FIRE-INHIBITOR MINERAL PLATFORM

Architecture and Mechanism

Q: What is the Fire-Inhibitor Mineral Platform at the architectural level?

It is a mineral-hosted fire-resistance system consisting of engineered mineral particles (zeolite, synthetic zeolite, silica, aluminosilicate, clay, diatomaceous earth, perlite, vermiculite, calcium silicate) that are coated with a non-migrating, insoluble, thermally stable fire-inhibitor layer. The mineral substrate is not the fire retardant; it is the structural host that carries the fire-resistant chemistry.

The architecture is defined by:

- A mineral core providing thermal mass, porosity, and structural stability
- A bonded fire-inhibitor layer that does not dissolve, leach, or volatilize
- A non-reactive, thermally stable particle that integrates into bulk materials
- This is an additive platform, not a surface coating.

Problem Definition

Q: What problem does this platform solve?

Traditional fire-retardant systems suffer from:

- Leaching or migration over time
- High loading requirements that weaken materials
- Interference with polymer chemistry or foam expansion
- Reliance on halogens, heavy metals, or soluble salts
- Poor thermal stability under sustained heat

This platform solves these issues by:

- Anchoring fire-resistant chemistry to a mineral host
- Eliminating migration and leaching
- Reducing required loading levels
- Maintaining polymer, foam, and coating performance
- Providing stable, non-volatile fire resistance

Mineral-Hosted Mechanism

Q: What does “mineral-hosted” fire resistance mean?

It means the fire-resistant chemistry is bonded to the mineral surface, not added as a free, soluble, or reactive fire retardant. The mineral host provides:

- Thermal barrier behavior
- Structural stability during fire exposure
- A non-reactive carrier during processing
- A platform for distributing fire-resistant chemistry uniformly

The mineral itself is not the fire retardant; the engineered particle is.

Substrate Classes and Material Systems

Q: What materials can the Fire-Inhibitor platform be used in?

The platform is compatible with:

Plastics and thermoplastics:

- PVC, PE, PP, ABS, TPU, TPE (via melt compounding, extrusion, injection molding)

Foams:

- Polyurethane (flexible and rigid), PIR, polyiso, latex, memory foam

Coatings and paints:

- Water-based or solvent-based architectural, industrial, and protective coatings

Gypsum and drywall:

- Gypsum slurries, drywall cores, fire-rated boards

Cementitious materials:

- Mortars, plasters, stuccos, fireproofing sprays

Composites:

- Fiberglass systems, engineered panels, wood-plastic composites (WPC)
- This is a broad-spectrum additive platform.

Fire-Resistance Mechanism

Q: How does the fire-inhibitor layer work during fire exposure?

Depending on the embodiment, the fire-inhibitor layer:

- Promotes char formation
- Reduces heat transfer
- Suppresses flame spread
- Reduces heat release rate
- Improves burn-through resistance
- Enhances thermal stability of the host material

The mechanism is inorganic and thermally stable, not sacrificial.

Comparison to Traditional Fire-Retardant Systems

Q: How is this different from ATH, MDH, brominated, or phosphorus FR systems?

ATH/MDH:

- Require high loadings, release water, weaken materials.

Brominated systems:

- Halogenated, regulatory pressure, smoke/toxicity concerns.

Phosphorus systems:

Can plasticize polymers, may migrate, may require synergists.

This platform:

Mineral-hosted, non-migrating, thermally stable, lower loading, halogen-free, and compatible with polymer and foam chemistries.

Manufacturing Integration

Q: Does the Fire-Inhibitor platform interfere with manufacturing processes?

No.

The engineered particles behave as:

- Non-reactive fillers
- Thermally stable particulates
- Non-migrating additives

They do not interfere with:

- Polymerization
- Catalysts
- Curing systems
- Blowing agents in foams
- Extrusion or molding operations
- This is a drop-in additive.

Particle Size Engineering

Q: What particle sizes are used and why?

Typical ranges:

- 1–5 µm for coatings and clear films
- 1–10 µm for textiles and laminates
- 1–50 µm for plastics, foams, composites
- 5–50 µm for gypsum and cementitious systems

Particle size is selected based on:

- Dispersion
- Thermal behavior
- Mechanical impact
- Processing compatibility

Halogen-Free Architecture

Q: Is this platform halogen-free?

Yes.

The fire-resistant performance is achieved without:

- Halogenated flame retardants
- Heavy metals
- Soluble salts

Performance is driven by:

- Mineral structure
- Inorganic fire-resistant chemistry
- Stable, non-migrating architectures

Optional Antimicrobial Layer

Q: Does the platform include antimicrobial performance?

Not by default.

Some embodiments optionally include an antimicrobial precursor layer, but:

- It is not required
- It is not part of the fire-resistance mechanism
- It is not part of odor control or bedding systems
- Fire resistance stands alone.

Durability and Failure Mode

Q: What is the designed failure mode?

The designed behavior is:

- Gradual thermal and structural degradation under extreme fire exposure
- No leaching
- No dripping
- No chemical release
- No volatilization
- The mineral host remains intact.

IP Position

Q: What is the IP defensibility of the Fire-Inhibitor platform?

Claims cover:

- Mineral-hosted fire-resistant architectures

Substrate-specific integration (gypsum, foams, plastics, coatings, cementitious materials)

- Performance mechanisms
- Non-migrating, insoluble fire-resistant layers
- Dual-layer FR+AM embodiments (optional)

This is not a commodity mineral — it is a protected architecture.

What This Is NOT

Q: What is the Fire-Inhibitor platform NOT?

It is not:

- A surface coating
- An intumescent paint
- A halogenated FR
- A phosphorus FR
- A soluble salt
- A sacrificial additive
- A polymeric FR
- A reactive FR that interferes with polymer chemistry

It is a mineral-hosted, non-migrating, thermally stable additive.