

**Rail, Mass Transit**



**CELLOBOND™ ULEF Phenolic Systems  
for Fire Safe, Cost Effective Composites**



**Composite rail component manufacturers are searching for ways to meet increasingly strict regulations, such as the European Fire Safety Standard EN 45545-2—even category HL3—without breaking the bank.**

**At the same time, improved safe use and handling is always a concern. To offer enhanced processing options, Hexion Inc. (Hexion) has developed CELLOBOND Ultra Low Emitting Formaldehyde (ULEF) Phenolic Resin Technology. Part of the Bakelite® family of phenolic resin systems, CELLOBOND ULEF resins further reduce formaldehyde emissions during composite production without compromising decades-proven composite fire safety performance—and without additional fire retardant additives or intumescent gelcoats.**

**Features**

- Incorporating the features of the long established range of CELLOBOND fire resistant resin systems, but with the additional benefits of ultra low emitting formaldehyde properties.
- Appropriate for vacuum infusion, vacuum assisted resin transfer molding (VARTM), hand lay-up and prepreg processing
- Useful for numerous interior and exterior components, such as: fronts, window surrounds, roofs, ceilings, flooring, side panels, stand backs, luggage racks, drivers’ desks, toilet modules, heat shields
- Ultra Low Emitting Formaldehyde (ULEF) portfolio surpasses industry standards

**Benefits**

- Can meet HL3, the toughest classification of EN 45545-2, the new European Fire Safety Standard
- Does not require flame retardant additives or use of intumescent gelcoat
- Does not burn readily and if involved in a fire, produce reduced levels of smoke and toxic fumes
- ULEF technology offers more, lower-emitting processing options without compromising proven performance
- As no fillers are required, the density is very low compared to other composite resins and metals
- A composite panel can weigh up to 50% less than aluminum and up to 80% less than steel
- Excellent, high-strength mechanical performance
- Water based

## Processing options and properties of CELLOBOND ULEF resins

The CELLOBOND Ultra Low Emitting Formaldehyde portfolio has been designed for use in open mold processes such as Hand Lay Up (HLU), and closed mold processing such as Vacuum Infusion (VI), Vacuum Assisted Resin Transfer Molding (VARTM), Resin Transfer Molding (RTM), pultrusion, prepreg and bulk or sheet molding (BMC/SMC) processes.

CELLOBOND ULEF resins are used in combination with PHENECAT™ Catalysts. Hexion experts can recommend the right product options and concentrations to optimize your particular process and part requirements.

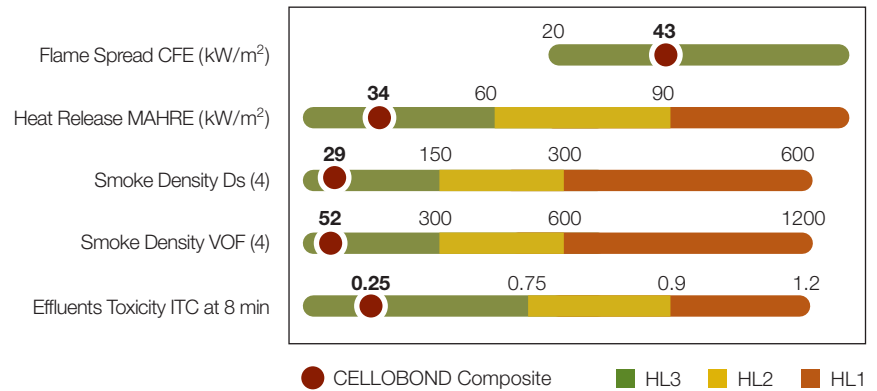
Process							Product	Properties		
Pre-Preg	SMC/BMC	Pultrusion	VI	VARTM	RTM	HLU		Free HCHO (%)	Viscosity (25 °C, cps)	Solid Content (%)
		•	•	•	•		CELLOBOND J2027 X01	<0.1	300	72
•	•	•					CELLOBOND J6021 X01	<0.1	2000	77
						•	CELLOBOND J2042 X01	<0.1	Thixotropic TI: 1.7 – 3.8	73

## Fire Safety Performance of CELLOBOND J2027 X01 Resins According to EN 45545-2

Testing according to the new European Harmonized Fire Safety Standard EN 45545-2 demonstrates that

CELLOBOND J2027 X01 composites easily meet hazardous classification HL3.

### CELLOBOND J2027 X01 composites testing, according to EN 45545-2 R1 interiors



Test results of a 2 mm thick phenolic composite panel (37 wt% fiber content)

## Mechanical Testing of Composites Made With CELLOBOND ULEF Resins

In addition to complying with the toughest fire safety regulations, phenolic composites offer engineers the freedom to design lightweight structures with optimal mechanical performance.

Some advantages are:

- Very low density due to absence of fillers
- High specific modulus and strength
- Excellent dimensional stability with a coefficient of thermal expansion (CTE) matching that of steel
- Composites made with CELLOBOND J2027 X01 have mechanical properties comparable to traditional CELLOBOND J2027 X.

Property	Unit	Composites made with CELLOBOND J2027 X01
Density, ISO 1183-1	kg/m <sup>3</sup> x 10 <sup>3</sup>	1.43
Tensile strength, ISO 527-4	MPa	115
Tensile modulus, ISO 527-4	GPa	11.4
Elongation at break, ISO 527-4	%	1.63
Flexural strength, ISO 14125	MPa	222
Flexural modulus, ISO 14125	GPa	9.9
Izod Impact Strength at standard atmosphere, ISO 180	kJ/m <sup>2</sup>	66
Izod Impact Strength at -10 °C, ISO 180	kJ/m <sup>2</sup>	94
Charpy Impact toughness at standard atmosphere, ISO179-1	kJ/m <sup>2</sup>	75
Charpy Impact toughness at -10°C, ISO179-1	kJ/m <sup>2</sup>	85

Phenolic composite (infused) 4 mm panel with CELLOBOND J 2027 X01 + 5% PHENCAT 382 40% CSM – Combination Mat - CSM

## Hexion Manufacturing Capability

Hexion's state of the art equipment, process development, and control systems capability ensure that CELLOBOND resins deliver end-product consistency. Our global manufacturing footprint ensures a secure supply of product, no matter where you need it in the world.

Our core competency in aromatic chemistries allows us to utilize a variety of aromatic raw materials for broader performance windows.

A wide range of reactor sizes, delivery formats and packaging opportunities offer flexible supply chain options for our customers.

## Hexion Technical Support

Hexion's customers benefit from world class technical specialists and testing capabilities used to develop and optimize solutions to meet their specific requirements.

Hexion's in-house facilities allow functional groups investigation, determination of purity, molecular weight distribution, determination of glass transition, mechanical testing and morphology studies to test and develop first class polymer chemistries.

Hexion support customers with guidance and training for safe use and handling of products, manufacturing of parts and quality troubleshooting.

For environmental customer support (ECS), Hexion offers a full range of environmental analysis, including workplace emission measurement at your site. Ask your Hexion contact for more details.

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Our global team produces the best in specialty chemicals and performance materials and provides the technical expertise to customize them to your exact needs. The result? Specific solutions, not generic products, leading to thousands of breakthroughs that improve bottom lines and enhance lives.

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HXN-749 04/17

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