# CLARIFICATION OF THE PARAMETERS OF THE INSTALLATION FOR DETERMINING THE EXPLOSION CHARACTERISTICS OF DUST–AIR MIXTURES

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**Abstract:** At the V. V. Voevodsky Institute of Chemical Kinetics and Combustion of the Siberian Branch of the Russian Academy of Sciences, an installation has been designed for determining the characteristics of the explosion of dust–air mixtures in accordance with the regulatory document GOST 12.1.044-89 (p. 4.11). The installation makes it possible to determine the lower concentration limit of flame propagation, the minimum phlegmatizing concentration of the phlegmatizer, the minimum explosive oxygen content, as well as the maximum explosion pressure of dust–air mixtures. The need to determine such characteristics is caused by safety requirements when performing production processes associated with the formation of combustible dust and gas mixtures. The purpose of this work is to justify the choice of the design parameters of the ignition source, the time of the beginning of spraying, and the time of switching off the heating spiral which are the main parameters for the correct determination of the explosion indicators of dust–air mixtures. To achieve this goal, experimental studies of the material and design parameters of the heating spiral were carried out and their optimal values were selected. A theoretical description was given that satisfactorily describes the experimentally measured dynamics of the heating and cooling processes of the heating spiral. The moment of opening of the air supply valve, which determines the start time of spraying and the time of switching off the heating spiral, was justified.

**Keywords:** explosive dust; explosion limits; explosion pressure; heating spiral; heat exchange

**DOI:** 10.30826/CE21140309

## Figure Captions

**Figure 1** Installation for determining the indicators of explosion of dust–air mixtures. Schematic diagram: *1–3* — valves for air, gas, and phlegmatizer supply; *4* — pressure gauge valve; *5* — supply valve to the receiver; *6* — gas supply valve from the receiver to the gas analyzer; *7* — supply valve from the reaction vessel to the gas analyzer; *8* — valve for measuring pressure in the reaction vessel using a pressure gauge; *9* — pressure relief valve from the main line to the atmasphere; *10* — pressure relief valve from the reaction vessel; *11* — pneumatic distributor; *12* — check valve; *13* — pressure sensor; *14* — heating spiral; *15* — rotameter; *16* — gas analyzer; *17* — receiver; *18* — prechamber; *19* — reaction vessel; *20* — pressure gauge; *21* — autonomous power supply; *22* — filter; and *23* — electronic control unit

**Figure 2** Dependence of the heat transfer coefficient $\alpha$ on the equilibrium temperature $T_e$

**Figure 3** Dependence of the measured equilibrium temperature $T_e$ on the power of the current source $P$ at different positions of the thermocouple

**Figure 4** Time history of temperature $T$ inside the spiral: *1* — calculation of the temperature of the heating spiral according to Eq. (3); *2* — experimental temperature data measured inside the heating spiral; and *3* — result of the joint calculation of heating and cooling of Eqs. (3) and (4)

## Table Caption

Dependence of the equilibrium temperature $T_e$ on the supply voltage

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*Received August 14, 2021*

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