WP Static Electricity in Industry

ELECTROSTATICS 2025 International Conference on Electrostatics

9-12 November 2025, Bologna, Italy

Accidental self-ignition of hydrogen cloud released from pressure cylinder

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Abstract:

Hydrogen is a promising energy carrier with wide-ranging applications, but its safe storage and handling remain critical challenges. This study investigates the conditions leading to the accidental self-ignition of hydrogen during a controlled release from a pressurized cylinder. In the experimental setup, a hydrogen cylinder pressurized to 200 bar was penetrated by a bullet to simulate an accidental release. Thermocouples were strategically placed to measure the temperature of the escaping gas, while the event was monitored using high-speed cameras and drones equipped with thermal imaging technology. Temperature measurements of the escaping gas showed minimal variation. However, ignition was observed a few meters from the release point—a surprising result that suggests the involvement of external factors, such as electrostatic discharge or environmental interactions, rather than direct ignition from the hydrogen itself. These findings highlight the complexity of hydrogen behavior during high-pressure releases and underline the need for further research to understand and mitigate such risks.

Keywords: hydrogen safety, self-ignition, experimental investigation,
Category (topic): 4. Hazards
Preference: Oral/Poster
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