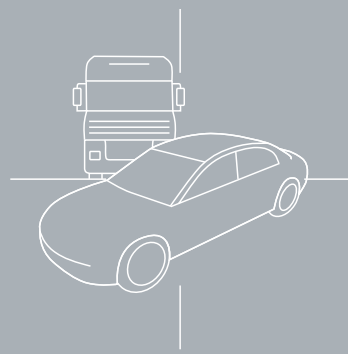


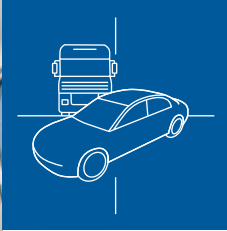
The **Automotive** Industry

>> Focusing on system solutions <<



DSM Composite Resins

Unlimited. **DSM**



In the driving seat for **composite system**

Buyers expect more frequent model changes, customizations, facelifts, more choice and more extras. To meet these demands, automotive OEMs need materials that offer flexibility, design freedom, integration of functions and low weight. Materials like SMC/BMC.

ECONOMICAL SYSTEM SOLUTIONS

SMC/BMC (Sheet/Bulk Molding Compounds) deliver a unique blend of properties such as high strength, high temperature resistance, low density and economical system solutions. The most important ingredient of SMC/BMC is the resin, and the one company that has led the field in the development of specialist resins for molding compounds is the European market leader, DSM Composite Resins. We are active throughout the whole value chain, working with our direct customers - compounders - but also with other partners such as the convertors and, of course, the OEMs themselves: stimulating both product push and market pull.

LOW WEIGHT AND DESIGN FREEDOM

SMC composite parts will typically be some 20-30% lighter than equivalent steel parts resulting in substantial fuel savings and improved performance efficiencies over the life of the vehicle. Opportunities for further weight savings are being investigated by DSM Composite Resins such as design optimizations and special low-density SMC formulations. Tooling costs for SMC molding are substantially lower than for metal forming which facilitates more frequent model updates, styling differentiations and product offerings. SMC holds no limits for the designer and

opens up a host of styling possibilities and economical system solutions.

HEAT RESISTANCE AND PAINTABILITY

SMC composites have high levels of thermal stability, which means that, once molded, parts will maintain their dimensional accuracy across temperatures ranging from -50°C to +200°C. This is why SMC and BMC have long been used for sunroof frames, headlamp reflector shells and engine bay components. Heat resistance is also important for the painting of body panels. Panels are fixed alongside metal parts and painted on-line using normal stoving temperatures. DSM Composite Resins is a recognized leader in the development of the Class A, low profile resin systems that have helped exploit new opportunities for SMC in exterior body panels.

LOW OR HIGH SERIES PRODUCTION

Traditionally SMC has been associated with low and medium series vehicles (< 75,000 units per year), but recent applications have proven that volume parts in excess of 300,000 per annum are possible in SMC. Material advances are combined with developments in compression and injection processing, to produce a fully industrialized product that can meet high output - as well as the cost and quality needs - of the volume car market. To

be a viable alternative to steel and aluminum SMC needs to meet the highest levels of quality and consistency. This is an important area of development focus for DSM Composite Resins.

Whether you are a compound producer or original equipment manufacturer, you can count on DSM Composite Resins to provide dedicated support and fit-for-purpose solutions. We are more than just a supplier, we're a partner.



>> Leadership by focusing on **customers' needs** for success <<

The dials point to our **customers'** needs for success

EUROPEAN LEADERSHIP

Part of the performance materials cluster of the international DSM group, DSM Composite Resins, is the largest producer of structural resins in Europe and a technology leader. We have particular expertise in the development and production of specialist resins for SMC/BMC production. Our expanding production base now includes France, Germany, Italy, the Netherlands, Spain, the UK, and China; supported by local Sales Offices, Competence Centers and Expertise Centers. This infrastructure gives us the capability to provide technical and commercial support on a local or an international level.



TECHNICAL COMPETENCE

Resins and additives determine the processability and end-use properties of SMC/BMC. It is a field of specialist expertise as there are many variables such as reactivity, stability and thickening behavior that have to be balanced in a very close tolerance process. The heritage of DSM Composite Resins is firmly rooted in the best European resin technologies and our Competence Center Closed Moulds has particular expertise in the SMC/BMC sector, with a strong focus on automotive. Located at Ludwigshafen in the industrial heartland of Germany, the Center provides specialist support to our compounding customers and OEM partners.

VALUE CHAIN MANAGEMENT

DSM Composite Resins has an important role to play in the automotive value chain. The holistic view that we gain from dealing directly with OEMs as well as with compounders and convertors, means that we are aware of trends and changing needs in the end-user segment: valuable intelligence that we can feed back into the composite value chain. And by working directly with OEMs we can ensure that their new design and production concepts fully optimize and exploit the unique benefits of composites. This way we keep automotive

design engineers up to speed with composite developments and capabilities.

MEETING INDUSTRY NEEDS

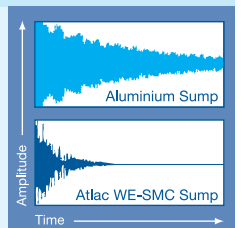
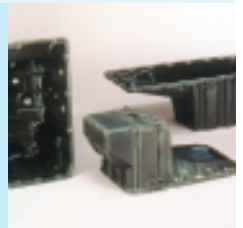
We work very closely with our compound customers to ensure that formulations are optimized to meet the needs of the automotive industry. For example issues such as emission reduction have to be addressed. Reducing emissions from cured SMC/BMC components is an important area in which we are cooperating closely on development projects. After all, our customers and partners expect us to keep one step ahead, to innovate solutions and to anticipate new industry standards and regulations.



Different requirements: different resin systems

DSM Composite Resins can help to design and develop the optimum composite solutions for your needs, taking into account the surface qualities or structural requirements of the part. For each of the main automotive application areas for SMC/BMC we have a range of dedicated resin products in our portfolio.

Application	Solutions
<p>Class A body panels</p>	<p>We have developed high quality low shrinkage resins and low profile additives which enable our customers to produce SMC for high quality Class-A exterior body panels for passenger cars and trucks.</p> <p>Our depth of knowledge and expertise in the manufacture and processing of these materials has resulted in a wide range of dedicated products, meeting all processing, performance and esthetic needs for body parts.</p> <p>Because our resins have been successfully used for many products, over many years, we can recommend with confidence, systems to suit the exact needs of the end use application. The portfolio includes: Palapreg P0423-02, Palapreg P18-03, G13 and Palapreg H2681.</p>
<p>Example</p>	<p>Class A-SMC is used in the decklid of the prestigious Mercedes CL Coupé. This application met stringent quality, design and cost constraints; thus proving its potential in medium-to-high volume passenger car body panels. The decklid also allows free passage of radio waves. The component is mounted directly onto the steel frame and painted on-line (E-Coat). The thermal stability of Class A-SMC allows it to withstand the high baking temperatures (190°C) - without losing surface quality or dimensional tolerances.</p>
<p>Underbonnet & semi-structural components</p>	<p>The increased heat generated under the bonnet requires a high temperature resistant resin system.</p> <p>Atlac XP 810 as a tough, high performance, thickenable vinyl ester resin, designed to meet the most demanding underbonnet applications with its excellent high temperature performance, chemical resistance and toughness.</p> <p>Atlac XP 810 gives molding compounds very consistent thickening behavior with excellent fiber wet-out characteristics enabling high glass content / high strength compounds. Reactivity is also high which means rapid cycle times.</p> <p>We offer a complete system consisting of Atlac XP 810 and Palapreg shrinkage additive, to suit the end-use properties of the compound. Atlac XP 810, is ideal for semi structural components and chemically resistant parts such as engine sumps.</p>
<p>Example</p>	<p>In these diesel engine oil sumps for Daimler Chrysler, damping properties were increased by a factor of 10 compared to the equivalent metal casting. Noise reduction of up to 2dBA is achievable and a close tolerance fit is maintained across all temperatures, thanks to the similar linear expansion between SMC and steel or aluminum. Because the SMC is based on Atlac XP 810 it is able to withstand the high temperature engine oil and meet the extra toughness and impact resistance requirements of this demanding application.</p>



Select your solution

Here is a selection from our dedicated range of resins for SMC/BMC. These compounds are converted by hot press compression or injection molding. If you don't see a product that's right for you, just contact your local sales office.



Resin Name	Chemical Nature	Solid Cont.	Viscosity (°C)	Tensile Str. (MPa)	Tensile Modul. (GPa)	El. at break (%)	HDT (%)	Tg (°C)	Application / End Markets / Remarks
General purpose									
Palapreg P 17-02	Ortho	65	1400	60	3.8	1.7	140	170	Industry standard, LS, LP.
Palapreg P 0401-02	Ortho	61	535	65	4.2	2.4	106	140	Standard, LS, low viscosity.
Palapreg P 176-01	Ortho								General purpose LS.
High performance									
Palapreg P 2273-01	Ortho	67	2500	70	3.7	2.4	120	165	LS, LP, good gloss, pigmentability and flexibility.
Palapreg P 14-01	HC-pure maleic	69	3000	55	3.7	1.3	116	150	LS, high gloss, excellent pigmentability.
Palapreg P 15-01	Iso	65	1050	90	3.8	4.6	98	123	Special applications, high toughness.
Palapreg P 152-01	Iso	65	3300	60	3.8	1.7	130	150	High resistance to heat and hydrolysis.
Atlac XP 810	VE	57	2250	81	3.6	3.5	145		Corrosion and heat resistant, parts "under the hood".
Palapreg P 104-01	VE	64	1000	75	3.7	2.6	135	160	Corrosion resistant, excellent properties at elevated temperatures.
Palapreg 0030-03	Ortho								Toughener, high impact resistance LS.
Daron 11-102	mod. DCPD resin								Excellent high Temperature Performance.
Palapreg P 103-01	mod. Ortho								High media resistance (eg trays) and weatherability.
Low profile									
Palapreg P 18-03	pure maleic	66	1750	50	3.5	1.5	140	185	LS, LP, Class-A, multi purpose premium resin.
Palapreg P 18-21	pure maleic	66	2000	30	4.0	0.9	155	185	LP, Class-A , headlamp reflectors.
Palapreg P 0423-02	pure maleic	65	1300	55	3.4	1.7	145	185	LP, premium Class-A resin.
Palapreg G 14	system								Premium Class-A system.
Palapreg G 13-21	system	55	650						Top Class A for all applications.
LS / LP additives									
Palapreg H 814-01	PS	33	5600						High performance LS.
Palapreg H 850-01	PMMA	37	4000						Headlamp reflectors.
Palapreg H 8199	PMMA	34	3200						Headlamp reflectors.
Palapreg H 852-03	mod. sat'd PEs	36	160						LPA, excellent flow at low pressure, high filler levels.
Palapreg H 860-01	mod. sat'd PEs	39	400						LP-system in combination with PS or rubber;
									Class A pigmentable.
Palapreg H 892-02	sat'd PEs	40	150						Low viscosity component for Class A, high gloss in BMC.
Palapreg H 2681-01	mod. sat'd PEs	70	1500						Premium LPA for ribbed and nonribbed Class A parts.
Palapreg H 2681-03	mod. sat'd PEs								Premium LPA optimised for large surface area body panels.
Palapreg H 1080-01	PVAc	39	5000						LP additive.



Examples of customer **success**

There are many examples of where we have worked closely with customers and partners to develop fit-for-purpose composite solutions. Here we look at three case histories of successful co-operations with key customers and OEM partners.

'TRIPLE C PROJECT VALIDATES HIGH VOLUME SMC'

DaimlerChrysler

Daimler Chrysler initiated 'Triple C' (Compound, Characterization and Consistency), a multi-disciplinary project to make improvements, install traceability systems and increase transparency along the SMC supply chain. As the premier supplier of Class A resin systems, DSM Composite Resins is a key partner in the co-engineering team.

Triple C will validate SMC Compounds for high series class A, on-line paintable exterior body panel applications, using the Mercedes CL Coupe decklid as a reference model. All key factors and process steps in the SMC value chain were studied for optimum performance.

Triple C examined each process stage - from resin and compound formulation and production through to the finished molded and painted part - assessing and developing quality-monitoring systems. It meant establishing an integrated process control and optimization process, generating know-how that will eventually lead to the introduction of a new Premium SMC quality for automotive exterior applications. The ultimate goal is to approach the productivity and consistency levels of steel: the results so far are encouraging. <<

'COOPERATION CREATES NEW OPPORTUNITIES'

Jean Paul Ollivier: MD France/ European Technical Coordinator, Menzolit Group

Menzolit, as well as being a co-partner on multi-disciplinary projects such as Triple C and Green label, is an important customer of DSM Composite Resins. The company has production sites in France, Germany, Italy, Spain, and the UK, and is Europe's largest compounding and molding company.

'We appreciate the support we get from DSM, working with us in a technical capacity, and helping at a market level to resolve quality and recycling issues,' said Jean Paul Ollivier, Managing Director of Menzolit France and European Technical Coordinator for the Menzolit Group. 'DSM cooperates in many projects. For example, with the trend towards smaller and deeper headlamps, the heat resistance requirement has increased from 200°C to 240°C. DSM has helped us meet these new requirements by evaluating BMC formulations with new resins and additives. A material with high thermal behavior will also create new application opportunities in other areas.' <<

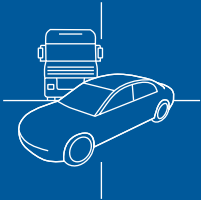
'CLASS A SURFACE FINISH IS ALL IMPORTANT'

Pierre Yves Murard: Research & Development Manager, Mecelec

The Inoplast Group operates in several areas including compound production, composite molding and recycling. Inoplast, a first rank automotive supplier employs more than 1000 people at 12 production sites. Inoplast specialize in the molding of Class A exterior body panels for customers like Renault, Peugeot, Citroen, Fiat, Lancia, Saab, Volvo, Mercedes, Audi, Matra, BMW and GM.

Mecelec recently established a new automated compound manufacturing facility that produces some 25,000 tons of product each year; 80% of which is SMC and the balance is mostly BMC. Two thirds of production goes to Inoplast, the rest is sold on the open market. DSM Composite Resins has long been a key partner as R&D Manager Pierre Yves Murard remarked: 'DSM provides very good technical and commercial support. Producing low profile materials for Class A surface finish is all-important. We've also cooperated on new system developments, for example in weight reduction and in reduced emissions. DSM is a strong ally in our battle against competitive materials like steel and aluminum.' <<

Leading by example



>> If **quality** is not at the heart of a firm's culture then it means nothing <<

Norman Hart

QUALITY LEADERSHIP

All DSM Composite Resins production sites and competence centres are approved to ISO 9000. We are now working towards the implementation of a fully aligned Quality Management system based on Total Quality Management philosophy that promotes performance excellence across every aspect of our business, our people, processes and products. DSM safety, health and environmental best practices are already benchmarks within our industry, and we will continue to focus our efforts on sustainable, durable processes with the highest possible yield and the minimal environmental impact.

PRODUCTION CONSISTENCY

Each of our production sites has seen major investment over recent years to streamline processes and improve environmental performance. DSM Composite Resin plants use highly automated, computer-controlled processes and all operations – from materials dosing, reactor operations and blending – are closely monitored and controlled to ensure batch-to-batch consistency. Performance is continuously monitored and backed up by statistical process control. Our rigorous quality programs cover every stage in the supply chain from incoming raw materials testing to customer deliveries.

CO-DEVELOPMENT PROJECTS

With a reputation for innovation and problem solving, DSM is frequently asked by OEMs to join multi-disciplinary development programs. These co-engineering initiatives bring material technologists and processors together to answer the needs of industry for stronger, lighter and more environmentally friendly materials. Past examples include CARMAT (initiated by PSA) that explored modular floor concepts; MOSAIC (initiated by Renault), which investigated composite / hybrid solutions for a complete front structure; and most recently Triple C (initiated by Daimler Chrysler) to improve the SMC quality chain.

RECYCLING

Faced with ever-tougher EU waste directives on landfill, incineration and ELV (End of Life Vehicles), the key European suppliers in the chain together with the European composite trade association, the GPRMC, and associated bodies have initiated and are implementing the 'European Composite Recycling Concept'. The funding will help in the development and validation of new recycling concepts. DSM Composite Resins is one of the founding partners and is supporting this important program in a very active way.

Glossary of terms

UPE	Unsaturated Polyester
VE	Vinyl ester
DCPD	Dicyclopentadiene
LSE	Low Styrene Emission
RTS	Rapid Tooling System
GRP	Glass Reinforced Plastics
Ortho	Orthophthalic
LS	Low Shrink
LP	Low Profile
SMC	Sheet Molding Compound
BMC	Bulk Molding Compound

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