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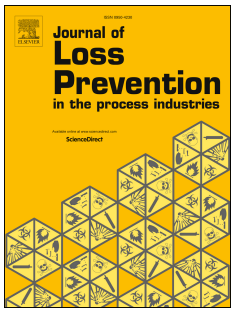

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Propagation Indices of Methane-Air Explosions in Closed Vessels

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Abstract

The peak explosion pressure, the maximum rate of pressure rise and the time necessary to reach the peak explosion pressure are important flammability indices of fuel–air combustion in closed vessels, characteristic for the laminar propagation stage of the process. In the present paper, these indices were examined using methane of various concentrations within the flammability limits, at variable initial pressure between 50 and 200 kPa and ambient initial temperature. For each composition, the experimental explosion pressures were compared with the adiabatic explosion pressures, computed under the assumption that chemical equilibrium is reached in the flame. The experimental explosion pressures and the rates of pressure rise are examined in comparison with literature data, the fluctuations being attributed to differences of heat lost by the flammable gas to the explosion vessel, during flame propagation. Using the differences between the adiabatic and experimental explosion pressures, the amount of heat lost to the walls during the explosion propagation in a closed vessel and the fraction of the transferred heat from the total released heat have been determined.

Keywords: methane; closed vessel; explosion; propagation; safety

1. Introduction

The explosion propagation in a confined space filled with a flammable mixture raises important safety issues for human activities involving fuel processing, storage or transport. After ignition, the flame propagates in the entire confined space determining a fast energy release, accompanied by pressure rise and by heat and light emission. The pressure evolution during confined explosions is the most important information necessary for risk assessment and for

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