

SMC in the applications for Electrical Enclosures

*Advantages in comparison to the PC,
ABS-PC and PPE thermoplastics*

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CONNECTER LES ÉNERGIES AUX HOMMES

SMC HEAT-HARDENING STRUCTURE

SMC is a material composed by 3 main components

- A thick net of **polyester macromolecules** **chemically linked** during the moulding
- Mineral load
- **25mm** fibreglass that have a **role of mechanical reinforcement**

Result:

High resistance to temperature (due to the chemical net structure)

Warping and fissure resistance

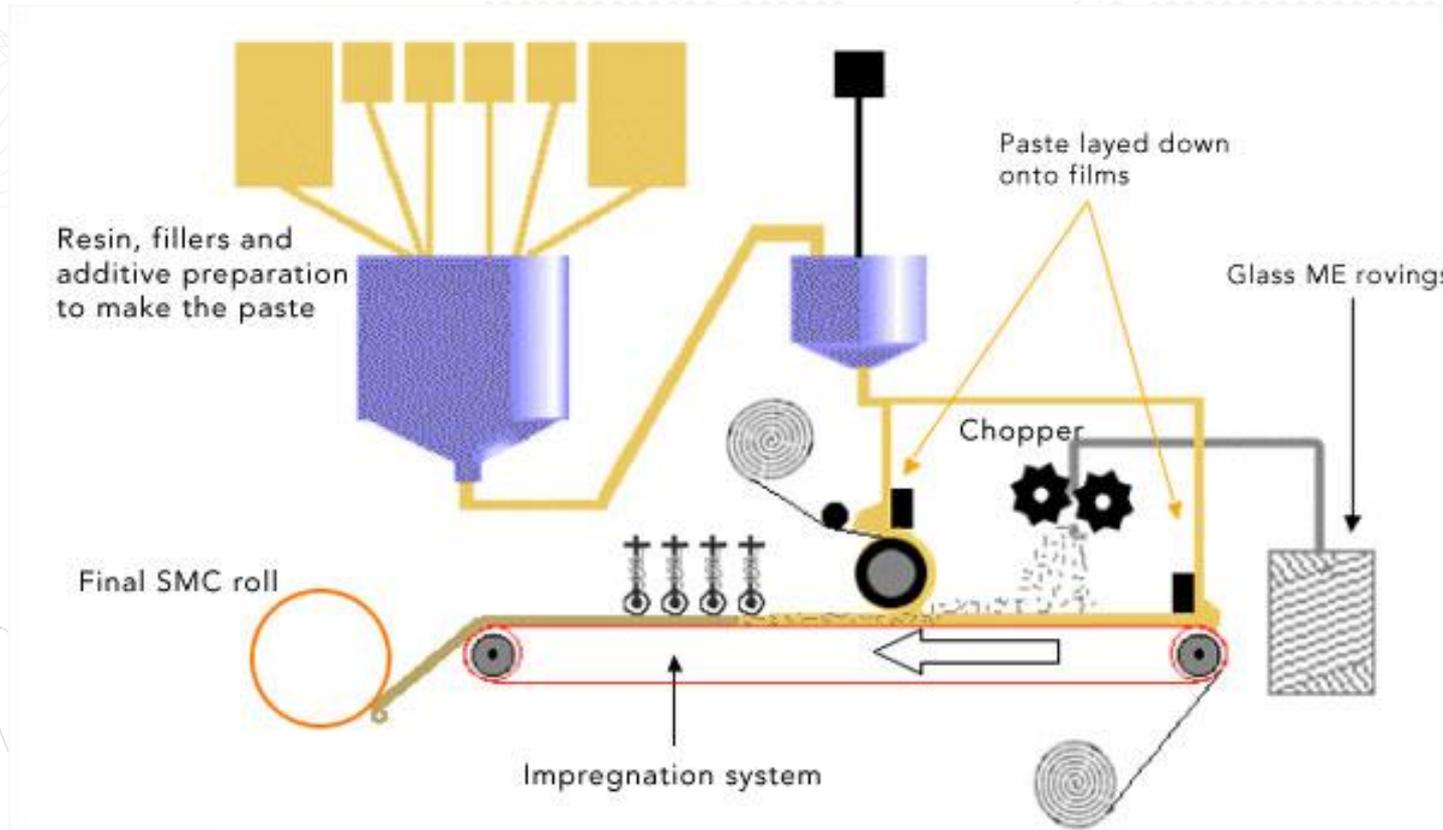
High and constant general characteristics; unaffected by the length of the exposure and by the environmental solicitations (life span > 30 years)

At equal performances, SMC is always **competitive**.

- A Thermoplastic is a tangle of macromolecules that **are not chemically linked**
- The thermoplastic compound essentially keeps his performances from the polymer nature

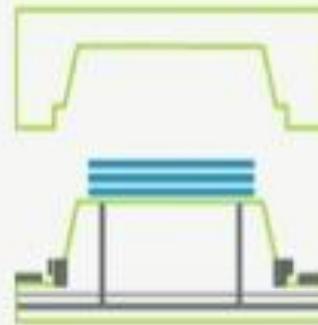
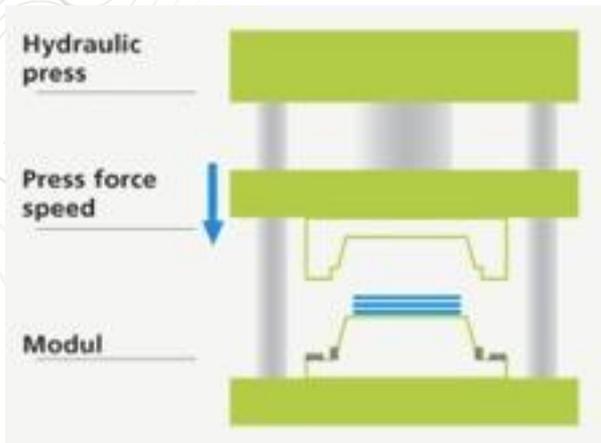


SMC PRODUCTION

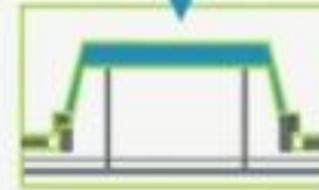


- SMC is a material formulated according to its final use

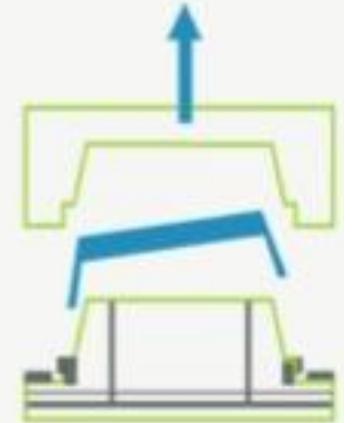
SMC MOULDING CYCLE BY COMPRESSION



Start of cycle.
Charge placement,
mould coverage 50
to 70 %



Moulding, 60 - 100 bar
specific pressure,
130 to 160 °C



Moulding, 60 - 100 bar
specific pressure,
130 to 160 °C

ADVANTAGES OF SMC MOULDING BY COMPRESSION

- High T° and high pressure moulding = high reactivity = rigid structure
- Long fibreglass reinforcement = high mechanical resistance
- Piece of big dimensions

GROUPE-CAHORS COMPOSITES



SMC MECHANICAL PERFORMANCES

SMC properties

Rigidity 4 to 5 time higher than thermoplastics at identical thickness (**structural piece**)

Mechanical bending resistance **1,3 to 2 times bigger**

Mechanical endurance higher than thermoplastics (resistance to repetitive efforts)

High compression resistance

High performance versus impacts (due to fibreglass reinforcement)

Constant mechanical performances from **-40 to +130° C**

Constant mechanical performances over time (several decades) in the open air



Results of mechanical performances on SMC enclosures

Low deformation on mechanical solicitations (protection against electrical contacts – IP grade of protection)

Resistance on permanent mechanical efforts – **no warping phenomenon** unlike thermoplastics (ex: conservation of the tightening efforts on the insertion columns without risk of fissuring)

Vibration resistance (vehicle pass, wind effect...) could deteriorate thermoplastics' mechanical resistance up to its destruction (fissure)

Impact resistance > 10-20J (20J = 5kg mass – h = 40cm)

Equal enclosure protection after an impact that provokes a fissure.

Closed fissure, resistant to propagation (due to fibreglass reinforcement).

Inaccessibility to electrical contacts (IP conservation) → Human protection

On the other side, if the impact energy is really important, thermoplastics can shatter so they don't ensure the circuit protection anymore -> Electrocutation risk

DIMENSIONAL STABILITY PERFORMANCE

SMC properties

- **Dimensional contraction < 0,15%** means **3 to 7 times less** than type PC, PPE thermoplastics
- Small water absorption (equivalent to PC, PPE after a 24h immersion)
- Thermal expansion coefficient **4 times inferior** to thermoplastics and similar to metal
- Heat distortion temperature (1,8MPa) **> 200° C** after PC ~ 128 °C and PPE ~ 100 °C

High resistance to temperature

Ball pressure test: SMC > 200 °C versus ABS PC :75-100 °C PC : 125 °C PPE: 75-125 °C

The temperature range represent the performances of upscale fireproofing material

Weak thermal conductivity (isolating power equivalent to thermoplastics) allows for a limited interior condensation

Dimensional stability results on SMC enclosures

High resistance to temperature without deformation that means **maintaining IP and functionality** (ex: door movement)

High dimensional stability at any temperature

SMC properties

High volumetric resistance $> 10^{12}$ Ohm.cm

High superficial resistance $> 10^{14}$ Ohm

SMC: after 100 drops -> no inflammation

ABS PC: after 2 drops -> priming current + inflammation of the sample

PPE: after 9 drops -> priming current + inflammation of the sample

Electrical insulation results on SMC enclosures

SMC has excellent insulation performances

SMC has a CTI $> 600V$ and there's no risk of inflammation in case of creepage current

It is the chosen insulating material for the applications with direct contact with the metal (supporting active parts)



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SMC properties

- Inflammation resistance: **Glow Wire Test 850 °C and 960 °C (IEC 60695-2-12)**

SMC = pass 960° C – no drop

Fire resistance results on SMC enclosures

Natural resistance to inflammation and propagation (**low organic part**)

Cannot be damaged by a flame, as opposed to TP enclosures

It does not melt, it does not drip, it does not collapse due to an exterior fire (high temperature), always assuring the protection of the interior equipments.

Low volume and toxicity of smokes (CO₂ – CO..)

As opposed to dense and toxic gas TP's smokes (obtained out of toxic halogens or other)

Non corrosive smokes due to the low deterioration of the equipments in case of fire

It does **not contain any halogen flame retardant**

CHEMICAL RESISTANCE

	SMC	PC	ABS PC	PPE
Solvent	good	poor (fissuration)	poor (fissuration)	poor (fissuration)
Weak Acid	good	poor	poor	good
Strong Acid	fair	poor	poor	good
Weak Base	fair	poor		good
Strong Base	fair	poor		good
Sea Water	good	good		good
Sodium Hypochlorite	good	poor		good

Chemical resistance results on SMC enclosures

It can be easily cleaned using the traditional solvents

Acid resistance - hydrochloric acid(10%), phosphoric acid (85%), sulphuric acid (37,5%), nitric acid(10%)

Resistance to moderate alkaline – diluted bleach (sodium hypochlorite)

Resistance to hot asphalt (bottom part of the enclosure, in contact with the surface of the road), hydrocarbon, alcohol, methylene chloride, sea water

SMC properties

The aspect becomes matt (without shine) after 2 and 5 years.

After several decades, an erosion is **< 100-150 micrometers**

SMC remains intact at more depth (no degradation)

If the aesthetics must be improved, SMC can be easily cleaned and brushed with a standard detergent to obtain again an aspect close to the original one

SMC can be painted with an acrylic paint or varnish (applied after cleaning the surface)

Initial properties are maintained during the -40 to +130 °C range

Initial properties are maintained in time whatever the withstood climatic conditions

-> Essential characteristic that allows SMC to be different from thermoplastics by comparison

Climatic agent resistance results of SMC enclosures

Info: standard exigency to outdoor long life endurance: the loss of the mechanical proprieties can be < 50% after 20 years of outdoor exposition.

SMC is a durable material. An SMC product ensures its function in time (> 30 years) in whatever outdoor conditions for the product (UV, humidity, temperature)

The tests show a 10-15% loss in mechanical resistance in electrical enclosures after 20 years of outdoor exposure (severe conditions with an inclination of 45°)

ABS-PC, PC, PPE become matt and turn yellow when their UV stabilizer is consumed. They lose their mechanical resistance as time goes along and during the years.

● DURABILITY / MAINTENANCE

SMC is a robust and without maintenance solution for the electrical enclosure application.

SMC fulfils the current technical specifications and will probably always be according to an evolution towards the most restrictive specifications (ex. electrical enclosures in France)

SMC resists vandalism (hard to fraud), it is not much sensible to traditional aggressions (mechanical, flame...)

SMC is easily cleaned and can be painted

● RECYCLABILITY

SMC is a **durable material, so an environmentally favourable solution**

It only contains a 25% of organic materials (oil branched), and the rest of its composition is mineral (essentially calcium carbonate load and fibreglass).

At the end of its life span, after several decades of service, it can be:

- recovered though grinding and reintroduced as load in different materials
- used as load in cement works

The current tests in France show the excellent compatibility of roughly cut SMC with the cement works production. Indeed, SMC brings a low calorific value as well as the Ca (out of CaCO_3 load) and Si (SiO_2 fibreglass) elements, contained in the cement

- at worst, it can be burn in incinerator dumps (inert product without halogens)