Clean Maritime Policy Unit

POLICY BULLETIN

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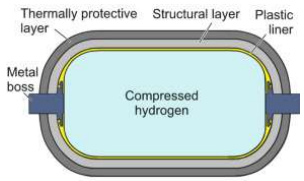
Microleaks-No-Burst Safety Technology:

Self-venting in a fire for TPRD-less hydrogen storage tanks

Hydrogen fuel has different characteristics from fossil fuels. Safer storage is critical for its use in transportation whether by ship, plane, rail or automobile, and at refuelling stations. The breakthrough Microleaks-No-Burst (μLNB) safety technology eliminates hazards and drastically reduces risks of hydrogen storage tank rupture in a fire.

This note presents the innovative Microleaks-No-Burst (μLNB) storage technology meeting stringent safety requirements with compressed hydrogen. The technology was tested under various conditions, including the extreme fire scenario of a high-pressure hydrogen jet fire. This can occur in conventional storage systems, e.g. from a thermally activated pressure relief device (TPRD). The unprecedented performance of this storage technology is underpinned by extensive numerical studies and successful experimental validations.

Fig. Structure of the μLNB Type IV tank
Structural layer: fibre reinforced polymer
Thermal protective layer: another load bearing composite with lower heat conductivity



Advantages of the Microleaks-No-Burst (μLNB) storage technology over conventional (non-self-venting) gaseous fuel storage systems:

- Tanks do not rupture in any fire preventing losses of life or property due to blast wave, fireball and projectiles
- Leaking through narrow microchannels in the composite prevents flammable clouds forming in confined spaces such as tunnels, parking, garages, etc.
- Storage system is self-venting (TPRD not needed) reducing tank pressure to atmospheric levels and enabling e.g. responders to act as usual.

Savings in manufacturing costs are made by removing the need for a TPRD, reducing the use of carbon fibres (substituting cheaper fibres), and can reduce original size requirements.

POLICY IMPLICATIONS

Policies for the safe adoption of alternative fuels such as hydrogen are urgently needed. Suggestions include:

- Greater safety awareness needed for low carbon fuels in transport
- Tightening of rulings needed for low flash point fuels such as hydrogen. This should include a no rupture ruling (that μLNB would satisfy), or similar. This is to avoid hazards and risks from e.g. blast wave, fireball, projectiles, and long flames from TPRD.
- Support needed for the adoption of storage tanks with μLNB safety technology of self-venting (TPRD-less) explosion free in any fire.

The IP for this technology resides in the UK, and therefore commercialisation provides an economic opportunity for the UK.

RESEARCH PUBLICATIONS

Molkov, V., Kashkarov, S., Makarov, D. (2023). Breakthrough safety technology of explosion free in fire self-venting (TPRD-less) tanks. *International Journal of Hydrogen Energy*, *48*(86), 33774–33785.

Molkov, V., Kashkarov, S., Makarov, D. (2023). Explosion free in fire self-venting (TPRD-less) Type IV tanks: Validation under extreme impinging 70 MPa hydrogen jet fire conditions. *International Journal of Hydrogen Energy*, 48(100), 40117-40126.

Molkov, V., Kashkarov, S., Makarov, D. (2024). Explosion free in fire self-venting (TPRD-less) composite tanks: Performance during fire intervention. *International Journal of Hydrogen Energy*, 50, Part A, 804-814.

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