Beyond the Label

The question every technical audience should ask about combustible insulation claims

FALSE MYTHS ABOUT COMBUSTIBLE INSULATION

A TECHNICAL REVIEW OF COMMON MISCONCEPTIONS IN FIRE SAFETY

Polymer-based insulation materials have been an accepted insulation choice in building facades and flat roofs for many years.

Most people assume a material's combustibility tells the whole story. It doesn't. Fire performance is an emergent property of the **complete building assembly:** insulation, protective layers, fixings, fire barriers, and installation acting together, not a property of any single component considered on its own. The ultimate issue is the fire performance of the complete **end-use system** and not of materials in isolation. That distinction is the one that most often goes unexamined.

This review examines seven of the most widely circulated claims about combustible insulation and separates the accurate core of each statement from the broader conclusion typically attached to it.

"Reaction to fire class" of a material is one input into fire safety — not the verdict on it.

Myth 1. Combustible materials result in unsafe buildings

Does the reaction-to-fire class of a single material determine whether a building is fire-safe?

Reaction-to-fire classes alone do not determine fire safety.

Under EN 13501-1[1], construction materials are classified from A1 to F, with each successive class generally allowing increased contribution to fire growth, heat release, and fire spread under defined test conditions.

Contrary to prevalent assumptions, A1 materials may not be non-combustible in a physical sense; they are still allowed to have a calorific value of more than zero (MJ/Kg and MJ/m2), but it must be below certain low thresholds. In addition, in real-world terms, rock mineral fibre insulation classified as A1/A2 can smoulder. The smouldering can, in certain circumstances, spread and produce very high temperatures (of up to 500°C or more)[2] and may cause secondary ignition of other products.

No single material determines the fire performance of a wall, roof, or floor. It is a **property of the complete assembly**: the insulation, the protective layers around it, the fixings, the fire-stopping details, and the installation quality all interact. That is precisely why full-scale, system-level testing is required[3].

A combustible insulation material within a tested, certified, well-detailed assembly shows a different fire performance from the same material left exposed.

Myth 2. Plastic foam burns

Does the combustibility of plastic foam insulation make its use inherently hazardous?

Plastic foam can burn — but the assembly in which it is installed may not

It is correct and uncontested that plastic-based foam insulation may ignite and, in some cases, sustain combustion when directly exposed to an ignition source powerful enough for a sufficient duration. However, insulation is rarely exposed in buildings. In external thermal insulation systems (ETICs) on facades, for example, insulating materials are enclosed by a protective coating, and fire barriers can be included in the system.

In other types of application, protective boards, membranes, or cladding layers are used. These measures can prevent ignition of the insulation and restrict fire propagation. Full-scale fire testing of insulated systems[3] confirms this.

Research does not support a blanket conclusion that plastic insulation automatically causes uncontrolled fire propagation. It supports careful design: tested assemblies, robust surface protection, firebreaks and compartments, ignition-source control, and maintenance[4].

Myth 3. Non-combustible materials inherently confer fire resistance

Does non-combustible insulation material inherently confer a fire-resistance rating for the element it's installed in?

Non-combustible products may contribute comparatively little to fire-resistance.

This conflates two separately regulated properties. **Reaction to fire** (EN 13501-1[1]) categorises how a material behaves when directly exposed to heat/fire, using heat-release-based and other parameters. **Fire resistance** (EN 13501-2, tested under EN 1364, EN 1365, or ISO 834)[5] is a time-based rating that applies only to a complete, tested **assembly**, never to a material in isolation. It is a way of measuring how long a product prevents penetration of fire, heat, and smoke and keeps its load-bearing capacity.

Fire resistance is a property of a complete tested assembly. It depends on the interaction of all relevant components within the tested system, rather than on the reaction-to-fire classification of any individual material.

Myth 4. Grenfell proves combustible insulation alone causes catastrophes

Did the Grenfell Tower fire establish that combustible insulation alone causes catastrophic fire to spread?

The predominant cause of the speed and extent of flame spread in the Grenfell Tower fire was the presence of PE-cored non flame retarded ACM cladding panels.

It is accurate that Grenfell Tower's refurbished wall system comprised non flame retarded PE-cored ACM cladding panels outside of combustible insulation. However, the Inquiry described that the predominant cause of the speed and extent of flame spread was the combustion of the PE core of the ACM panels, and not the combustion of the insulation[6].

The UK's Ministry of Housing, Communities and Local Government (MHCLG) testings[7] and other research[8,9] have shown that, had the insulation been non-combustible, the result would have been the same, i.e. the combustibility of the insulation was irrelevant. This is supported by the fire incident which occurred at a high-rise building in Valencia, Spain, on 22nd February 2024.

Myth 5. Combustible insulation produces toxic smoke.

Does non-combustible insulation produce less toxic smoke, making those constructions inherently safer?

Combustion toxicity is a legitimate concern; however, all fires produce toxic gases and particulates in the form of smoke.

Toxic gases are produced by all fires. The quantity and nature of the gases produced in a fire depend on several factors, such as the quantity and quality of different materials involved, their configuration, and the ventilation conditions. The concentration of gases also depends on the volume of the compartments in which the combustion products accumulate.

In many building fires, significant quantities of toxic gases originate from the combustion of room contents and decoration[10], not from the building envelope or any insulation contained within.

Myth 6. Flame retardants make insulation toxic by default.

Does the need for flame retardants make combustible plastic-based insulation inherently problematic?

Risk depends on the specific chemistry and the way the flame retardant is incorporated in the product, not the mere presence of a flame retardant.

Most plastic-based insulation materials include flame retardants to meet specific fire classification requirements. Historically, this often meant using halogenated compounds. Some, such as HBCD, have since been banned under the Stockholm Convention on Persistent Organic Pollutants[11] and superseded by other substances, meeting the current regulations.

The presence of a flame retardant does not, by itself, establish that a product is toxicologically problematic. The impact depends on the specific compound, its persistence, its bioaccumulation potential, and its current regulatory status. Tarring all flame retardants with the same brush ignores important differences, and the progress made in replacing legacy substances that are now largely restricted or discontinued.

Myth 7. Installation of PV panels on roofs results in a higher fire risk

Does combining photovoltaic panels with combustible insulation constitute a major, insulation-driven fire risk?

The additional fire ignition risk is inherently associated with the PV system

The installation of PV systems above flat roofs introduces new and complex fire safety risks. Incident data show that most PV-related fires originate from electrical faults, DC-side connector failures, DC arc faults, and installation defects such as poor cabling, faulty mounting, or defective inverters.

PV panels installed on flat roofs create a cavity between the PV panel and the roof, which supports heat re-radiation, causing heat build-up under the panel. Fire performance of roofs with photovoltaic installations depends on the complete roof build-up [12], system design, installation quality, ignition sources and maintenance practices rather than insulation type alone.

The evidence[13,14,15,16,17,18] suggests that flat roofs insulated with combustible insulation materials can perform as well as, or better than, flat roofs insulated with some Class A1/A2 insulation materials. [19]

Endnotes

1. EN 13501-1: Fire classification of construction products and building elements — Reaction to fire.

2. Perttu Leppanen, and Mikko Malaska (2019) Experimental Study on the Smouldering Combustion of Mineral Wool Insulation in Chimney Penetrations (source)

3. BS 8414-1/2: Fire performance of external cladding systems; EN 13785-1/2: Reaction-to-fire tests for façades — intermediate/large-scale test methods.

4. McLaggan M. et at (2021) Towards a better understanding of fire performance assessment of façade systems: Current situation and a proposed new assessment framework (source)

5. EN 13501-2: Fire classification of construction products — Fire resistance; test methods EN 1364, EN 1365, ISO 834.

6. Grenfell Tower Inquiry, Phase 1 and Phase 2 Reports.

7. https://www.gov.uk/guidance/aluminium-composite-material-cladding#acm-fire-test-reports

8 Guillaume E. et al (2019) Reconstruction of the Grenfell Tower fire. Part 3—Numerical simulation of the Grenfell Tower disaster: Contribution to the understanding of the fire propagation and behaviour during the vertical fire spread. Fire and Materials 44(1):35-57 DOI:10.1002/fam.2763. (source)

9. Guillaume E. (2020) Reconstruction of the Grenfell Tower fire – Part 4: Contribution to the understanding of fire propagation and behaviour during horizontal fire spread. Fire and Materials 44(8):1072-1098 DOI:10.1002/fam.2911 (source)

10. OFR (2025) Research and analysis Fire safety: Smoke and toxicity (source)

11. Stockholm Convention on Persistent Organic Pollutants — HBCDD listing.

12. Jomaas, G., & Kristensen, J. (2018). Experimental Study of the Fire Behaviour on Flat Roof Constructions with multiple Photovoltaic (PV) panels. Fire Technology. Advance online publication. https://doi.org/10.1007/s10694-018-0772-5 (source).

13. KINGSPAN, 'The Performance of Two Dutch Flat Roof Constructions in the Event of a Fire in a PV System - A White Paper'. Kingspan Insulation B.V., Jan. 2025. Accessed: Mar. 13, 2025. [Online]. Available: https://www.kingspan.com/content/dam/kingspan/kil/campaigns/kice/kingspan-pv-on-flat-roof-fire-testing-white-paper-en-nl-v2.pdf

14. PU Europe, 'PU Europe Factsheet #24 Fire performance of thermal insulation products in end-use conditions. PU Europe, Jun. 2022. Accessed: Jul. 24, 2023. [Online]. Available: https://www.pu-europe.eu/factsheet-24e-test-report-now-available/

15. Comparative test on fire behaviour of flat roof waterproofing systems with different thermal insulation materials and equipped with identical PV (source)

16. KIWA BDA, 'Large-scale fire test on a flat roof system with EPS insulation and a cement-bonded particle board fire barrier, with a PVC roof waterproofing sheet', Test report 25L0053/1, Apr. 2025.

17. KIWA BDA, 'Large-scale fire test on a flat roof system with EPS insulation and a cement-bonded particle board fire barrier, with a bitumen roof waterproofing sheet', Test report 25L0053/2, Apr. 2025.

18.KIWA BDA, 'Large-scale fire test on a flat roof system with EPS insulation and a cement-bonded particle board fire barrier', Test report 24L0474/3 REV 02, Feb. 2025.

19.KIWA BDA, 'Large-scale fire test on a flat roof system with MWR insulation and PVC roof waterproofing sheet', Test report 25L0198/2, May 2025.

Further study

- SFPE Handbook of Fire Protection Engineering.
- International Building Code (IBC).
- ISO 9705: Full-Scale Room Fire Test.
- FM Global Property Loss Prevention Data Sheets.
- EU Fire Safety Guide, Modern Building Alliance.
- (DBI), 'Large-scale tests of flame spread on roof build-ups with PV systems: A White Paper', SIEC21006-003, Mar. 2026.
- The Danish Institute of Fire and Security Technology (DBI), 'Large-scale tests of flame spread on roof build-ups with PV systems: Phase I', SIEC21006-001, Nov. 2025.
- The Danish Institute of Fire and Security Technology (DBI), 'Large-scale tests of flame spread on roof build-ups with PV systems: Phase II', SIEC21006-002, Nov. 2025.
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