

KraussMaffei

YOUR SYSTEM PARTNER FROM DEVELOPMENT TO SERIES PRODUCTION

Solutions for the Automotive Industry



PARTNERING WITH INDUSTRY

KraussMaffei is a premium partner for the plastics and rubber processing industries worldwide

Whatever you aim to achieve in plastics or rubber processing, KraussMaffei is your partner. We are the only company in the market with expertise in the three major machine technologies for plastics processing – injection molding, reaction processing and extrusion. We continually integrate this know-how across the different technologies to develop new processes and machinery for plastics and rubber processing.

People for plastics

As an international company, KraussMaffei has a presence in all the major markets for the plastics and rubber processing industries and employs around 3,000 people worldwide. Our sales and service network keeps us close to all our customers around the world.

Commitment to customers

Cutting edge technologies and outstanding machinery are one part of the answer – comprehensive support by experts committed to your interests is the other. Our know-how is based on many decades' experience and steady investment in research and development. We deliver what you need – from the product idea to a customer-specific system solution.

Adding value for customers

We put our expertise to work for your success. With machine ranges engineered for modularity, we can deliver application-specific solutions based on our wide range of standard modules and specially engineered solutions. This strategy offers customers technical and cost advantages.

Close to customers around the world

We are the “people for plastics”. We are your partner from the first exploratory discussion, through development of the optimal solution to commissioning, servicing and operating your system, including moving and final disposal of your system. At all times, you are assured of outstanding competence in planning and engineering, reliable spare parts, logistics and fast-response service and support.

SECTOR-SPECIFIC SOLUTIONS

KraussMaffei solutions are as diverse as the challenges facing our customers



Automotive

Automotive components for all vehicle areas – chassis, cockpit, frame and engine compartment – are made on KraussMaffei machines and systems. Over 500 companies from the global automotive and automotive components industry are among our customers.



White Goods

Efficient thermal insulation is a key factor in reducing the power consumption of fridges, freezers and chillers. PUR rigid foam systems ensure optimal insulation even in relatively thin layers. KraussMaffei Italiana is a competence center for PUR rigid foams.



Construction

Plastics are widely used in the construction industry, where they offer striking benefits, such as light weight, weather- and UV-resistance, impact resistance, resistance to scratching, easy installation and good thermal insulation. Many construction plastics are extruded and here customers can count on productive solutions from KraussMaffei.



Life Sciences

Products for the healthcare and pharmaceuticals industries must be manufactured to stringent cleanliness and quality standards. With many years' experience, our expertise in compliance and cost-effectiveness is second to none. Our system solutions are qualified for high cleanroom classes.



Electrical / Electronics

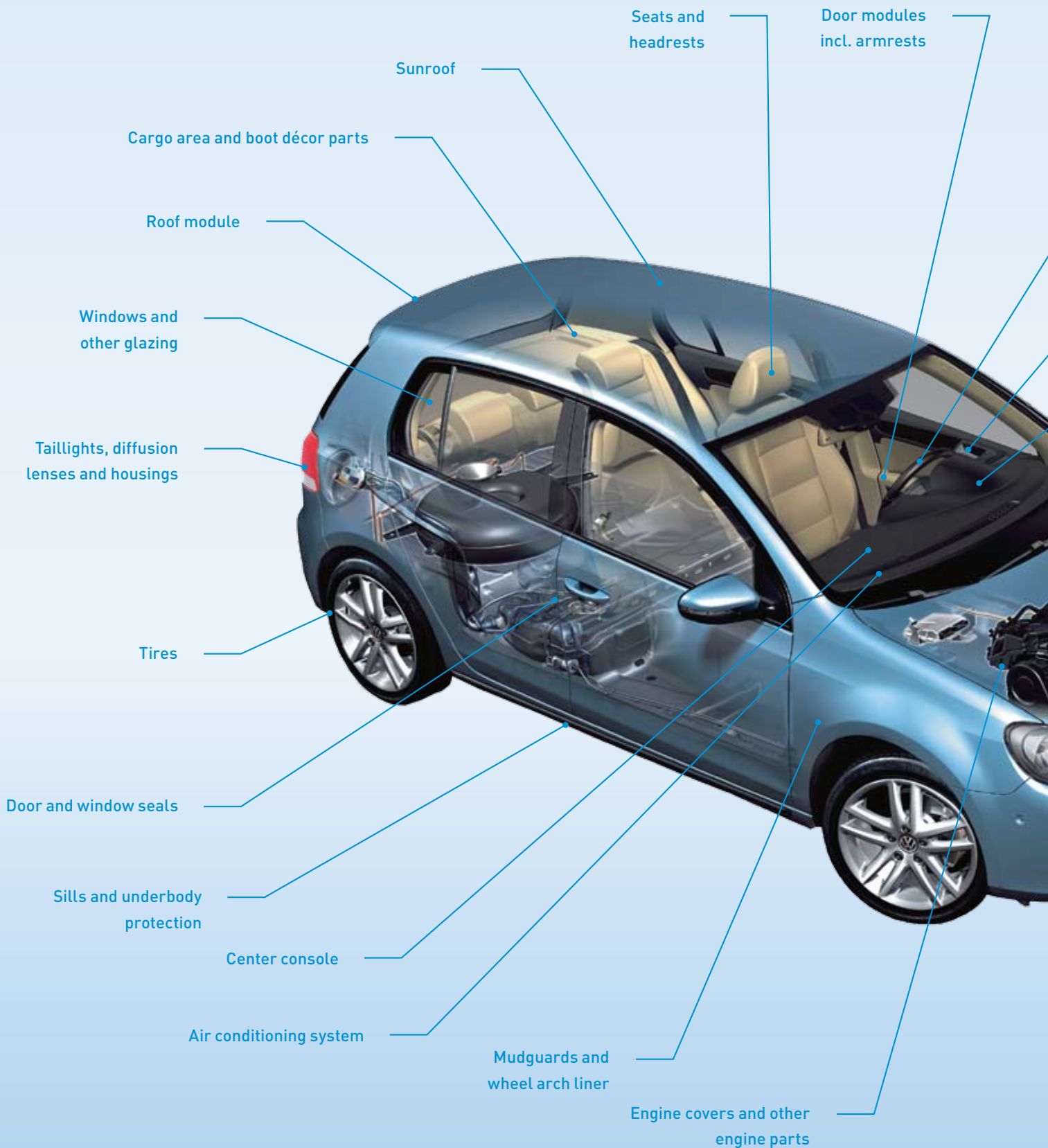
The electrical and electronics industries make extensive use of plastics. They produce a huge range of plastics products, often with highly specialized properties. Optimal electrical insulation and resistance to thermal and mechanical stress are among the key properties.



Packaging

Plastics open up endless possibilities for packaging. They are extremely lightweight, design potential is limitless and recycling is unproblematic. Many companies operating in the packaging industry are longstanding KraussMaffei customers.

Plastic and rubber components for automotive applications are produced in a huge diversity of forms and functions





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Looking ahead – setting standards for people and the environment

Plastic and rubber products have become indispensable in the automotive industry. There is nothing to replace them, because the pursuit of weight reductions is already a compelling factor in vehicle development. Light weight is essential for energy-efficient mobility – and energy efficiency is a must in view of ever scarcer resources.

Car makers today are endeavouring to limit CO₂ emissions and consumption of fossil fuels. More and more lightweight chassis components are helping to make this goal a reality.

Meeting tomorrow's standards today – lightweight components make it possible

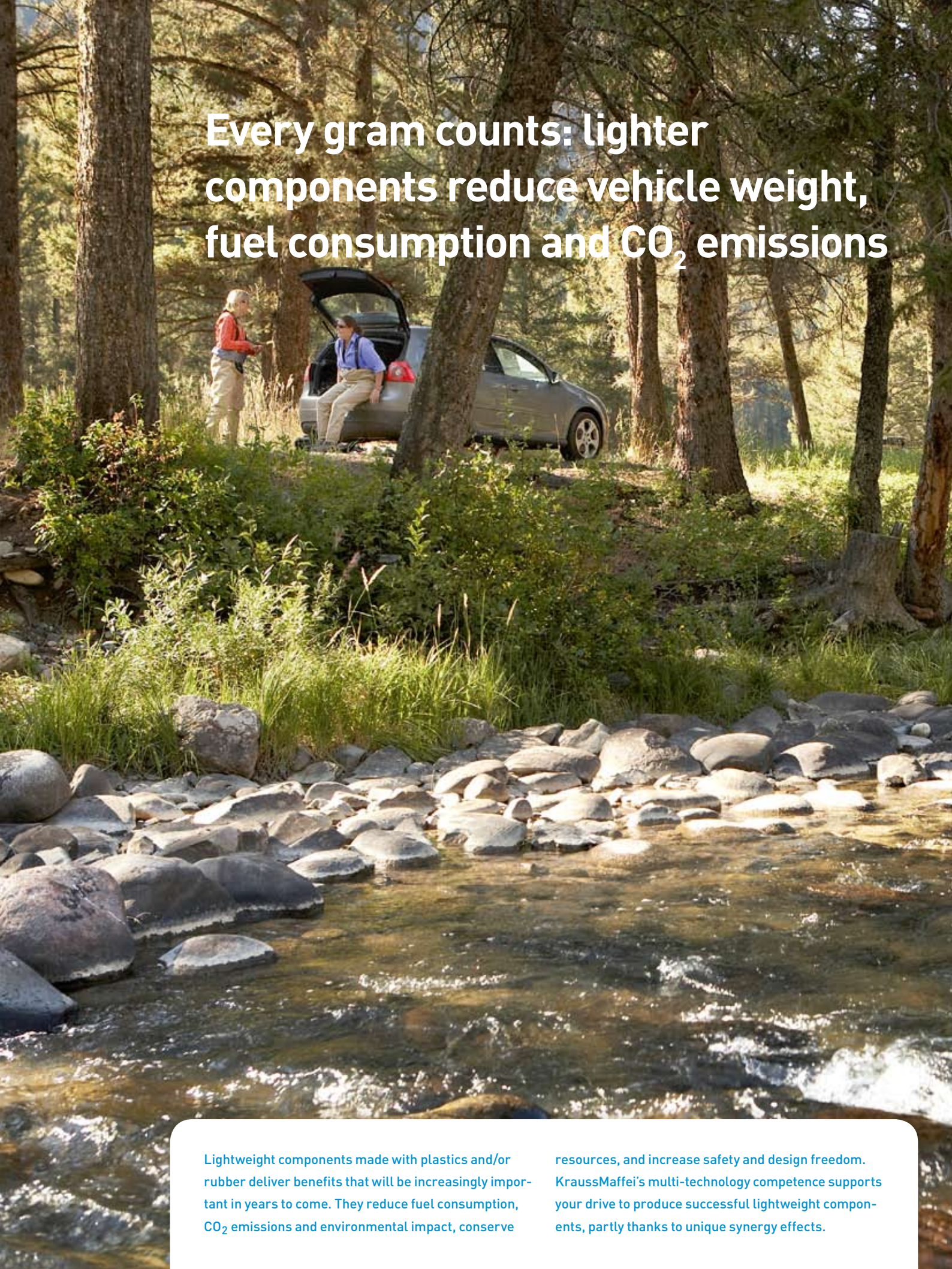
On the road to reducing overall vehicle weight, plastics are replacing more and more metal parts. The mechanical strength of today's plastics is comparable to metal, but plastics offer far wider design scope and make it easier to produce parts with complex geometries. The complex, plastic-based composite parts produced today are more than capable of meeting future standards for safety and reliability. Working with plastics makes it possible to integrate other functions, such as

optimal sealing properties or higher mechanical strength. The design freedom makes it easy – and thus cost-effective – to offer customers a high level of individual choice in configuring their vehicles.

Fast track to series production with multitechnology solutions

KraussMaffei is unique worldwide in its ability to combine injection molding, extrusion and reaction technologies. This multitechnology competence enables KraussMaffei to identify synergy potential ahead of competitors and to exploit it quickly and effectively to deliver successful production solutions. Typical solutions combine elastomers or thermoplastics with renewable raw materials, or deliver lower CO₂ emissions through energy-saving products.





Every gram counts: lighter components reduce vehicle weight, fuel consumption and CO₂ emissions

Lightweight components made with plastics and/or rubber deliver benefits that will be increasingly important in years to come. They reduce fuel consumption, CO₂ emissions and environmental impact, conserve

resources, and increase safety and design freedom. KraussMaffei's multi-technology competence supports your drive to produce successful lightweight components, partly thanks to unique synergy effects.

SUPPLYING SYSTEM SOLUTIONS

Choose more efficiency – with superior production concepts and a single contact partner for your whole project

KraussMaffei is the only company worldwide capable of offering plastics and rubber processors machinery and know-how for all three key technology areas.

Why not profit from our unique breadth of expertise? We can help you produce more efficiently. And you can rely on us for neutral advice, because we have all the processes in our portfolio. We can complete your project faster, because there are no frictional losses in integrating machinery from different suppliers in order to produce complex automotive components. We make your production more flexible – last-minute changes to part design are easier with KraussMaffei. The reference project described below shows our system competence at work.

Peguform launches production of instrument panels for the Audi A4

Peguform, one of the leading European automotive components suppliers, won the contract to supply instrument panels for the Audi A4, B8 model. The instrument panel assembly consists of an injection molded substrate, with an integrated mounting for the centre tunnel, in 2-component technology. It is partially backfoamed with polyurethane, trimmed

and punched and then transferred to downstream processes, such as clip assembly and final assembly.

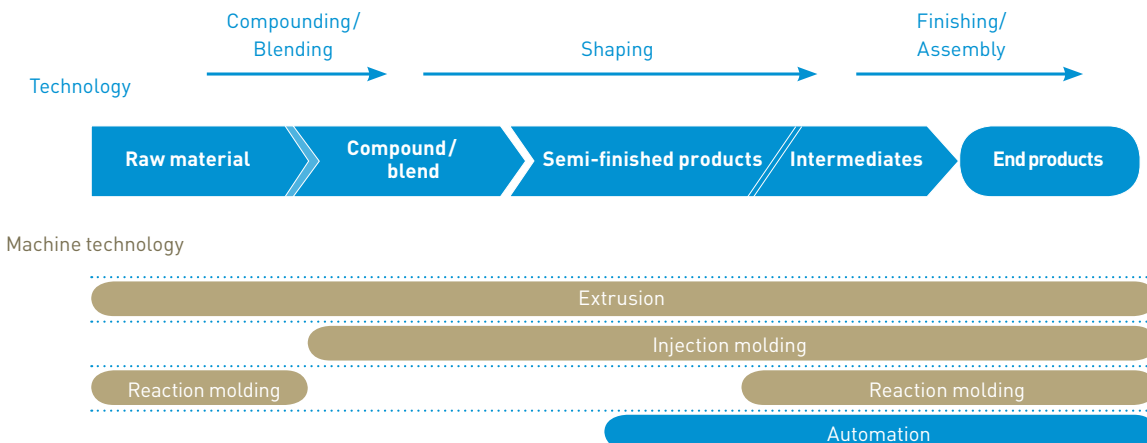
Fully automated production from injection molding to foam backing and final assembly

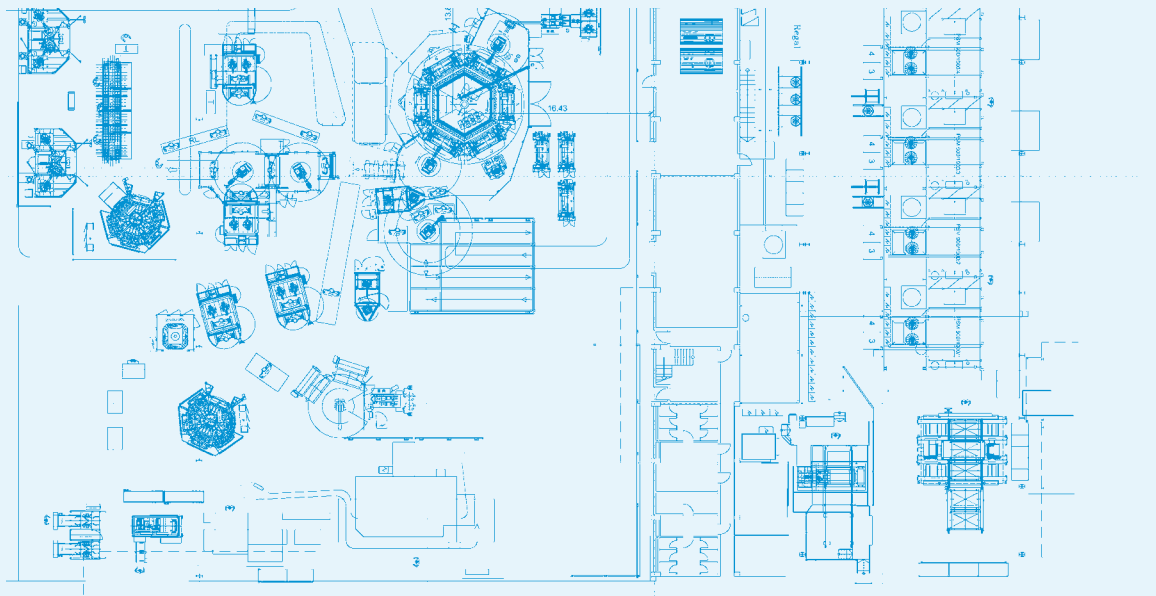
KraussMaffei worked closely with Peguform to plan and implement the whole production line, including fully automated injection molding with buffer station, backfoaming unit, routing and punching centre, milling and airbag scoring, complete tooling for foaming and punching, conveying and handling equipment and automated clip assembly and final assembly.

Expert and neutral advice

In the Peguform production line, the rotary table system for foaming was planned and supplied by KraussMaffei as were the foam molds and the entire cutting centre, including the punching and cutting systems, the product fixtures and robot software. We can bring our breadth of expertise to bear early as the product development phase to give users neutral advice on the best trimming and cutting technology for a specific product. KraussMaffei

KraussMaffei generates sustainable solutions through its holistic approach to the value-adding chain.





KraussMaffei is your system partner from planning through to implementation of complete automated production lines, such as the one for instrument panels and armrests shown here in overview. We supplied the entire systems technology and most of the tooling.

With our unique concentration of expertise in extrusion, injection molding and reaction molding, tooling and automation, KraussMaffei is your ideal system partner. We plan and implement complete fully automated systems to produce complex component assemblies.

is a neutral consultant, always recommending the best combination of processes to achieve the desired result. Finally, as your system partner, we can supply the complete turnkey production system.

Faster time-to-market - no friction losses at the interfaces

By choosing to partner solely with KraussMaffei, Peguform saved itself substantial coordination

effort. KraussMaffei experts also took over responsibility for defining all the mechanical, electrical and electronic interfaces necessary for smooth communication between individual system components and upstream and downstream units. To sum up – KraussMaffei has provided Peguform with a reliable basis for uncomplicated planning, fast implementation and efficient production of complete component assemblies.

Lightweight components integrate functions and save costs

Mudguards, side panels or bumpers made of plastic composites have mechanical properties comparable to metal parts, but they are up to 50% lighter. Wider design freedom is another advantage, as are excellent impact absorption in the event of a crash and the absence of corrosion.

More functions, lower weight

Functional integration is a major trend. Apart from the use to which the part will be put, another consideration is whether the part falls into the horizontal or vertical category. Based on this information, the potential for functional integration, weight savings and safety aspects is analyzed with regard to all the possible production processes. We can offer neutral advice at this point because we can supply the machinery and know-how for the whole spectrum of processes for horizontal and vertical parts. We can, for example, supply expert, unbiased advice on the best combination of injection and reaction molding, from LFI and RRIM to RTM, in order to meet the product specification and production volumes. This makes us practical discussion partners as early as the concept phase of planning exterior parts.

Compounding + injection molding = flexibility in material formulations

Compounding plays a huge role in the development of new polymers with defined properties. In-house compounding can save processors substantial costs. Granulate compounded to a custom formula can be used to produce components – for example, with application-specific reinforcement – capable of fully replacing metal parts. The next logical step is to

couple custom compounding with injection molding in an integrated process – as in KraussMaffei's Injection Molding Compounder (IMC). Flexible, custom compounding immediately ahead of the injection process has two major benefits. One is the ability to produce premium parts with excellent mechanical properties. The other is the potential for huge cost savings, especially through reductions in material costs.

Colour choice without paint

Plastic/glassfiber composites offer a very wide spectrum of solutions for large-area components, both horizontal parts like roof modules and vertical parts like mudguards. Long-fiber injection using the LFI-PUR process, for example, allows glassfiber concentrations in the part to be varied to match calculated loads at different points. The resulting components combine high strength with very light weight. The vision for the future is to produce such parts with Class A surfaces by back injecting decor films or by in-mold painting. Both these solutions make it possible to change colour from one shot to the next. And they eliminate the need for separate paint shops and the associated logistics. Besides saving costs, such processes also reduce the environmental impact of the production system.



MANUFACTURER: Volkswagen

PRODUCT: Mudguard for Touareg

MATERIAL: 100 % polyurethane

TECHNOLOGY: RRIM

Reinforced Reaction Injection Molding

CUSTOMER BENEFITS:

In RRIM reinforcing fibers are mixed into the PUR components. Low component viscosity makes it possible to use RRIM to make large, complex, thin-walled high-strength parts. RRIM offers wide design freedom.



MANUFACTURER: Audi

PRODUCT: : Bumper for A6

MATERIAL: Polypropylene, EPDM/talcum, CDP preparation

TECHNOLOGY: Standard injection molding

CUSTOMER BENEFITS:

To be cost effective, bumper production needs a consistent, ultra-efficient demolding process and efficient automation of deflashing, flame treatment, etc. On KraussMaffei machines, high-performance plasticizing and proven wear protection ensure impeccable performance over many years of demanding operation.



MANUFACTURER: Volkswagen

PRODUCT: Frontend carrier for Golf V

MATERIAL: Polypropylene, 30 % glassfiber, D-LFT-IM

TECHNOLOGY: IMC injection molding compounding

CUSTOMER BENEFITS:

Compounding followed inline by injection molding reduces material costs by up to € 1.00 / kg. Mechanical properties are improved by direct compounding of endless LFT instead of rod-shaped pellets. The result is lower material costs and enhanced safety.



MANUFACTURER: Same Deutz

PRODUCT: Tractor engine cover

MATERIAL: 100 % polyurethane

TECHNOLOGY: LFI-PUR, in-mold painting

CUSTOMER BENEFITS:

In in-mold painting, the high-gloss paint layer is sprayed directly into the mold, back-injected with the PUR/long glassfiber mix and then pressed into shape in the mold. The result is cost-effective production of LFI parts with high-gloss surfaces.

MULTITECHNOLOGY SOLUTIONS

Choose to work with a system partner and generate extra value

A complete processing solution, supplied by a single system partner, can bring decisive benefits for your business. Provided, of course, that your system partner has the wide competence to identify synergies ahead of the curve and the engineering capability to turn them rapidly into successful products.

A competent and experienced system partner reduces procurement effort for your business and slashes your time-to-market for a new product. KraussMaffei fits the bill in every way. We have the over-arching expertise in all the key technologies for plastics processing to take a holistic approach to developing customized production solutions. We have the engineering skills to deliver fast, efficient solutions.

System partners generate added value

KraussMaffei is unique worldwide in its ability to combine injection molding, extrusion and reaction technologies to deliver successful production solutions. Our solutions can be supplied as turnkey production cells, including KraussMaffei robots, molds and tooling. Integrating discrete production processes in one production cell slims down your logistics effort and slashes costs. Our SkinForm technology is a case in point. The process is a complex one, as is explained below, but the complete technology, together with the unique multitechnology know-how that made its development possible came from KraussMaffei.

SkinForm – innovation for a successful solution

SkinForm is a new-generation multicomponent and multiprocess solution for producing plastic

parts with application-specific premium surfaces. It combines injection molding a substrate with the application of, often complex, polyurethane surface layers in a “one-shot” process. KraussMaffei supplies the injection molding machinery, the robotics, the polyurethane systems, the molds and the post-mold tooling for this proprietary process. SkinForm is a unique complete solution for surface finishing which opens up huge scope not only for new design solutions in automotive interiors, but also for non-automotive applications. SkinForm parts are premium products in every sense of the word – in look&feel and in their mechanical properties. The process also delivers impressive cost savings – by integrating several processing steps into one compact system solution, it's possible to produce high quality, functional components at very competitive prices.

Adding value with premium surfaces and a luxury look&feel

SkinForm makes it possible to produce complex thermoplastic parts with premium surfaces in a variety of polyurethane materials. The parts are made in one production cell in a “one-shot” process. In the automotive industry, the main application is to produce interior trim parts with scratchproof surfaces, a leatherlike haptics and brilliant optics. The versatility of polyurethane materials opens the door to other applications – from high-quality paint systems to polyurethane systems for luxury softtouch effects, or specific acoustic and damping properties. Integrating processes in a single production cell and a one-shot process makes it possible to implement new functionality in the plastic part. It also saves cost-intensive post-mold processing.





The SkinForm process developed by KraussMaffei makes it possible to produce complex parts, normally requiring multiple process steps, in a single work process. A striking example is the production of a thermoplastic substrate and the application of a scratchproof PUR surface layer which has the look&feel of leather and which offers scope for brilliant designs.

Where comfort meets safety

As your system partner, KraussMaffei supplies solutions for applications in all areas of a vehicle. In car interiors every detail counts. Drivers and passengers expect functionality, clarity and comfort. At the same time, car interior components have to meet demanding safety criteria and other technical specifications. With intensive expertise in this area, KraussMaffei supplies production machinery and systems, molds and mold carriers, tooling and a complete range of cutting, routing, punching and scoring systems. You benefit in many ways by getting the complete value-adding chain from one supplier. However demanding your product specifications, we can offer you a choice of processes and process combinations to produce strikingly attractive, technically excellent plastic parts.

Almost boundless choice

Décor films are one approach to enhancing surfaces for automotive interiors. They can range from simple to fairly complex multilayer décor produced in an in-line extrusion process. For key components like instrument panels, the industry offers a range of process options all aimed at producing the attractive surfaces and essential functionality. The instrument panel is one of the dominant design features in the passenger compartment, making a striking contribution to the overall impression of style, comfort and value in the vehicle interior. High quality instrument panels with complex geometries are usually given a décor finish using some form of polyurethane technology. Slush molding, casting or spray processes create premium surfaces in the form of a plastic skin with an attractive look & feel. Impressive softtouch effects are achieved by using foam techniques for the skin and the substrate. KraussMaffei supplies the polyurethane machines, the molds and the mold carriers for all these surface enhancement techniques.

SkinForm – a revolution in processing

KraussMaffei developed the SkinForm process which combines the advantages of injection molding for thermoplastics with those of polyurethane processing. SkinForm makes it possible to produce thermoplastic parts and then enhance them with new functions or a new appearance in a single ‘one-shot’ process.

Wood, metal, leather – enhanced or replaced by polymers

Costly walnut veneers, with a deep-gloss coating, enhance the interiors of up-market cars. The protective, high-gloss coating is applied in a CCM process (Clear Coat Molding), in a single work process. This process applies the clear coating which gives the wood veneer a three-dimensional effect and brings out the grain in the wood. It also protects the wood against scratching. Other décor elements can be given surfaces with an attractive look&feel through in-mold decoration using décor film and metal foil. One or more of these processes will be used to create a passenger compartment which communicates the high value of the car. The parts are made of polymers – but with the look&feel of leather, wood and steel.

Natural fibers/plastic composites

Plastics reinforced with natural fibers are being used in more and more applications in vehicle interiors. Some of them are décor components and as such visible, but mainly these composite materials are used in substrates and carriers. A range of renewable raw materials and a range of polymers are available. It's possible, for instance, to produce natural fiber composites without energy-intensive predrying. These materials have several advantages – they weight less, if they shatter in a crash the shards are less sharp than glassfiber-reinforced composites and, finally, their processing takes up to 60% less energy.



MANUFACTURER: BMW

PRODUCT: : Instrument panel and steering wheel for the 5 Series

MATERIAL:
100 % polyurethane (surface, carrier, back foaming, steering wheel)

TECHNOLOGY:
LFI-PUR Long Fiber Injection molding, PUR sprayskin, PUR back foaming

CUSTOMER BENEFITS:
This KraussMaffei technology opens up new scope for part design and reinforcement. Complex geometries, such as undercuts can be designed as required. The result is wide design freedom.



MANUFACTURER: Skoda

PRODUCT:
Test door side trim panels for the Roomster

MATERIAL:
PC/ABS + PUR

TECHNOLOGY:
SkinForm

CUSTOMER BENEFITS:
The unique combination of a PUR process and injection molding makes it possible to produce high-quality surfaces economically. This 3-colour door module with a surface that looks and feels like leather includes softtouch effects and colour change from shot to shot.



MANUFACTURER: Audi

PRODUCT: Centre console for A6

MATERIAL:
100 % polyurethane (surface)

TECHNOLOGY:
CCM Clear Coat Molding

CUSTOMER BENEFITS:
Real wood decors that are high-gloss and scratchproof – thanks to CCM. The one-shot process coats the wood veneer with an even layer of transparent polyurethane in a highly-automated, low-cost process.



MANUFACTURER: BMW

PRODUCT: Front seat

MATERIAL:
100 % polyurethane

TECHNOLOGY:
Dual hardness

CUSTOMER BENEFITS:
Very comfortable seats – thanks to dual hardness technology. Multicomponent and duplex mixing heads produce different hardness zones in the seat squabs. The result is flexible production and the comfort people expect in an up-market car.

AUTOMOTIVE TESTING

Fast time-to-market thanks to outstanding service competence

For car makers, design studies are an excellent way of communicating in-house trends in technology, visual language and strategy. The move from a design study to a realistic production concept takes effective cooperation between experts in design, engineering, tooling and production.

Component tests are major milestones on the way to a volume-production component. KraussMaffei offers in-house component testing, with the advantage that we can react quickly and make any engineering modifications to the production cell without loss of time. A system partnership with KraussMaffei shortens your communication paths and ensures significant time savings on the way from design study to volume production.

Identify weak points earlier in the development process

Automotive components are exposed to extreme thermal and mechanical stresses – from sub-zero temperatures to baking heat, plus thousands of kilometres on all types of road. Airbags, steering wheels, seating systems and instrument panels must meet rigorous safety standards. Subjecting a part to mechanical and climatic tests at KraussMaffei Automotive Testing early in development enables reliable assessments of its durability and operating reliability and safety. This is especially important for safety-critical parts

and those subjected to high loads. It reduces the time between the design study and a product ready for volume production. And it facilitates an efficient production start-up. The earlier any weak points are identified, the easier and cheaper it is to correct them.

Engineering and consulting

For prototypes produced at KraussMaffei, the essential tests can be carried out in-house with no delays. The availability of climate chambers, vibration test rigs, UV test facilities and other equipment offers extensive options for testing virtually any part. KraussMaffei Automotive Testing offers a unique combination of engineering and service competence – we stand for fast, resource-efficient development of new components for the automotive industry.



Ready for the toughest conditions with KraussMaffei



Over 50 years' experience in climatic and mechanical testing make KraussMaffei your ideal partner in automotive component testing. Our laboratory is accredited to test to DIN EN ISO/IEC 17025. One

core speciality is testing vehicle safety systems. We work closely with your experts to devise a product-specific test series to ensure your product is rugged and reliable.

Aesthetics and functional integration – plastics for solutions that are clearly brilliant

Transparent plastic glazing is a successful substitute for glass. By offering far wider scope for complex part geometries, for example, to integrate fixtures and connection points, it eliminates the need to compromise on functionality and functional integration.

Glass + polymer

Originally glass was the only option for transparent automotive components. In many applications, plastics with all their benefits are now replacing glass. Where glass is still used, polymer films are making it safer. Nowadays, automotive glazing without safety films is almost non-existent.

The face of a vehicle

Headlights and taillights are major brand-specific design elements in a car. The development of headlights is undergoing radical changes with the integration of new functions, such as adaptive front lighting systems (AFS), xenon or LED lights. The new headlight models make huge demands on the surface quality of the plastic glazing elements. Other quality criteria include temperature stability and impact resistance, the flow behaviour and demolding behaviour of the material, gas emissions and thermal expansion. Expert blending of thermoplastics on twin-screw extruders creates materials that meet all the requirements for automotive glazing – from processability to a whole spectrum of functional properties.

Design and functional integration

Roof modules with areas up to 1.5 square metres are already being made of polycarbonate with weight savings of up to 9 kilograms compared with an equivalent module using glass. Producing them is a challenge – the PC material must be processed

very gently and the product demolded under cleanroom conditions. KraussMaffei has over 30 years' experience in engineering machinery and systems for processing transparent polymers, eg, PMMA and polycarbonate. In order to produce stressfree large parts, we migrated our compression molding process, originally developed to produce optical media such as CDs, to our big machine concepts. Multicomponent molding techniques are allowing us to supply machines capable of adding functional elements such as ribs, handles, fixtures and guide elements. In this way, you sharply reduce both component count and assembly and logistics effort. UV blockers can be blended into the raw material during compounding or a special film – also produced on KraussMaffei machines – can be used to achieve the same result.

High-tech films for many functions and applications

Highly elastic safety films are used in the manufacture of shatterproof glass – an elastic PVB film with good bonding properties is integrated as a functional middle layer between layers of glass. The film prevents the glass shattering into separate shards in a crash. The film needs to meet demanding specifications for flexibility, wear and tear-propagation resistance, and light resistance. KraussMaffei supplies complete turnkey extrusion lines for the different high-tech film products used in the automotive industry.



MANUFACTURER: SEAT

PRODUCT: Side quarter section for the Leon

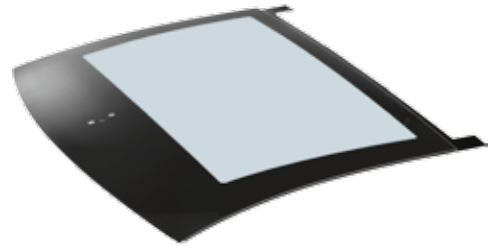
MATERIAL: PMMA, PC, TPE

TECHNOLOGY:

Compression molding, multicomponent version, cleanroom conditions

CUSTOMER BENEFITS:

Functional integration, design bonus and cost efficiency by substituting polymers for glass. GlazeForm was used to include the grip depression in the part design. Glass does not allow such complex shapes.



MANUFACTURER: Smart

PRODUCT: Sliding sunroof for ForFour

MATERIAL: Polycarbonate

TECHNOLOGY:

Multicomponent molding with spinplaten technology and compression molding, window encapsulation

CUSTOMER BENEFITS:

The polycarbonate sunroof is far easier to produce than a glass one. Using multicomponent molding the part plus the fixing elements is produced in just one work cycle. The result is a more cost-competitive product through functional integration.



MANUFACTURER: Volkswagen

PRODUCT: Taillight assembly for Passat

MATERIAL: PMMA, coloured PMMA

TECHNOLOGY:

StampForm – compression molding, multicomponent molding, Opticolour

CUSTOMER BENEFITS:

Special plasticizing and compression molding process for high-precision transparent PMMA parts. Multicolour/multicomponent molding allows up to 7 colours per taillight assembly. High competence in multicomponent molding.



MANUFACTURER: Audi

PRODUCT: Lamp carrier for A3

MATERIAL: BMC

TECHNOLOGY:

PolySet

CUSTOMER BENEFITS:

Lamp carriers must withstand a range of temperatures from sub-zero to hot – non-thermoplastic materials are ideal here because of their dimensional stability at extreme temperatures. The result is a perfect fit in heat and cold.

New routes to linking worldwide knowledge resources

In addition to technology-specific development in injection molding, extrusion and reaction molding, KraussMaffei carries out and supports more broad-based R&D, specifically into integrated, multiprocess solutions. To accelerate research in this direction, we set up the PRIMUS network for innovation.

The PRIMUS network bundles all our in-house R&D resources – across the whole range of interdisciplinary value-adding processes, from compounding to surface treatment of finished products – and forges links with external resources. The PRIMUS network puts us ahead of the curve in generating sustainable solutions for the growing expectations and needs of car users and the automotive industry. Our innovative solutions give KraussMaffei customers a competitive advantage and a high level of surety that their investment in new machinery will pay off rapidly.

PRIMUS opens the door to new solutions

PRIMUS stands for Process Integrated Machinery for Unique Solutions. In a wider sense, it also stands for our claim to leadership in innovation in our industry. Through PRIMUS, KraussMaffei links in-house development resources with external input from scientific research institutes and industrial partners. We set up a special centre for functional integration in light-weight components, which coordinates close cooperation between our process engineering experts and universities and industry partners working in related fields.

The long-term aim is to promote energy-efficient mobility, specifically through intensified research and development effort in the field of lightweight, plastic-based components.

Process integration for higher productivity

In a substantially expanded development lab, KraussMaffei is driving development in innovative processes that integrate polyurethane processing and injection molding. The lab's resources are available to all the members of a network of materials suppliers, universities, plastics processors and moldmakers. It has contributed to the development of new materials and special production processes which are paving the way for components capable of replacing rubber-metal combinations. The new components have the same mechanical properties as their predecessors, but their manufacturing cycles can be optimized to deliver significant cost savings.

Proactive development brings new prospects for carmaking

KraussMaffei invests continuously in research and development. Our specialists are endeavouring to expand our product and service portfolio with new ideas, new processes and new products that will produce better cars and cut manufacturing costs. We make these successful and innovative solutions available to our customers. We are perfectly placed to supply machinery and services exactly tailored to your requirements. Our solutions are fast, cost-effective and successful.



A photograph of two men in business attire examining a complex industrial component. The man on the right, wearing glasses and a pink shirt, is holding the component, which has a long thin rod extending upwards and several electrical connectors on the side. The man on the left, in a dark suit, is looking at the component with interest. The background is a plain, light-colored wall.

KraussMaffei – leading innovation to boost productivity

Our R&D effort is concentrated on supplying process-integrated solutions from a single vendor. Our PRIMUS network for innovation creates the links and makes available the resources

that generate these solutions. As our customer, you profit from this bundled know-how and proactive innovation to increase the productivity of your business.

Unfazed by extreme conditions – plastics and rubber instead of compromises

Plastics and rubbers are becoming the materials of choice for many underhood and underbody applications. They have shown that they are capable of withstanding the high thermal and mechanical stresses typical of these applications.

Glassfiber-reinforced plastics are successfully meeting the challenges of underhood and underbody applications. Apart from thermal resistance, they score on high stiffness, toughness, dimensional stability and resistance to corrosion by engine oil, fuel, de-icing salt, etc. Unit manufacturing cost is naturally also a major factor. Rapid advances in materials and processing technology for plastics and rubber are delivering components that meet all these criteria. For example, KraussMaffei compounder systems produce the starter materials, by blending polymers with organic or inorganic fillers and reinforcing materials.

Better than metal

Thanks to modern processing methods, polyamides and thermosets are beginning to fulfil their great potential to substitute for metal components in automotive applications. Lower production costs, light weight and the scope for functional integration are major advantages that plastic components have to offer along with their thermal and chemical resistance. High precision engineering produces thermoset throttle valves, brake pistons and other components that are replacing metal parts. High dimensional consistency means that, even without post-mold processing, these components meet specifications for very tight tolerances.

Elasticity in the engine compartment

Many high-tech rubber products perform key tasks in vehicles, usually out of sight. Specifications for components such as profiles, hoses and V-belts are becoming steadily more exacting as materials in the engine compartment are subjected to increasing stresses. Like plastic components, rubber parts must be able to withstand high temperatures and aggressive chemicals. KraussMaffei develops, engineers and supplies machines and complete production systems to manufacture rubber V-belts, high-pressure hoses and seal profiles that meet the most demanding specifications.

More components, more functions more value

KraussMaffei's Multinject technology for multi-component injection molding opens up new ways of producing engine-compartment components. Advanced multicomponent systems are capable of producing chemical and heat resistant parts with absolutely precise contours and with integrated metal inserts. Examples of components made using Multinject production cells include rigid-flexible composite parts or parts with integrated gaskets. Alternatively, integrated gaskets can be produced in a C.A.S.E. reaction molding process where even very small throughput volumes can be metered and mixed at high pressure with decisive benefits. KraussMaffei has exclusive rights to this high-pressure/low throughput technology. We also have the know-how to integrate it and the injection molding machine for the substrate in complete turnkey production cells.



MANUFACTURER: Optibelt

PRODUCT: Poly-V-belt

MATERIAL:

EPDM mix with fabric insert

TECHNOLOGY: Roller head extrusion

CUSTOMER BENEFITS:

Machines and systems from KraussMaffei Berstorff are used to produce all types of wrapped and raw-edge V-belts and poly-V-belts for use in industrial drives, agricultural machinery, cars and trucks and home appliances.



MANUFACTURER: Daimler AG

PRODUCT: Throttle valve housing

MATERIAL:

BMC polyester bulk molding compound

TECHNOLOGY: PolySet

CUSTOMER BENEFITS:

This BMC throttle valve housing won the innovation prize at the SPE-Awards 2007. The complete housing can be produced in one work cycle. The housing is 30 % lighter and 50% cheaper than the equivalent part made of aluminium – and has the same functionality.



MANUFACTURER: Volkswagen

PRODUCT: Fan module for the Passat

MATERIAL: Polyamide, talcum, polypropylene / EPDM

TECHNOLOGY:

Multicomponent molding, Multinject

CUSTOMER BENEFITS:

The rigid-flexible composite part has 6 different gasket zones. Assembly injection molding makes functional integration possible. This approach produces more complex assemblies, eliminates logistics for semi-finished products, reduces manufacturing costs and makes final assembly in the engine easier.



MANUFACTURER: Volkswagen

PRODUCT: Media supply lines

MATERIAL: Polyamide 66 GF30, polyamide

TECHNOLOGY:

Multicomponent process, sandwich process combined with water injection technology (WIT)

CUSTOMER BENEFITS:

Combining multicomponent molding and water injection allows production of tubing with large cross sections and reduces material consumption. The result is lower manufacturing costs, but the same high resistance to fuel and other chemicals.

Water management and more

Seal profiles play the lead part in chassis water management. They don't simply keep rain water out of the passenger compartment, they channel it away along defined paths.

In addition, the complex geometry of the profiles makes sure the heavy doors of premium cars close with barely a whisper. Special material mixes for C.A.S.E. applications help to reduce road noise in the passenger compartment. KraussMaffei is your system partner for complete production cells for seal profiles. With our production cells you

can be sure that the separate elements – injection molding machine, industrial robot and PUR mixing and metering machine are all tuned to work perfectly together with absolutely no interface problems or effort. In many automotive applications, appearance plays an ever greater role. Flocked profile strips contribute to the luxury appearance of vehicle interiors. In general, profiles are now far more than simply seals – they have a big role to play in acoustics, comfort and style. KraussMaffei offers a comprehensive range of rubber extruders and downstream equipment



PRODUCT: Seals

MATERIAL: Polyurethane

TECHNOLOGY: C.A.S.E. (Coatings, Adhesives, Seals, Elastomers)

CUSTOMER BENEFITS:

High productivity through processing fast-reacting PUR systems – made possible through the use of high-pressure PUR processing. High-pressure mixing heads self-clean after each shot, so eliminating the time and materials wasted in cleaning cycles.

plus systems for three different vulcanization processes. This comprehensive portfolio and the processing expertise we bring to your project are your guarantee of a production system that is perfectly matched to your requirements. We can supply systems to produce any profile for any application – from simple to complex and with up to five different components.

The polyurethane seal, including a rain channel, for window and roof modules can be applied in a single work process. This approach eliminates

assembly and logistics costs that would otherwise be incurred for handling different profiles. Glass encapsulation too brings substantial benefits – the polyurethane not only serves as a seal, it also compensates for tolerance variations and facilitates installation of the glazing.



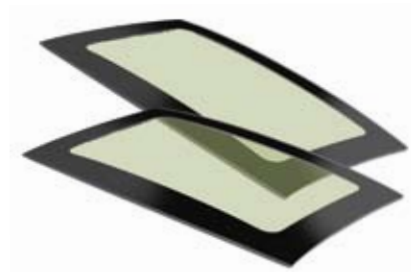
PRODUCT: Seal profiles

MATERIAL: EPDM, TPE with or without steel reinforcement

TECHNOLOGY: Profile production system for continuous extrusion and vulcanization

CUSTOMER BENEFITS:

The combination of extrusion and vulcanization techniques opens up virtually unlimited design scope and highly reproducible quality in profile manufacture.



PRODUCT: Glass encapsulation

MATERIAL: Polyurethane

TECHNOLOGY: Window encapsulation

CUSTOMER BENEFITS:

No damage to glazing thanks to low cavity pressures in the mold. Low cavity pressures also mean that simpler molds and mold carriers can be used. PUR has proved superior to other materials for these applications owing to its outstanding properties.

For tires with optimized properties

Tires are expected to be tough and safe – and to last a long time. The drive to achieve characteristics like low rolling resistance and improved grip on all road surfaces has changed the specifications for tire materials. Today's tires are made up of over 10 rubber compounds and up to 20 separate components. KraussMaffei supplies a complete portfolio of extrusion and roller systems for all stages of tire production.

Tires are complex high-tech products and enormous effort goes into their development. The long process chain involved in manufacturing tire components is only successfully completed by defect-free production. Advanced production systems are capable of turning out products that meet the highest standards. KraussMaffei supplies machinery and systems for all the production stages from compounding to tread production.

Tire manufacturers strive to increase the durability and service life of vehicle tires and to reduce rolling resistance. At the same time, it's essential not to lose characteristics such as grip on wet and dry roads, and resistance to abrasion. Modern tires are made up of different layers and especially for tread strips, silica is now widely used instead of soot to reduce rolling resistance and increase wear resistance. The abrasive silica compounds makes heavier demands on the abrasion resistance of contact surfaces in the extrusion machinery.

Harmonized extrusion systems

Multiplex extrusion systems from KraussMaffei can shape up to 4 precisely specified rubber compounds to a tire component in special profile dies. The tire segments are accurately dimensioned with no trapped air. The system components, extrusion line, profile die and tooling systems are supplied as modules and engineered to work together perfectly. This approach leads to minimal reject rates and short set-up times – to maximize the profitability of the production lines.



PRODUCT: Tires

MATERIAL: Natural and synthetic rubber, fillers such as soot, silica, carbon and chalk, steel and textile cord

TECHNOLOGY: Multiplex extrusion lines, roller head systems, cap strip systems

CUSTOMER BENEFITS:

KraussMaffei tire production systems are cost-effective solutions for continuous production of high-quality tire components.



TABULAR OVERVIEW

All application areas, all process technologies

Vehicle exterior

Application	Requirements	Processes
Radiator grille, front grille	High surface quality and dimensional stability; impact resistance	Standard injection molding technology IMD – in-mold-decoration; back foaming of preformed décors RIM, RRIM – (reinforced) reaction injection molding; admixing of reinforcing fibers to PUR components
Body side molding	Highest optical specs; highest specs for dimensional stability in changing temperatures (→ gap dimensions)	Standard injection molding technology IMC – injection molding compounding (Technology ³); the IMC process combines continuous plasticizing (extrusion) with discontinuous injection; it gives users a largely free hand to specify and compound custom formulations immediately prior to injection molding RRIM – reinforced reaction injection molding ²
Bumper, apron (front, back)	Design-critical component, high impact resistance	Standard injection molding technology IMC – injection molding compounding (Technology ³) ¹ RRIM ² skins with painting
Sill cover	High optical specs; highest specs for dimensional stability in changing temperatures (→ gap dimensions), impact resistance	Standard injection molding technology RRIM – reinforced reaction injection molding ² Compounding PP + EPDM, filler and/or glassfibers with PP beads as lining
Bumper core	High energy absorption	Extruded PP beads that are expanded
Marque badges, décor strips	First-rate surface quality, paintability, printability	Standard injection molding technology
Mudguards	Highest optical specs; highest specs for dimensional stability in changing temperatures (→ gap dimensions)	Standard injection molding technology IMC – injection molding compounding (Technology ³) ¹ RRIM – reinforced reaction injection molding ²
Side doors	Highest optical specs; highest specs for dimensional stability in changing temperatures (→ gap dimensions)	Standard injection molding technology
Side door seals	High resistance to fluctuating temperatures, noise absorption	Rubber extrusion and vulcanization of EPDM
Door handles	Functional integration, colour consistency with adjacent components	Standard injection molding technology

Key to footnotes on page 37

Vehicle exterior

Application	Requirements	Processes
Side mirror housing	Multifunctionality, paintability, impact resistance	<p>WIT – water injection technology; injection molding hollow objects by injecting water under pressure into the plastic core of the still malleable part</p> <p>GIT – gas injection technology; injection molding hollow objects by injecting gas under pressure into the plastic core of the still malleable part</p> <p>StampForm – injection/compression; injection molding combined with various compression technologies for producing small to mid-sized components with first-rate surface quality</p> <p>RIM² with paintable rigid foam</p>
Window seals	Long service life, high temperature resistance, very good sealing properties	<p>Rubber extrusion and vulcanization of EPDM</p> <p>C.A.S.E. – coatings – adhesives – sealants – elastomers; high-pressure process for very low output rates and sealing bead application</p>
Roof module	High stiffness; dimensional stability in changing temperatures, high surface quality	<p>SpinForm – two-component injection molding in swivel platen technology; this technology is suitable for large, multicomponent moldings or for maximizing the productivity of rotary table applications</p> <p>LFI – thermoformed film is reinforced by LFI (interior trim is also backfoamed in a LFI process)</p> <p>RTM – resin transfer molding; glassfiber/carbon fabric saturated in closed mold</p>
Rear hatch	AA surface quality and highest mechanical strength, single or double shell designs	<p>Standard injection molding technology</p> <p>IMC – injection molding compounding (Technology³)¹</p>
Rear hatch seal	High resistance to changing temperatures	Rubber extrusion and vulcanization of EPDM
Rear spoiler	Paintability, small production runs	<p>Standard injection molding technology</p> <p>Multinject – multicomponent injection molding technology</p> <p>RIM, RRIM – (reinforced) reaction injection molding²</p>
Hub caps	Surface quality, paintability, adequate temperature resistance (brakes)	<p>Standard injection molding technology</p> <p>Compounding of polyamides and glassfibers</p>
Dirt trap /splash guard	Dimensional stability, flexibility	Rubber extrusion of various synthetic and natural rubbers
Windscreen wiper profiles	High abrasion resistance, weather resistance, good bonding	Rubber extrusion and vulcanization of EPDM

Vehicle interior

Application	Requirements	Processes
Door inserts	Functional integration, high optical and tactile specs	<p>Standard injection molding technology</p> <p>DecoForm – back injection/back compression molding of sensitive décor material</p> <p>SkinForm (Technology³); SkinForm combines injection molding and polyurethane processing; it offers new options for applications where excellent surface quality and tactile qualities are of primary importance</p>
Pillar trim/covers	Impact resistance, no spalling, high resistance to changing temperatures even for complex geometries	<p>Standard injection molding technology</p> <p>DecoForm – back injection/back compression molding of sensitive décor material</p> <p>SkinForm (Technology³)³</p> <p>MuCell® – patented process for physical foaming of thermoplastics; the MuCell process produces parts with high stiffness and negligible warpage.</p>
Airbag cover	Functional integration, controlled burst lines	<p>Multinject – multicomponent injection molding to produce parts with multiple materials/colours in a single operation</p> <p>DecoForm – back injection/back compression molding of sensitive décors</p> <p>SkinForm (Technology³)³</p> <p>Scoring – intentional lines of weakness on the inside of the dashboard skin for the passenger airbag</p>
Hot air duct	High thermal stress	<p>Standard injection molding technology</p> <p>Multinject – multicomponent injection molding⁴</p> <p>Compounding of PP + EPDM, filler and/or glassfibers</p> <p>RRIM – reinforced reaction injection molding; admixing reinforcing fibers in PUR components; here also bonding with I-panel</p>
Adjustable air outlet	Heat stability, assembly molding	<p>Multinject – multicomponent injection molding⁴</p> <p>Compounding PA + glassfiber</p>
Décor flaps/covers	Excellent optical and tactile qualities, potential information carrier	<p>IMD – in-mold decoration; back foaming of preformed décors</p> <p>SkinForm (Technology³)³</p> <p>DecoForm – back injection/back compression molding of sensitive décor material</p> <p>Compounding PA + glassfiber</p>

Key to footnotes on page 37

Vehicle interior

Application	Requirements	Processes
Wood veneer	Excellent optical quality, scratch resistance	CCM – clear coat molding: flow-coating high-quality components (usually wood veneer) with a very thin, glass clear, two-component PUR system
Ashtray module	Highest temperature resistance, functional integration	DuroSet – processing of free-flowing non-thermoplastics
Handle	Dimensional stability for large cross-sections, optical and tactile qualities	WIT – water injection technology; injection molding hollow objects by injecting water under pressure into the plastic core of the still malleable part GIT – gas injection technology; injection molding hollow objects by injecting gas under pressure into the plastic core of the still malleable part
Pedals, pedal module	High mechanical specs, spalling resistance	Standard injection molding technology GIT – gas injection technology ⁴ MuCell [®] – patented process for physical foaming of thermoplastics ⁵
Switches/push-buttons	Tactile quality, information carrier, often with transparent component	Multinject – multicomponent injection molding technology ⁴
Carpets	Noise and vibration damping, levelling car floor, optical and tactile qualities	DecoForm – back injection/back compression molding of sensitive décor material RIM, R-RIM – backfoaming with flexible foam or heavy foam R-PSM – backfoaming a heavy foam layer
Trunk lining	Noise and vibration damping, levelling boot interior, optical and tactile qualities, wear resistance	DecoForm – back injection/back compression molding of sensitive décor material LFI honeycomb-core technology – long-fiber injection; production of long glassfiber-reinforced components in a one-step process; here also with structural component spraying (SCS) of a honeycomb core
Backrests	High energy absorption in case of a crash, design-critical component	DecoForm – back injection/back compression molding of sensitive décor material SkinForm (Technology) ³
Seat trim (side panel)	Multifunctionality, mechanical specs	Standard injection molding technology SkinForm (Technology) ³
Roof liners	Stiffness, dimensional stability in changing temperatures, high surface quality, scratch resistance	LFI-PUR – thermoformed film is reinforced by LFI-PUR; interior trim can also backfoamed in a LFI-PUR process
Roof liners	Surface quality, scratch resistance, thermal insulation	Film extrusion Foam extrusion
Steering wheel	Pleasant optical and tactile qualities, very good ductility in case of a crash	PUR integral foam Injection molding insert technology

Vehicle interior

Application	Requirements	Processes
Gear lever	High optical specs	<p>PUR integral foam SkinForm (Technology³); SkinForm combines injection molding and polyurethane processing; it offers new options for applications where excellent surface quality and tactile qualities are of primary importance Standard injection molding technology</p>
Seats and backrests, seat squabs, backrests, rear seat, headrests	High specs for degree of hardness, moisture compensation, vibration absorption, long-term performance, and for energy absorption and distribution in a crash	<p>Dual-hardness-PUR with inserts, including in situ foaming of seat covers PUR part partly with inserts; integral foam; flexible foam, also in situ foaming Extruded PP beads that are expanded</p>
Footmats	Long service life, in part with acoustic function	<p>DecoForm – back injection/back compression molding of sensitive décor material RRIM – reinforced reaction injection molding; inclusion of reinforcing fibers in PUR components; barite-filled elastomers; PUR spray molding</p>
Dashboard/centre console	Often highly complex components, high resistance to changing temperatures, highest optical quality in visible areas, tactile quality, allowance for thermal elongation, moderate mechanical specs – impact resistance (in the event of head impact)	<p><u>Dashboard or dashboard support</u> IMC – injection molding compounding (Technology³); the IMC process combines continuous plasticizing (extrusion) with discontinuous injection; it gives users a largely free hand to specify and compound custom formulations immediately prior to injection molding LFI-PUR – long-fiber injection; produces glassfiber-reinforced parts in a one-step process</p> <p><u>Dashboard surface</u> PUR-slush-molding; slush molding is used for freely formed sintered skins with undercuts and deep, narrow ridges PUR-Skinject – skin injection PUR-SpraySkin; PUR is sprayed into the mold in preset patterns by a special, robot-mounted mixing head DecoForm – back injection/back compression molding of sensitive décor material</p> <p><u>Foam for bonding support and surface</u> PUR backfoaming</p> <p><u>Post-processing</u> Scoring – intentional lines of weakness for airbags Milling and punching systems</p>

Key to footnotes on page 37

Vehicle interior

Application	Requirements	Processes
Décor films	High optical specs plus UV stability	Film extrusion – TPO
Hat trays/boot lids	Thermal and mechanical specs, good recyclability	Compounding of PP with natural fibers Sandwich honeycomb technology LFI – SCS (structural component spraying) honeycomb technology with LFI (long-fiber injection)
Door trim	High resistance to changing temperatures, allowance for thermal elongation, in part mechanical specs (side airbags), impact resistance, large number of variants	DecoForm – back injection/back compression molding of sensitive décor material SkinForm (Technology³)³ R-RIM – thermoformed film is backfoamed with rigid foam
Composite components or door trim components	Optical and tactile properties	Back compression of preformed or mold-formed foam-backed film or fabric SkinForm – cast skins; backfoaming (substrate and skin); spray skin
Elastic armrest	Optical and tactile qualities	PUR on substrate
Films for door inside trim	Leather look&feel, high grain quality, scratch resistance	Film extrusion – TPO
Side impact protection, child seats	Low weight, crash absorption	Extruded PP beads that are expanded
Toolboxes	Low weight	Extruded PP beads that are expanded

Engine compartment and underbody

Application	Requirements	Processes
Frontend carrier	Connection to longitudinal supports, high energy absorption in the event of a crash, high stress transfer; functional integration – accommodation of other modules (lights, radiators, etc.); high energy absorption, spalling resistance, resistance to chemicals and weather resistance, dimensional stability in changing temperatures; lightweight construction	IMC – injection molding compounding (Technology ³); the IMC process combines continuous plasticizing (extrusion) with discontinuous injection; it gives users a largely free hand to specify and compound custom formulations immediately prior to injection molding
Other structural components	Functional integration – accommodation of other modules (lights, radiators, etc.); high energy absorption, spalling resistance, resistance to chemicals and weather resistance, dimensional stability in changing temperatures; lightweight construction	IMC – injection molding compounding (Technology ³) ¹ Multinject – multicomponent injection molding technology to produce parts with multiple materials/colours in a single operation Encapsulation of metal inserts Compounding of PA and glassfiber
Fan propeller/ fan propeller housing	Exact dimensional stability and optimal true-running	Standard injection molding technology MuCell® – patented process for physical foaming of thermoplastics; the MuCell process produces parts of high stiffness and negligible warpage Compounding PA, glassfiber and PEEK
Intake manifold	Components with complex geometries and high temperature resistance	Standard injection molding in a soluble core process Multinject – multicomponent injection molding ⁴ Compounding PA6/PA66 with glassfibers
Oil temperature sensor and other components in hot-oil areas	Resistance to chemicals at high temperatures between 140 °C and 160 °C	DuroSet – processing of free-flowing non-thermoplastics
Oil sump	Temperature and impact resistance	Standard injection molding of high-performance plastics
Valve covers	Resistance to chemicals at high temperatures > 140 °C, reduction of noise emissions	PolySet – processing unsaturated polyester compounds Standard injection molding technology Compounding of PA, GF and PEEK
Water impeller	Precision components with high temperature resistance	Standard injection molding technology
V-belts for driving water pumps, generators and fans	High dynamic and static temperature resistance from -40 °C to +140 °C, wear resistance, noise minimization, durability	V-belt extrusion
Radiator tank/ windscreen support panel	Multifunctional stability, thermal stability	IMC – injection molding compounding (Technology ³) ¹ Multinject – multicomponent injection molding technology ⁴ SpinForm – SpinForm – two-component injection molding in swivel platen technology; this technology is suitable for large multicomponent parts or for maximizing the productivity of rotary table applications

Key to footnotes on page 37

Engine compartment and underbody

Application	Requirements	Processes
Wheel arch	Highly complex geometries, various material combinations	Multinject – multicomponent injection molding technology ⁴
Electric plugs	Dimensional stability	Standard injection molding – insert molding RIM – encapsulation with PUR flexible foam
Battery case	Resistance to chemicals, temperature resistance up to 80°C	Standard injection molding technology
Battery tray	High dynamic specs, vibration damping between vehicle and battery	Standard injection molding technology IMC – injection molding compounding (Technology ³) ¹
Engine encapsulation, noise shields, undershields	High stiffness and optimal deformation behaviour, high impact resistance, noise absorption	Standard injection molding technology with LGF IMC – injection molding compounding (Technology ³) ¹ LFI – long-fiber injection; produces glassfiber-reinforced parts in a one-step process RRIM – reinforced reaction injection molding; inclusion of reinforcing fibers to PUR components
Shock absorbers	Mechanical and thermal specs, vibration-damping	X-Form – reactive compounding during injection molding process (Technology ³); the X-Form process provides reactive crosslinking of TPU-X as part of the injection molding process; the combination of extrusion and reaction technology, produces plastics with the properties of elastomers and rubber in a single-step process; the resultant parts can be substituted for rubber-metal composites
Engine block covers	High temperature resistance, noise absorption, high-spec optics (visible parts)	Standard injection molding technology
Fuel hoses	High flexibility and pressure resistance, fireproof	Rubber extrusion of various synthetic rubbers
Coolant hoses	Pressure and temperature resistance, movement compensation	Rubber extrusion of various synthetic rubbers
Brake hoses	Pressure and temperature resistance	Rubber extrusion of various synthetic rubbers
Manifold hoses	Small bending radii, high thermal specs	Rubber extrusion of various synthetic rubbers
Sheet and films for rubber seals and gaskets	Resistance to chemicals, high thermal specs, high pressures	Roller head extrusion of various natural and synthetic rubbers
Noise protection panels	Acoustic damping	Roller head extrusion of various natural and synthetic rubbers
Plastic panels for the production of tanks	Lightweight construction, high resistance to chemicals, durability	Sheet extrusion

Engine compartment and underbody

Application	Requirements	Processes
Engine hood seal	Noise damping, high resistance to changing temperatures	Rubber extrusion and vulcanisation of EPDM
Cable sheathing	Seal cables from contact with sheet metal, damping, splash protection	RIM – flexible structural foam
Air filters	Bonding and sealing of the filter paper	RIM – PUR rigid and flexible foam

Tires

Application	Requirements	Processes
Tire tread consisting of different compounds for cap, base and side walls	Adhesion, wear resistance, damping, low rolling resistance	Multiplex extrusion system for processing natural and synthetic rubbers
Side wall	Carcase protection against side damage and weather effects	Roller head extrusion system for processing synthetic rubbers
Apex or core profile	Driving stability; precise steering behaviour, cushioning effect decisive for driving comfort	Duplex extrusion system for processing synthetic rubbers
Inner liners	Sealing of air-filled tires, replaces the inner tube in today's (tubeless) tires	Roller head extrusion system for butyl rubbers

Transparent parts and related accessories

Application	Requirements	Processes
Front head lights (lens and cover)	Low weight, scratch resistance, excellent surface quality with low birefringence, design-critical component	Standard injection molding technology StampForm – injection/compression molding
Front head lights (housing)	High-precision part, high temperature resistance and surface quality (reflector)	PolySet – processing of unsaturated polyester compounds
Taillights (lens)	Design-critical component, high contour accuracy (scattering)	Multinject – multicomponent injection molding technology to produce parts with multiple materials/colours in a single operation
Taillights (housing)	Functional integration, thermal specs	Multinject – multicomponent injection molding technology
Taillights (lamp socket and cover)	Functional integration, electrical insulation of conductors	Standard injection molding technology – insertion technology

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Transparent parts and related accessories

Application	Requirements	Processes
Cockpit units (pane)	First-rate surface with low birefringence	CoverForm – scratchproof coating applied in the mold immediately following injection molding (Technology ³) StampForm – injection molding combined with various stamping techniques to produce small to mid-sized components with premium surface quality
Cockpit units (carriers, pointers, gears, etc.)	Tiny precision components	Standard injection molding technology
Pop-up/sliding sun roof (frame)	Stiffness, AA surface quality, functional integration (sealing lip, frame)	Plastic glazing – injection/compression molding of large components Multinject – multicomponent injection molding technology ⁴ SRIM – structural reinforced injection molding; spraying of structural components
Fixed glazing (side) and glass roof	Design-critical components, high-spec optics for windows and frames, functional integration; UV permeable	Plastic glazing – injection/compression molding of large components SpinForm – two-component injection molding using swivel platen technology Film extrusion of PC
Window seals	Thermal and acoustic insulation, very good weather resistance	Rubber extrusion , vulcanization of EPDM
Window encapsulation	Reduction of assembly and material costs for smaller production runs	RRIM – window pane encapsulation with special material Standard injection molding of TPE C.A.S.E. – bonding of glass and metal components
3rd brake lights	Optical quality, functional integration, electrical insulation of conductors	Multinject – multicomponent injection molding Compounding PMMA
Interior lights	Optical quality	Multinject – multicomponent injection molding ⁴ StampForm – injection/compression molding ⁷
Films for safety glass	Shatterproof, UV permeable, colouring	Film extrusion of PVB

KEY TO FOOTNOTES

¹ IMC – Injection Molding Compounding (Technology³); the IMC process combines continuous plasticizing (extrusion) with discontinuous injection; it gives users a largely free hand to specify and compound custom formulations immediately prior to injection molding

² RIM and RRIM – (Reinforced) Reaction Injection Molding; inclusion of reinforcing fibers to PUR components

³ SkinForm (Technology³); SkinForm combines thermoplastic injection molding and polyurethane processing; it offers new options for applications where excellent surface quality and tactile qualities are of primary importance

⁴ Multinject – multicomponent injection molding to produce parts with multiple materials/colours in a single operation

⁵ MuCell® – patented process for physical foaming of thermoplastics; the MuCell process produces parts with high stiffness and negligible warpage

⁶ GIT/WIT – gas/water injection technology; injection molding hollow objects by injecting gas under pressure into the plastic core of the still malleable part

⁷ StampForm – injection/compression; injection molding combined with various compression technologies for producing small to mid-sized components with first-rate surface quality

Technology³ processes are colour coded blue.

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KraussMaffei is a premium partner for the plastics and rubber processing industries worldwide. KraussMaffei machines and systems are used wherever plastics and rubber are converted into products. As a knowledge-driven technology company, we build on many decades of experience and a strong commitment to research and development.

Plastic and rubber products for automotive applications deliver properties that other materials cannot match. They can increase safety, reduce weight, save fuel, reduce environmental impact, expand design scope and simplify manufacturing processes. Plastics offer a wealth of opportunities to generate effective, lower-cost component solutions. KraussMaffei supplies machines and production systems for the whole spectrum of plastic and rubber automotive components – from vehicle interior to engine underhood applications. Our engineering and our process expertise cover the whole value adding chain – from material compounding to surface enhancement. Our customer base in the automotive industry includes over 500 car makers and components suppliers around the world. Our experience can benefit your projects.

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