

# APPLIED PHYSICS AND ENGINEERING(ICAPE)

March 15, 2023 | Paris, France

Received date: 23-07-2022 | Accepted date: 25-07-2022 | Published date: 23-03-2022

## Flame propagation of LPG-air mixtures in a closed cylindrical vessel

**Codina Movileanu**

Ilie Murgulescu Institute of Physical Chemistry, Romania

The dynamics of premixed flame propagation in closed vessels models the burning process in a typical internal combustion engine and represents the initial flame acceleration stage in the development of detonation waves, being an important topic of the combustion science. The explosions occurring in domestic environments or chemical plants are frequent accidental events taking place during storage, transportation and manufacturing of gaseous fuels, failure of chemical and/or petrochemical plants, of high pressure vessels, fuel leaks in buildings or cleaning the fuel tanks. The knowledge of characteristic parameters of these processes allows the assessment of explosion risks for flammable mixtures in various conditions and the design of equipment and industrial plants where they might be formed. The characteristic parameters of explosion propagation in confined conditions are in closed connection with the initial pressure, temperature and concentration of the mixture, the characteristics of the explosion vessel and the position of the ignition source.

In the present paper, the explosions of gaseous LPG-air mixtures with various LPG concentrations between the flammability limits and initial pressures between 0.20 and 1.50 bar were experimentally investigated at ambient initial temperature, using a cylindrical vessel with 1.5 length to diameter ratio. The ignition, made by inductive-capacitive electric sparks, took place in the geometrical center or near vessel's bottom.

For centrally ignited explosions, linear correlations were found for the peak explosion pressures and the maximum rates of pressure rise against initial pressure. The intercepts of linear correlations  $p_{max} = f(p_0)$  are relevant for the amount of heat transferred to the explosion vessel before the end of combustion, depending on vessel's asymmetry. The comparison between experimental and adiabatic explosion pressures afforded the estimation of heat losses appearing in the last stage of explosions, strongly influenced by the ignition source position, initial concentration and pressure of flammable mixtures.

### Recent Publications

1.C. Movileanu, V. Giurcan, M. Mitu, D. Razus, D. Oancea, Ignition by Low-Voltage Electric Discharges of Diluted and Undiluted C<sub>3</sub>H<sub>8</sub>-Air Mixtures, Ind. Eng. Chem. Res. 2021, 60, 12123-12132.

2.C. Movileanu, M. Mitu, V. Giurcan, D. Razus, D. Oancea, Quenching distances, minimum ignition energies and related properties of propane-air-diluent mixtures, Fuel, 274, 2020, 117836.

3.Razus, D., Movileanu, C., Oancea, D., Additive influence on ignition of stoichiometric ethylene-air mixture by break sparks, Fuel 232, 134-140, 2018

### Biography

Codina Movileanu has her expertise in chemical kinetics in homogeneous and heterogeneous systems, combustion and flames of gases, flammability of gaseous mixtures in air, safety recommendations, for closed and open systems where deflagrations may occur. Available experimental techniques: methods for measuring the ignition and propagation parameters characteristic for gaseous fuel-oxidant mixtures (flammability limits; minimum ignition energy, for initiation with high-voltage or low-voltage electric sparks or with heated wires; peak pressure, maximum rate of pressure rise, deflagration index of closed vessel explosions; propagation speed and normal burning velocity). Main research directions: critical conditions for explosion initiation by means of electric sparks or hot bodies (metallic wires, jets of hot, burned gas); flammability limits; flame propagation in hydrocarbon-oxygen and hydrocarbon-air mixtures, in steady and non-steady conditions.

cmovileanu@icf.ro