EFFICIENCY OF WATER-FUEL EMULSION PREPARATION

Kundenko M.P., Zubchenko P.O.

National Technical University «Kharkiv Polytechnic Institute», Kharkiv

In modern power engineering, due to the need to use more and more heavy, low-quality fuels (with a complex composition of the mineral part due to deeper oil refining), the problems of corrosion and contamination of heating surfaces of steam boilers, ICE elements and GTD under the influence of the flow of combustion products are becoming relevant. Water-fuel emulsions are multi component chemical systems, the combustion characteristics of which are not currently systematized. Many of the positive effects of emulsifying liquid fuels are associated with their economy and soot formation, while using only atomized volatile fuels. In this regard, considerable attention has been paid to the study of the combustion of single droplets and jets of emulsion aerosols.

In its liquid state, water, being a natural brake on all thermal processes, leads to unstable operation of power plants. At the same time, in its vaporized form, water regulates the course of combustion processes, contributes to the complete burning of fuel and, as a result, improves the environmental characteristics of heavy hydrocarbon combustion. Therefore, it is advisable to pre-prepare water-emulsion fuels for combustion by converting as much of the water as possible from the liquid state to the vapor state. The process of heating a drop of water-fuel emulsion at atmospheric pressure is accompanied by a sudden change in their diameter by a factor of 1.5-2, separation of small particles from the bulk of the fuel, and sometimes even crushing of the initial drop. These features of the droplet behavior are the result of microexplosions that occur when the phase state of water in the fuel changes in the form of bulk inclusions.

Another important factor that characterizes the efficiency of using WFE is the increase in the efficiency and durability of furnace equipment. Radiation heat transfer (in the furnace) and convective heat transfer are enhanced. The generation of an acoustic field helps to clean the heating surfaces.

One of the serious problems that arise when burning furnace oils is their high sulfur content. Sulphur compounds are carried away with the flue gases, polluting the atmosphere, and when high-sulphur fuel oils are used in metallurgy, they partially pass into the melt. To prevent this, it is necessary to conduct theoretical and experimental studies of electrophysical methods of WFE preparation using low-frequency acoustic technologies.

References:

1. Research on the Method of Improving Fuel Quality for Heat Generators. Kundenko M., Rudenko A., Mardziavko V. *Proceedings of the 5th International Conference on Modern Electrical and Energy System, MEES 2023*.

2. Development of a Model of Cell Functioning to Measure the Interaction of Low-Energy EMF Kundenko M., Chaly I., Vakhonina L., Rudenko A., Mardziavko, V. *32nd International Scientific Symposium Metrology and Metrology Assurance, MMA 2022*.