Electronic supplementary materials *Mendeleev Commun.*, 2025, **35**, 617–618

Effect of electric field on the ignition of methane–air mixtures

Vladimir S. Arutyunov, Kirill Ya. Troshin, Aleksandr A. Zakharov, Andrey A. Belyaev and Artem V. Arutyunov

The experiments were carried out in a static installation, previously used to study the ignition processes of various gases.[S1,S2] A heated spherical-cylindrical stainless steel reactor had a diameter of 120 mm and a total length of 272 mm (Figure S1). One of the ends of the reactor is a hemisphere with a diameter of 120 mm. An optical quartz window with a diameter of 120 mm and a thickness of 20 mm is installed in the opposite end. Channels with an internal diameter of 9 mm for gas inlet, pressure measurement and insertion of the central electrode are located at a distance of 176 mm from the optical window.

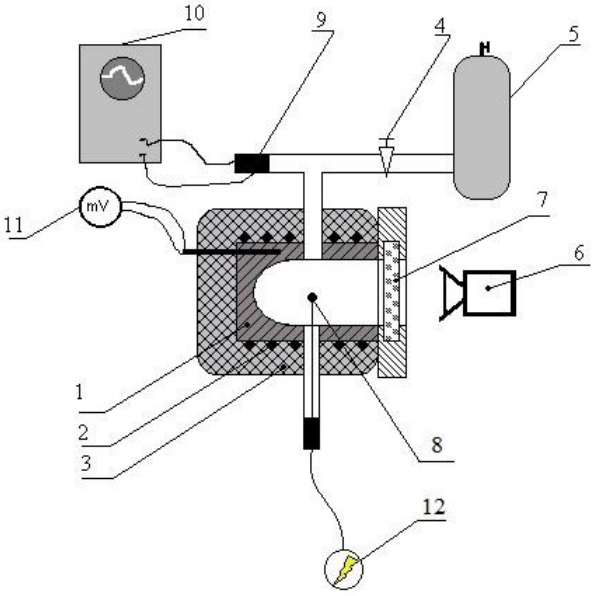

Figure S1. Reactor diagram. 1 – stainless steel reactor; 2 – electric heater; 3 – thermal insulation; 4 – bypass valve; 5 – high–pressure mixer; 6 – video camera; 7 – quartz window; 8 – spherical electrode; 9 – pressure sensor; 10 – registration system; 11 – thermocouple millivoltmeter; 12 – high voltage unit.

Steel balls of various diameters installed in the center of the reactor were used as electrode. In most experiments, a steel ball with a diameter of 6 mm was used. The experiments were carried out mainly at a pressure of 1 atm and temperatures up to 700°C. The ignition delay time (IDT) was determined as the difference between the moment of high voltage supply after the mixture was injected into the reactor heated to a set temperature, and the moment of a sharp pressure rise.

A quartz window made it possible to visually verify that no gas breakdown occurred within the range of temperatures under study at atmospheric pressure and voltage at the electrode, $U < 20$ kV. This was also confirmed by the low leakage current of the discharge circuit, less than 1 μA. The experiments were performed at a lower voltage $U < 13$ kV (electric field strength $E \approx 2$ kV/cm). In a number of experiments, high-speed video recording of ignition and flame propagation in the reactor was performed at a frequency of 5,000 frames per second.

References

S1. K. Ya. Troshin, A. V. Nikitin, A. A. Belyaev, A. V. Arutyunov, A. A. Kiryushin and V. S. Arutyunov, *Combust., Explos. Shock Waves*, 2019, **55**, 526; https://doi.org/10.1134/S0010508219050022.

S2. V. Arutyunov, A. Belyaev, A. Arutyunov, K. Troshin and A. Nikitin, *Processes*, 2022, **10**, 2177; https://doi.org/10.3390/pr10112177.