Grace Construction Products

Monokote® Fire Protection Systems

Performance Under Fire



GRACE

Monokote® MK-6®/HY®



Petronas Twin Towers, Kuala Lumpur, Malaysia



International Finance Centre II, Hong Kong



LG Towers, Beijing, China



Incheon International Airport, Incheon, Korea



Tower Palace 1, 2, & 3, Seoul, Korea



Cheung Kong Centre, Hong Kong



Esplanade - Theatres on the Bay, Singapore



JR Central Station, Nagoya, Japan



Front Cover:
Taipei Financial Centre, Taiwan

Also known as Taipei 101, this 508-metre structure makes a striking addition to Taipei's city skyline. Monokote MK-6®/HY® and Z-146 were sprayed onto the structural beams and columns, and columns of the hign-speed elevator shafts. Altogether more than 252,000 bags of Monokote cementitious fireproofing were used in this landmark project, currently the tallest building in the world.

Monokote® MK-6®/HY®

Interior Concealed Fireproofing

Proven in-place performance on interior structural steel makes it the most widely used fireproofing material in the world. MK-6®/HY® is a low cost, gypsum-based, cementitious, spray-applied fireproofing product designed for an easy, fast application to steel and concrete substrates. MK-6/HY incorporates application benefits including Grace's patented injection technology for fast set and improved hangability.

Typical Uses

- High-rise and low-rise commercial office buildings
- Conventional buildings
- Hotels, resorts and casinos
- Health care facilities, sports centres
- Schools and museums
- Airport terminals

Benefits

- High bond strength
- Quick set in 15 minutes
- Resists damage from air erosion and abrasion
- Gypsum-based formulation contains no mineral fibres
- No topcoat or surface sealer required

Performance Characteristics*

Physical Properties	Monokote MK-6/HY Values	Test Method
Dry Density, Minimum Average	240 kg/m^3 (15 pcf)	ASTM E 605/UBC STD 7-6
Bond Strength	16.85 KPa (352 psf)	ASTM E 736
Compression @10% Deformation	71 KPa (1,483 psf)	ASTM E 761
Air Erosion	0.000 g/m^2 (0.000 g/ft^2)	ASTM E 859
High Velocity Air Erosion	No continued air erosion after 4 hours	ASTM E 859 UMC STD 6-1
Corrosion	Does not contribute to corrosion	ASTM E 937
Bond Impact	No cracking, spalling or delamination	ASTM E 760
Deflection	No cracking, spalling or delamination	ASTM E 759
Resistance to Mould Growth	No growth	ASTM G 21
Surface Burning Characteristics	Flame spread - 0 Smoke developed - 0	ASTM E 84
Combustibility	Less than 15 MJ/m^2 Total 20 kw/m^2 peak heat release	ASTM E 1354

* Independent laboratory tested values. Test reports available upon request.



Menara Imperium, Jakarta, Indonesia



Chek Lap Kok Airport, Hong Kong



T & C Tower, Kaohsiung, Taiwan

Monokote® Z-106/HY

Interior Exposed Fireproofing

A 100% portland cement binder, medium density fireproofing product that provides excellent moisture resistance and durability for interior, exposed applications. Z-106/HY incorporates application benefits including Grace's patented injection technology for fast set and improved hangability. It provides highly cost-effective installation while assuring the specifier of high performance in-place characteristics.

Typical Uses

- High-rise commercial office buildings
- Transportation terminals
- Convention centres
- Parking garages
- Light manufacturing facilities
- Mechanical rooms
- Elevator shafts
- Power plants
- Dockyards

Benefits

- Cement-based formulation provides high bond strength
- Quick set in 15 minutes
- Damage-resistant surface resists air erosion, abrasion and impact damage
- Can be trowel-finished for improved aesthetics
- Withstands high humidity and condensation
- Proven performance with moisture exposed ASTM Bond and Compressive Tests



Footbridge at Tseung Kwan O, Hong Kong







Korean Airlines Cargo Terminal, Incheon International Airport, Incheon, Korea

Performance Characteristics*

Physical Properties	Z-106/HY Values	Test Method
Dry Density, Minimum Average	350 kg/m^3 (22 pcf)	ASTM E 605
Bond Strength	117.5 kN/m^2 (2,463 psf)	ASTM E 736 **
Compressive Strength @10% Deformation Compressive Strength	963.1 kN/m^2 (20,188 psf)	ASTM E 761 **
Deflection & Bond Impact	No Cracking or Delamination	ASTM E 759, ASTM E 760
Air Erosion	0.000 gm/m^2	ASTM E 859
Mould Inhibitor	Yes	ASTM G 21

* Independent laboratory test values. Test reports available upon request.
** Test modified as required for high density, high performance products.

Monokote® Z-146

High density, cement-based fire protection delivers maximum protection for interior or exterior exposed applications.

Typical Uses

- High-tech clean rooms
- Transportation terminals
- Heavy manufacturing facilities
- Gymnasiums and sports facilities
- Elevator shafts and stairwells
- Mechanical rooms

Benefits

- Cement-based formulation provides extremely high bond strength
- Tough, concrete-like surface resists air erosion and abrasion
- Trowelable finishing for improved aesthetics
- Releases no particulate matter or volatile organics to interfere with sensitive computer chip manufacturing environments
- Resists freeze/thaw, wind and rain



National Semiconductor Facility, South Portland, Maine, USA



Singapore Post Centre, Singapore



White Oak Semiconductor, Richmond, Virginia, USA



Wolsung Nuclear Power Plant, Korea

Performance Characteristics*

Physical Properties	Z-146 Values	Test Method
Dry Density, Minimum Average	640 kg/m³ (40 pcf)	ASTM 605
Bond Strength	611 kN/m² (12,765 psf)	ASTM E 736**
Compressive Strength @10% Deformation Compressive Strength	3830 kN/m² (80,000 psf)	ASTM E 761**
Deflection & Bond Impact	No Cracking or Delamination	ASTM E 759, ASTM E 760
Air Erosion	0.000gm/m²	ASTM E 859
Mould Inhibitor	Yes	ASTM G 21
Volatile Organic Content (off gassing) at 50°C organic compound C6. C28	Less than 1 PPMW (Part per million by weight) Below Detectable Limits	Dynamic Headspace (Thermal Desorbtion) Gas Chromatography Mass Spectrometry)
Leachable Ammonia	Less than 50 PPB (50 Parts per billion, 50 Nanograms/mg) Below Detectable Limits	Leachable Ion by Ion Chromatography

* Independent laboratory test values. Test reports available upon request.
** Test modified as required for high density, high performance products.

Performance Under Fire

On May 4, 1988, the First Interstate Bank building in Los Angeles, CA, USA, endured the worst high-rise fire in Californian history. Monokote Fireproofing performed as specified and protected the structural steel, thereby preventing damage to the steel frame and possible collapse of the building.

Facts

- Temperature reached 1,093°C in one hour
- 99% of Monokote remained bonded to the steel structure
- 99% of steel structure retained acceptable yield strength
- Damaged floors were re-opened after four months of renovation

Monokote®

Fire Test Approvals

Monokote Fireproofing has been tested world-wide and has the following global approvals, which includes over 120 design listings at Underwriters laboratories Inc. (UL).

USA	UL 263/ASTM E 119
Japan	JIS A 1304
Spain	PNE 23.820
England	BS 476 Part 20, 21
Canada	ULC S101/ASTM E 119
France	ISO R-834
Germany	DIN 4102
Korea	KSF-2257
China	GB 14907-2002

International Standard of Manufacturing

Monokote fireproofing products applied in Asia are produced in Grace's ISO 9002 certified manufacturing facility in South Korea. The facility is under the Underwriters Laboratories Inc's Follow-up Service Programme. Monokote products are manufactured under strict quality control, in accordance with Grace Construction Products' formulations and specifications. The facility's location also ensures prompt delivery of quality Monokote fireproofing products to meet the most demanding construction schedules.



First Interstate Bank building on fire



Grace Construction Products manufacturing facility, Incheon, Korea

Team 1 - Your assurance of quality

Product quality alone doesn't guarantee success. It requires professional installation from qualified applicators.

The proper application and installation of fireproofing is critical to its long-term performance and meeting the required hourly fire ratings. Grace has a world-wide Team 1 programme which promotes excellence and quality among its network of trained and qualified applicators. Only these applicators have access to all Grace fireproofing products, patented application technologies, technical support and over 40 years of experience.



Reputable hardware (continuous mixer) is deployed



Experienced and skilled sprayman



A proper and safe jobsite setup is crucial in achieving the product's designed in-place performance and in meeting the construction schedule

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