# Explosion characteristics of hydrogen-hydrocarbon-air mixtures at sub-atmospheric pressures

C. Movileanu, D. Razus, M. Mitu, V. Giurcan, A. Musuc, C. Hornoiu, P. Chesler
Ilie Murgulescu Institute of Physical Chemistry, Romanian Academy, 202 Spl. Independentei, 060021 Bucharest, Romania

Explosions of gaseous mixtures in closed vessels are characterized by important damaging effects: peak explosion pressures 7-10 times larger than the initial pressure and high maximum rates of pressure rise (between 50-500 bar/s), reached in a very short time (lower than one second, for small volume laboratory vessels).

The peak explosion pressure and the maximum rate of pressure rise of explosions in confined spaces are key safety parameters to evaluate the hazard of processes running in closed vessels and for design of enclosures able to withstand explosions or of their vents used as relief devices.

An experimental investigation on the explosion characteristics of hydrogen-hydrocarbon-air mixtures was carried out in a cylindrical chamber at room temperature (298 K) and sub-atmospheric pressures (40 kPa, 60 kPa, 80 kPa, 100 kPa). Based on pressure history recordings, some explosion parameters, e.g., maximum explosion pressure ($P_{max}$), maximum rate of pressure rise ($(dp/dt)_{max}$), deflagration index ($K_G$) and time to peak pressure ($\theta$) (combustion duration means all time till p reached the initial value) were derived. Effects of initial pressure ($P_0$), equivalence ratio ($\varphi$) and dilution fraction ($Z\%$) on these explosion indices were discussed. The results show that with the increase of initial pressure, the maximum explosion pressure, maximum rate of pressure increase and deflagration index increase monotonously while the combustion duration decrease.

Linear correlations $P_{max}/P_0$=f($Z$), $P_{max}$=f($P_0$) and $(dp/dt)_{max}$=f($P_0$) were found. In addition, the heat loss to the walls during the explosion propagation was estimated on the basis of the difference between the adiabatic and experimental measured pressure. The energy loss increases with the increase of initial pressure and specific heat of mixtures.