Beyond the Label

The question every technical audience should ask about combustible insulation claims

A TECHNICAL FIRE SAFETY REVIEW

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 centuries. This follows the principle of the 7-layers of fire safety in buildings, where all the safety layers are considered, ensuring ignition sources are separated, and installations are correctly detailed. The ultimate issue is the fire performance of the complete **end-use system** and not materials in isolation.

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

This review examines seven of the most widely circulated claims about combustible insulation, tests each against the standards and incident investigations behind it 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 combustibility class of a single material determine whether a building is fire-safe?

Combustibility class alone doesn't decide fire safety

Under EN 13501-1[1], construction materials are classed from A1 to F, with each class permitting greater flame spread and heat release. A1/A2 materials do not sustain combustion; B–F materials can ignite and burn under the right exposure.

The fire performance of a wall, roof, or floor is not a property of any single material. 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[2] alongside and independently of the reaction-to-fire class of any one component. A combustible insulation core inside a tested, certified, well-detailed assembly is a different proposition from the same material left exposed.

Euroclass System: Reaction to fire
A1: Non-combustible; no contribution to fire
A2: Very limited contribution to fire
B: Combustible; very limited contribution
C: Combustible; limited contribution
D: Combustible; medium contribution
E: Combustible; high contribution
F: Easily flammable; no performance determined

Myth 2. Plastic foam burns

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

Plastic foam burns — but the assembly may not

It is correct and uncontested that plastic-based foam insulation will ignite and sustain combustion when directly exposed to flame for a sufficient duration. However, insulation in buildings is rarely exposed. In external insulation systems, insulated roofing, and insulated cladding, the insulating material is enclosed by a protective coating, board, membrane, cladding layer or fire stopping that restricts and limits surface flame spread. Full-scale fire testing of insulated systems[2] confirms this.

Research does not support a blanket conclusion that plastic insulation automatically causes uncontrolled fire to spread. It supports careful design: tested assemblies, robust surface protection, fire breaks and compartments, ignition-source control, and maintenance[3].

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Myth 3. Non-combustible materials inherently confer fire resistance

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

Non-combustibility is not the same as a fire-resistance rating.

This conflates two separately regulated properties. **Reaction to fire** (EN 13501-1[1]) describes how a material behaves when directly exposed to fire: ignitability, flame spread, heat release, and smoke. **Fire resistance** (EN 13501-2, tested under EN 1364, EN 1365, or ISO 834)[4] is a time-based rating (for example, EI 90) that applies only to a complete, tested **assembly**, never to a raw material in isolation.

The term "non-combustible insulation material" does not, by itself, carry a fire-resistance rating; that rating belongs to a specific tested construction product that includes the insulation alongside its other layers and fixings. Saying a material "acts as a fire barrier for 90 minutes" conflates reaction-to-fire with fire resistance; two properties, two standards, two test methods.

> Some labelled "non-combustible insulation" materials smoulder and smouldering is a form of dangerously slow combustion.
> "*Based on reaction to fire performance mineral wool is typically classified as a non-combustible material and in European standards it belongs to category Euroclass A1. However, mineral wool insulation products contain organic material, which smoulders and generates heat at temperatures between 200°C and 500°C*"[5].

Myth 4. Grenfell proves combustible insulation alone causes catastrophe

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

Grenfell fire incident was a chain of failures, not a single material.

It is accurate that Grenfell Tower's refurbished wall system combines PE-core cladding panels with combustible insulation, consistent with the Grenfell Tower Inquiry's published findings. However, the Inquiry described that the predominant cause of the fire spreading 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) testing[7] and other research [8,9] have shown that, had the insulation been non-combustible, the result would have been the same.

This is evident in the fire incident, which occurred at a high-rise building in Valencia, Spain, on 22nd February 2024.

The Grenfell Tower Inquiry report stated other **chains of interacting failures**, not a single cause: the cladding panel choice, the "**stay put**" directive, the specific insulation and its behaviour, absent or inadequate cavity fire barriers, misrepresentation in product testing and certification, failures in building-control review, and wider organizational failures in risk assessment and management.

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, smoke, and heat.

Generation of toxic fumes and the amount generated depends on several factors such as the quantity of material burning, their configuration, the proximity of other combustibles, and the ventilation conditions. The concentration of smoke gases depends on the volume of the compartments into which the combustion products may accumulate.

In most cases, the bulk of the early-stage fire hazard comes from combustion of room content, occupant goods, and floor, wall, and ceiling decoration[10], not construction (or plastic insulation) materials.

The hazard of smoke production is inherent in any fire scenario. The challenges of toxicity arise from the need to make a comparative assessment between different products with differing material compositions and burning behaviour, which may be burning in different environments, that may generate a vast array of possible toxic species. This means that assessing the hazard posed by the burning of a material is currently beyond the state of the art in fire science. Additional issues arise due to the complexity introduced by products (rather than materials).

Myth 6. Flame retardants make insulation toxic by default.

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

Risk depends on the specific chemistry, 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 halogenated compounds; some, such as HBCDD, have since been substantially restricted under the Stockholm Convention on Persistent Organic Pollutants[11] and largely superseded by other chemistries, including polymeric and non-halogenated formulations that vary by product generation and region.

The presence of a flame retardant does not, by itself, establish that a product is environmentally or toxicologically problematic. The impact depends on the specific compound, its persistence, its bioaccumulation potential, and its current regulatory status. Lumping all flame retardants into a single hazardous category 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?

PV panels fire starts with electrical faults, not insulation

The addition of PV systems on the roof introduces new and complex fire safety risks; however, they can be used in a tested roof system and, in some cases, protected by appropriate membranes.

PV on the roof creates a cavity between the PV panel and the roof, which supports heat feedback, thus causing heat build-up under the panel. The fire performance of any roof is dependent on the type of roof build-up and the presence of the mitigation layer. In a peer-reviewed Fire Technology study, Kristensen and Jomaas tested flat roof mock-ups with six PV panels and found fire spread beneath the PV array in all four tests, but no self-sustained fire spread beyond the PV-covered area was observed[12].

Incident data show most PV-related fires originate from electrical faults, DC-side connector failures, and DC arc faults, and installation defects such as poor cabling, faulty mounting, or defective inverters rather than from the insulation or substrate beneath the panels.

Endnotes

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

2. 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.

3. McLaggan M. et al. (2021) Towards a better understanding of fire performance assessment of façade

systems: Current situation and a proposed new assessment framework (source)

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

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

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).

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.
- 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/
- 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
- 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.
- 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.
- LARGE-SCALE TESTS OF FLAME SPREAD ON ROOF BUILD-UPS WITH PV SYSTEMS — A WHITE PAPER, DBI SIEC21006