

ELECTROPLASMOCHEMICAL TECHNOLOGIES OF THE ORGANIC FUELS COMBUSTION(FIRING) AND OF THE POLLUTANT EMISSIONS REDUCTION

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Abstract: This paper work presents new electroplassmochemical technologies of the fuel composition preparation, of the flame direction and of the sulphur and nitrogen oxides conversion into mineral fertilizers. The experts debugged an efficient electroplassmochemical method regarding the thermal, kinetic and geometric characteristics setting of the flame and of the incomplete firing reducing.

Keywords: firing, electric field, electroplassmochemical technologies, fuel composition preparation, flame setting, fuel gas handling.

1. INTRODUCTION

The firing processes have an important role in the energy producing technology. The rational organization of the firing processes leads to the saving of huge quantities of fuel, to the consequences decreasing as to the ecological impact, to the good development of the technological process. The main problems that appear at the same time with the firing processes execution are the preparation and the assurance of the fuel intimate composition, the adjustment of the thermal, kinetic and geometric fuel characteristics, the interruption of the pollutant matters formation and the exhaust gasses depollution.

Lately, the experts looking for solving these problems showed a great attention for a new method as to the firing process set-up by the appliance of the electric fields. Due to the fact that the influence of the firing process becomes possible in the electric field at the atomic and molecular level by the selective action over the particles loaded in the admixture space of the firing components or directly in the flame, this method has the advantage of the supplementary intensification and of the finest setting of the process characteristics. The method is individualized in order to solve three categories of problems:

- 1) the preparation of the mixture fuel- comburant;
- 2) the direct action of the electric field over the flame for the setting of these thermal, kinetic and geometric characteristics;
- 3) the decreasing of the pollutant emissions from the firing plant

In this paper work there are presented new electroplassmochemical technologies for the organization of the preparation processes as to the mixture fuel-comburant for firing, for the flame direction and for the flue gas depollution.

2. THE APPLIANCE OF THE ELECTRIC AND MAGNETIC FIELD IN THE FIRING PROCESSES

By creating new possibilities for a good organization of the firing processes that exploit at maximum the chemical energy incorporated in the organic fuels, by applying new original modalities of finest direction of the firing process, and by the enhance of the oxidation and conversion chemical reactions of the polluted substances from the fuel gasses under the electric fields action, it was drawing up a complex method regarding the improving of the firing efficiency and the decrease of the polluted emissions in the atmosphere in the firing plants. (fig.1)

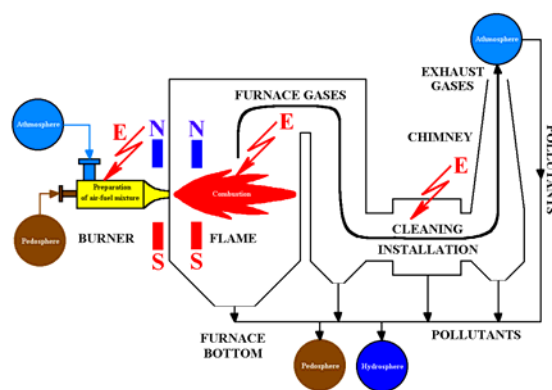


Fig. 1. The complex electric and electromagnetic fields in a firing energetic plant at the electroplasmochemical technologies accomplishment

3. ELECTROPLASMOCHEMICAL TECHNOLOGIES FOR THE PREPARATION OF THE FUEL MIXTURE FOR FIRING

At the specialists drafted new technologies for the preparation of the mixture fuel-comburant for the firing in the electric field [1-3], that can be used in the firing plants of the boilers, industrial kilns and thermal engines.

The new technical solutions use the electric fields action over the processes up to the gas firing, that improve and accelerate the firing of the gas and liquid fuels. The idea of applying the electric fields in the preparation phase of the mixture fuel-comburant for the firing, consists in the ionizing of the fuel components and of the comburant with inverse polarities in corona discharge fields and their mixture in an alternative field (fig. 2). This diagram offers the possibility of the intimate mixture of the firing components at the molecular level, that leads to the improvement of the firing efficiency and at the decrease of the air excess coefficient and of the unfired substances in the gases evacuated in the flue.

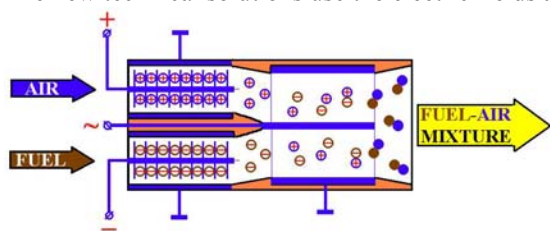


Fig.2. The diagram of the electroplasmochemical process as to the fuel mixture for firing

As to the liquid fuels, the appliance of the electric field offer great possibilities of direction and intensification of many processes like the liquid fuel pulverizing, the aerosol flux direction made of oxidant and liquid fuel, liquid fuel and combustion gasses to vaporize the disperse phase and to mixture the components.

4. THE SETTING OF THE GEOMETRIC, KINETIC AND THERMAL CHARACTERISTICS OF THE FLAME

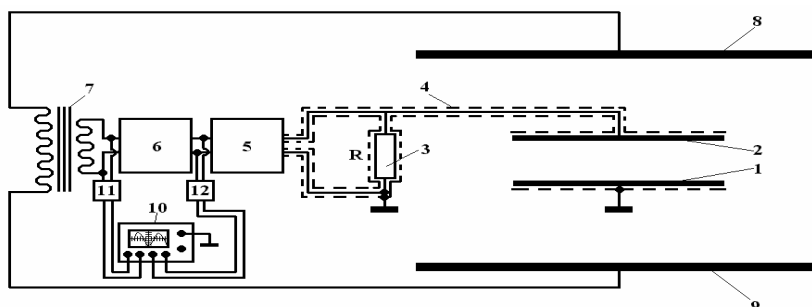


Fig. 3. The plant electric diagram for the setting of the geometric, kinetic and thermal characteristics through the conversion of the noise generated by the flame.

1,2-the electrodes of the passive drill, 3- the loading resistance of the passive drill, 4-the display; 5-the signals tension amplifier; 6-phase shifter; 7-high pressure converter; 8,9- the electric field application electrodes over the flame.

An important aspect of the conceived method refers to the direct interaction of the electric field with the flame. For this it was proposed the application of the rotate and alternative electric fields over the flame {4,5}, as well as the use of the reverse feedback of the firing setting device with the flame. All these are possible [6] through the electric noise record of the flame, through the amplification and its conversion into vibrations of the fuel (oxidant) efficiency or of the acoustic waves generated by the flame.(fig.3). The alternative electric field application over the flame leads to: the increasing of the firing efficiency, the increasing of the flame temperature or the decreasing of the carbon monoxide in the firing gasses. Through the rotating electric field application over the flame, through the variation of the electrodes speed or of the field angular frequency there is possible the flame characteristics setting: geometric (of the angle of inclination length and width) , kinetic (the fuel mixture speed, the normal firing speed) and thermal (the temperature and intensity of the generated heat).

5. ELECTROPLASMOCHEMICAL TECHNOLOGIES REGARDING THE TREATMENT OF THE FIRING GASSES

The technologies diagram of the simultaneous decrease of NO_x and SO_2 in the firing gasses is: he firing gasses receive the necessary energy for the ionization and radicals forming O, OH, HO_2 , which oxidize the molecules of NO_x și SO_2 in a pulsing field of corona discharge. These are transformed through the hydrolysis and neutralization reaction into nitrogen and sulphur acid. Through the ammonia introduction, it finally obtains ammonia nitrate and sulphate under the finest particles that are kept into an electro filter.(fig 4)

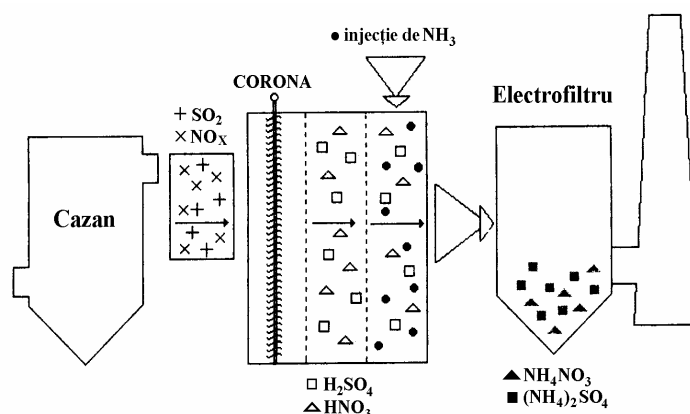


Fig. 4. The electroplasmochimical technologies regarding the treatment of the firing gasses

As to the proposed technology [7], the NO_x și SO_2 emissions reducing efficiency increases through the application over ionized firing gasses of an alternative electric field with the effective intensity of 5-30Kv / cm

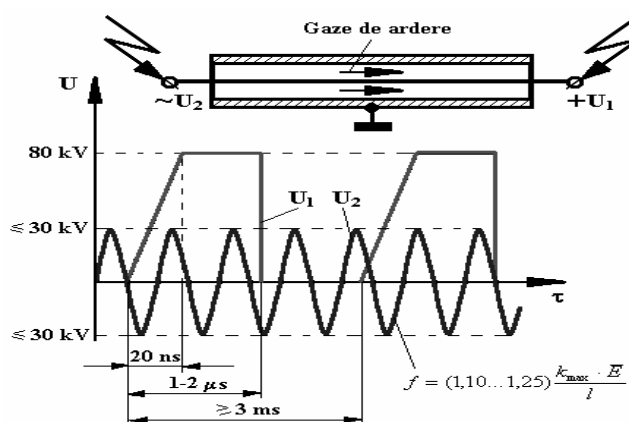


Fig. 5. The supply diagram of the reduction cell of SO_2 NO_x in the firing gasses trough the of the alternative and pulsing electric fields.

and the frequency determined by the maintenance condition of the ionized particles in the inter electronic space (fig.5).

In the alternative field the ionized particles have an oscillatory movement that increases the probability of the

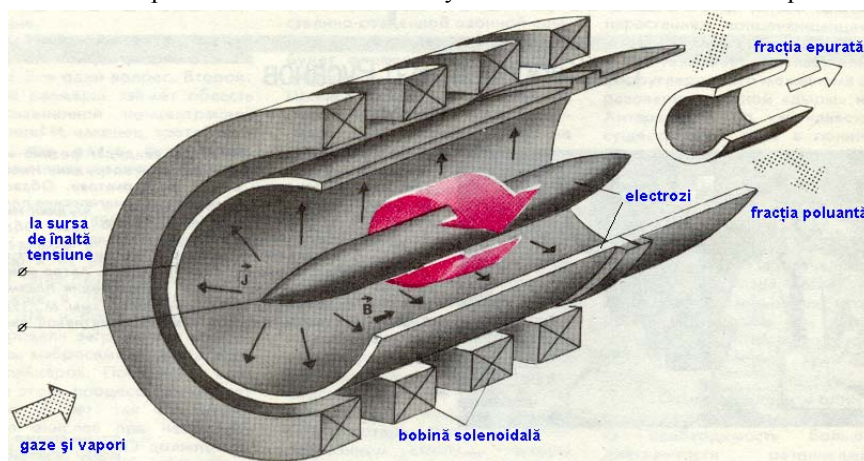


Fig. 6. The electroplasmochemical impuls technologies for firing gasses depollutions

impacts between the positive and negative ions and between these and neutral molecules, increasing the reduction reactions of the emissions.

Another way of the firing gasses depollution is the centrifugal action of the low temperature plasma components (the ionized firing gasses) in the radial electric field intersected with a longitudinal magnetic field (fig. 6) [8]. The components separated this way are in or out the reaction space.

4. CONCLUSIONS

New electroplasmochemical technologies have been elaborated such as : by the preparation of the mixture fuel-comburant for firing; by direct action of the electromagnetic and electric field over the flame; by the reduction of the pollutant emission in the firing plants.

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