MICHELIN

RESICARE

Beyond resin, innovation for life.

AEROSPACE & DEFENSE

Resi4 CARBON/CARBON

A unique, non-toxic[1] & renewable-carbon-based araminolic resin engineered for CMC composites offering high thermal stability[3].

Brake pad | Rocket nozzle | Thermal protection | Industrial furnace component | Heat exchanger | Battery casing

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Resi4 CARBON/CARBON

Araminolic resins provide a sustainable alternative to conventional thermosetting phenolics, formulated with unique, bio-based monomers that replace **formaldehyde** with **aromatic aldehydes** and **polyphenols.**

Resi4 CARBON/CARBON is a unique, bio-based[2] and formaldehyde-free araminolic resin for CMC (ceramic matrice composites) produced via the PIP process (precursor infiltration and pyrolysis), with high thermal properties. This pre-carbon precursor is a new alternative to historical phenolic resins, developed according to REACH legislation.

Benefits and characteristics

High thermal performance

Coke rate[3] **> 55%**

Stable temperature at **temperatures up to 1200C°**

Compatible with **impregnation** process

Compatible with **carbon fibers**

Solving toxicity issues in phenolic resins for your workers & a lasting peace of mind today and for the years to come

REACH compliant

Monomers **free of formaldehyde** & **phenol** by design

Free of CMR and **endocrine disruptors**

Water-based technology

Supports your company's sustainable development[2] & sovereignty strategy

Approaching 100% bio-based formulation

Bio-based raw materials: **5HMF monomer**

Low CO_2 emissions[2]

Advantages

No acute toxicity & serious health hazard pictograms VS **Formaldehyde, Phenol, Furfuraldehyde.**

Acute toxicity

Serious health hazard

Resi4 CARBON/CARBON CO_2 emissions[2] (CO_2kg / kg)

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(1)Formulated without chemicals meeting SVHC criteria (Substance of Very High Concern) as defined by European Chemicals Agency in date of 01/01/2026.

(2)Upon availability of our sugar-based monomers industrial demonstrators in 2027. Two of our first main industrial monomers demonstrators are based in France. The bio-based content is based on ISO 16620 guidelines based on internal data. CO2 emission's preliminary figures are based on internal data, compliant with iso 14044 guidelines. The variability of high and low values is depending of sugar sourcing.

(3)Coke rate – residu at 850°C > 50% (TGA – 10°C/min – nitrogen method).

Technical Data Sheet
Resi4 CARBON/CARBON

Product: Resi4 CARBON/CARBON.

Description: Aqueous aranolic resin.

Presentation form: Red - brown liquid.

Benefits: Formol-free, phenol-free formulation. High coke rate.

Main application: Carbon-Carbon composites with high thermal properties.

Main processing method: Impregnation.

Main cross-linking: Curing in an oven, pyrolysis.

Duration of use and storage: 15 days at room temperature. **Store in the freezer preferred** (6 months at -18°C). The viscosity can be adjusted by dilution in water or ethanol.

Handling precautions: This product must be used in accordance with the instructions in the Safety Data Sheet.

Characteristics of liquid resin

Property	Method	Unit	Measure
Viscosity at 20°C	Brookfield Viscometer	mPa.s	160 - 250
Non-volatile matter	NF EN ISO 3251	Mass %	63 - 66
pH	pH meter	-	11 - 12
Density	-	-	1,25
Curing temperature	DSC	°C	Up to 220
Duration of use at 23°C	Viscosity monitoring	Days	15

Resin shaping

This resin system releases gases (mainly H2O and CO2) during curing, which can cause pressure build-up or porosity without a gas evacuation system. This system is therefore not recommended for closed mold processes. Open or semi-open processes are preferable.

Thermal performance of the resin

Property	Method	Unit	Measure
Coke rate at 950°C	ATG (10°C/min from 40°C to 950°C)	Mass %	55 - 58

Destruction and disposal: Cleaning of liquid resin with water. Disposal with basic aqueous waste.

Additional information: For further information, please reach out to us through the contact form on our website (https://resicare.michelin.com/contact/).

Did you know?
REACH regulation focus

I've heard about the REACH regulation...
Should I really worry about it? Does it impact my business?

Yes! Regarding the European directive 2004/37/EC, employers must reduce the use of CMR substances in the workplace. This must be done by replacing the hazardous substance with a safer alternative, if technically feasible!

Got it... Time to improve our chemistry for a safer future!

Sent by Pioneer customer

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CERTIFICATION UTAC ISO 9001 UTAC CERAM