



Technology linings rocket nozzles now available for tunnel claddings / linings

Did you know ?

The resins of Borden Chemical are used for the "rocket nozzles" of the Space Shuttle, the Ariane rocket, rocket engines of the US defence, and private space enterprises like satellite launching rockets. These resins are also used as the binder for the silica which forms the base for the tiles of the heat shield of the Space Shuttle. Phenol is also used as the binder for Stone wool products like Rockwool



Now in reach. By production technologies developed in the Netherlands it's now possible to apply these extreme fire retardant composites for linings, claddings and insulation in tunnels, bunkers, shelters, and underground spaces like stations. The possibilities in applications are enormous. The production technologies are so efficient that it results in highly cost price effective products and applications.

What does this technology offer ?

- Extreme high fire retardancy properties reaching over the 2000 degrees Celsius.
- Extreme low smoke development (neglectable)
- Extreme high insulation properties (18-21 mW/mK), protecting concrete and steel structures for a long duration (> 2-4 hours) against the extreme heat in case of a fire.
- Maintaining structural integrity at high temperatures.
- No emission of toxic fumes and combustible vapours.
- Freedom of design. Highly integral and double curved parts are possible. It is possible to design and manufacture parts in which lighting, electrical systems and ventilation ducts are integrated.
- Claddings/parts can be designed as self-supporting monoque structures.
- Claddings/parts are low weight and high strength. Specific strength of composites can be 10 times that of steel.
- Claddings/parts have anti-graffiti coatings and are easy to clean. Many colour combinations are possible.
- By modular design and low weight quick and easy to assemble in tunnel, bunker, etc.

How does it work. The force behind phenol composites is the ablative process. This means the layer wise carbonisation/graphitisation of the composite layers. By this type of highly advanced composites the material only carbonizes in case of a fire, does not burn and does not contribute to a fire. Due to the ablative process, each carbonized layer will become complete fire proof insulating the next layer and slowing down the carbonization process layers wise. The more layers the longer it takes. This process goes on to extreme high temperatures (> 5000 degrees Celsius).

Some applications (see pictures below)

Extensive R&D has been done as result of fire disasters like the King Cross underground inferno. As result of this, in the US and the UK basic phenol reinforced parts have become a standard with the best possible rating according the London Underground regulations



- Clyde tunnel in Schotland
- Glasgow tunnel in Schotland
- Escalator tunnel underground station Liverpool Street (see photo above)
- Entrance tunnel Finsbury Park Tube
- St. Mary's Hospital, Portsmouth escape tunnel
- Central station New York etc.

Film material storage bunkers of the MOD have been covered with a insulation cladding made of ETP. This is a hybrid resins system of Borden and Dartford Composites Ltd. In these bunkers stored film material has been set into fire, resulting in a extreme fire of burning nitro gasses with temperatures exceeding well beyond 2000 degrees Celsius. Results from the fire test showed that the insulation was that good that the adjacent wall temperature only rose with 15-20 degrees Celsius

The highest possible fire ratings

- BS 6853 part B5.2 (certified according highest rating of the London Underground)
- NF F 16-101 MI/F0
- BS 476 Part 6 and 8, Class 1 and Class 1/0
- ASTM E84, highest possible rating
- BS 476 Part 22, Fire insulation and Integrity, greater than 1 hour insulation and integrity
- UKOOA Jet fire test, pass, (used ref. standards ISO 834 and BS 6336).

New innovations Unfilled phenol resins already meet with the highest fire retardancy ratings. If we modify or fill the resins with fillers like silica (tiles space shuttle), other ceramics and/or polysiloxanes and combine these in high fibre volume composites, the resulting composite parts becomes almost non combustible with maintaining the positive properties as described here fore. As result of this, composite claddings and parts can be made according the new European regulations for building products and materials meeting class A2.

WEBSITE: See also website of United Composites for more information: www.unitedcomposites.net

