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DETERMINATION OF QUENCHING DISTANCE FOR CARBON MONOXIDE-AIR FLAMES

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The dependence of quenching distance for CO-air flames on mixture composition, temperature, and pressure has been experimentally investigated.

The dead space and the quenching distance determine the quenching action of the surrounding walls on a flame [1, 2, 3]. The aim of the present work was an experimental determination of quenching distance for CO-air flames.

The experimental determination of quenching distance, in contrast to dead space, may be carried out with great accuracy, the method being a simple one [3, 4, 5]. The apparatus used consisted of a rectangular burner with adjustable

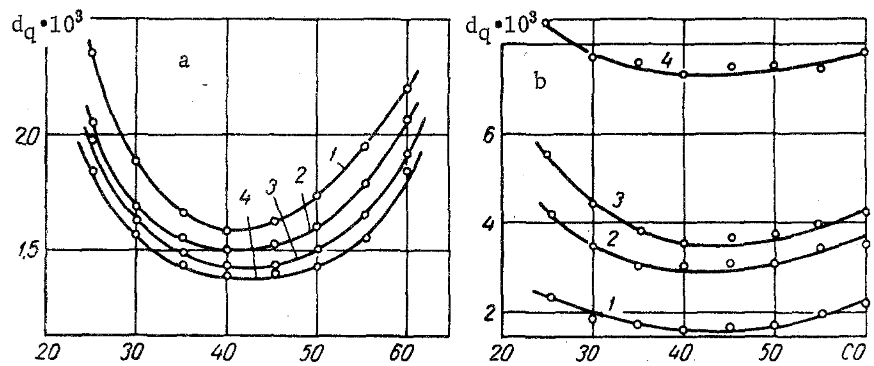

Fig. 1. Quenching distance d_q (in meters) as a function of mixture composition: a) at various temperatures (1 – T = 291°K; 2 – 373; 3 – 473; 4 – 573); b) at various pressures (1 – P = 10.1 • 10^4 N/m^2; 2 – 7.4 • 10^4; 3 – 6.1 • 10^4; 4 – 4.8 • 10^4)

aperture width. Two walls of the burner were duralumin plates (height 90 mm, width 30 mm, thickness 8 mm). The other two walls were plane-parallel glass plates (height 100 mm, width 60 mm, thickness 14 mm). The use of glass walls enabled the distance between the other two walls to be fixed with the help of a telescopic comparator (accuracy of measurement 0.01 mm). The distance between the duralumin walls could be varied using a micrometer screw. The

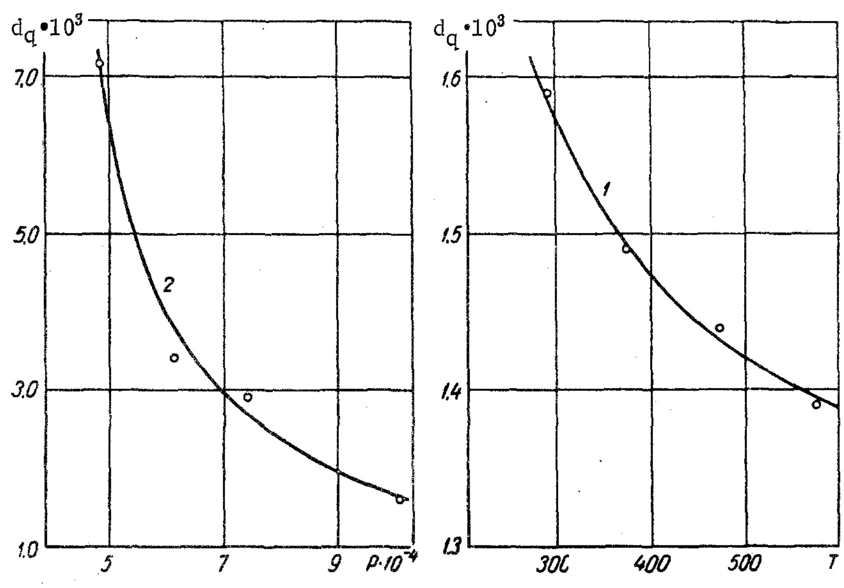

Fig. 2. Quenching distance d_q (in meters) as a function of mixture temperature T, °K (1), and mixture pressure p, N/m^2 (2), for a 40% CO + 60% air mixture.

CO-air mixture was supplied to the burner from a storage tank. A glass vessel was positioned between burner and tank, so that passage of the flame through the burner could be detected from the flash in the vessel. To investigate the dependence of quenching distance on temperature, a resistance heater was built into both duralumin walls, so that the walls could be heated to the required temperature. To determine the dependence of quenching distance on gas mixture pressure, the burner was located within a metal container, to which were connected a mercury manometer, together with a pump for exhausting the combustion products. The container had a valve to allow adjustment of pressure to the required level with the pump operating continuously, as well as windows to allow visual measurement of the quenching distance. In all cases the mixture was ignited by an induction spark.

The dependence of quenching distance on mixture composition for various temperatures is shown in Fig. 1a. As the temperature increases, the curves retain their general shape, but are displaced downward, i. e., the quenching distance decreases with increasing temperature. The dependence of quenching distance on temperature for a mixture of 40% CO and 60% air is shown in Fig. 2.

The dependence of quenching distance on mixture composition is shown in Fig. 1b. As pressure decreases, the curves retain their general shape, but are displaced upward, i. e., the quenching distance increases with decreasing pressure. The dependence of quenching distance on pressure is shown in Fig. 2 for a 40% CO + 60% air mixture.

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