

Understanding the Dynamics of Self-Ignition Phenomena in Hydrogen Mixtures

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Abstract:

This study explores the phenomenon and dynamics of self-ignition of hydrogen gaseous mixtures released from pressurized vessels, pipelines, and burners into the air, occurring without any ignition source. Research has demonstrated self-ignition at the oxygen boundary when hydrogen is released into oxygen through piston-driven mechanisms. This potentially hazardous situation is particularly relevant in hydrogen storage facilities during the sudden discharge of pressurized hydrogen, as well as during the pipeline transport of hydrogen.

So far we all know that it is possible that some form of electrostatic charging is a part of the mechanism where self-ignition of leaks of hydrogen from high pressure has occurred at ambient temperature. The postulated mechanisms described in the literature and discussed in our research do not account for all the reported ignitions and non-ignitions of hydrogen releases. There is the possibility that when hydrogen does ignite on release, two or more of the postulated mechanisms are present together.

The objective of the authors was also to conduct brand-new experimental study utilizing burner featuring distinct any obstacles as well as diameters and surface roughness of the extension tubes, to investigate the conditions under which hydrogen releases can ignite dynamically, particularly with respect to the electrostatic phenomena.

Keywords:	hydrogen, selfignition, combustion, hydrogen safety
Category (topic):	Hazards
Preference:	Oral
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