that the ignition of the fuel mixture is carried out in the plane circles Villars for provisioning the maximum rate of formation of free radicals.

In the proposed design of the combustion chamber it is proposed to apply the microwave plasma generators, positioned at an angle of 30 degrees to the axis of symmetry of the nozzle of the circle plane Villars. To suppress the ambipolar diffusion of charged particles in the combustion chamber has an internal screen.

When using a microwave plasma torches at a frequency of 2.45 MHz, we have a wavelength in 12.245 cm.

From here you can define the parameters of some of the main structural elements:

1. The inner diameter of the screen should be more than 12.45 cm.

2. The height of the cylinder is used as a screen, there must be more than 1.5 × 12.245 = 18.37 cm.

3. The gap between the inner wall of the combustion chamber and the outer wall of the cylinder should be less than 6.22 cm.

Conclusions

On the basis of the developed mathematical model of behavior of plasma particles in an external electromagnetic field is calculated design parameters of the combustion chamber with the use of an external magnetic field geometry and optimal positioning of the microwave emitters in the combustion chamber during combustion of composite biofuels.