Competence in casting

Move more with lightness

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Move more with lightness
Around 400 years ago, the English philosopher Francis Bacon (1561-1626) set the agenda for modern natural science. His expression “knowledge is power” placed research and development under the dictum of concrete practicality. This agenda has been renewed in the present day with the field of bionics, which has generated a great thrust of innovation across all branches of industry. This includes the automotive branch—and GF Automotive.

Bionics has become an inherent part of every development process at GF Automotive. Nature is used as an archetype for design. This combination of the familiar and its propagation into technology result in innovations cast as one piece. The questions this poses are: Can the weight of diecastings be reduced? Is lightweight construction possible without light alloys? And are there prospects for new casting materials?

True innovations are answers to the pressing questions of the day.

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The basic principle of using only as much material as necessary gives rise to the design of hollow or thin-walled diecastings. But material reduction with the same or even higher strength is only one form of lightweight construction. As a rule, when we think of lightweight construction, we think of light metals like aluminum and magnesium. This is certainly correct. But GF Automotive has also opened up trendsetting prospects for lightweight construction with cast iron.

**Combining the familiar to develop the new**

**Innovations cast as one piece**

Material reduction through bionic design

Using structural optimization, GF Automotive achieves reductions in weight of up to 10%.
Innovations

With the new iron casting material SiboDur, for the first time, there is a low-cost alternative to forgings for highly stressed drive train and chassis components. Not as light as aluminum or magnesium, SiboDur is less expensive and has greater fatigue strength, rigidity, and yield strength.

For engine components that are subjected to high temperatures—such as exhaust manifolds or turbochargers—GF Automotive has developed a highly temperature-resistant cast iron, SiMo 1000, for diesel engines, which can be used in place of high-alloy iron casting materials and complex welded constructions.

Expertise in lightweight construction at GF Automotive extends to new processes, such as aluminum foam—or LamiCast. The latter is a low-turbulence, low-pressure sand casting process for lightweight, thin-walled, and preferably hollow aluminum components, which allows weight savings of up to 40% over steel designs.

Other innovations are targeting compound casting, which allows functional integration in a single process step. Media- or pressure-carrying components can be combined with the casting part through integration, casting on, or encapsulation with minimal manufacturing effort. The combination of various materials also helps in finding an optimized weight solution.

What was previously inconceivable is now economical in series production and reproducible with a high level of quality welding cast iron. It provides precise location of joints, with high strength and long service life.

The innovations at GF Automotive extend all the way to local hardening, which enables increased surface hardness and fatigue strength in cast products. And that’s not nearly all. The company’s innovation pipeline is full. Just wait and see.

Material, design, process: These are the three pillars that support development expertise at GF Automotive. All of these areas are closely interrelated and interact with each other, because that is the only way to innovate.
Who says that castings have to be heavy?

New prospects for lightness in casting.

Of course everyone thinks that light weight means aluminum or magnesium. And they’re right. But with new, high-strength, iron casting materials for highly stressed chassis and engine components, or through material reduction based on bionic principles, GF Automotive has taken the weight out of casting—thereby developing a competence in lightweight construction that is unique worldwide. Casting has a future—with GF Automotive.
The three pillars of our success
Development expertise for the solutions of tomorrow

In the automotive industry, you need to be ahead of the values of your time. In recent decades, development cycles have become ever shorter. In the future, they will accelerate even further. But when the time windows become tighter and model ranges become broader, manufacturers and suppliers are faced with a growing need to work together more directly, more quickly, and more thoroughly—and to think further ahead.

GF Automotive is setting the standard. The company’s development expertise extends to all components and all phases of the development process. From material to design to process. In a finely meshed process, from the conception phase to final implementation, every dial is tweaked to develop and produce the perfect component with optimal properties. Installation clearance, cost-effectiveness, and functionality are taken into consideration.

Development process

Innovation pipeline

Virtual simulation: The entire development of the component, from material selection to casting process, is simulated and continuously optimized.
Using computer-aided structural optimization, initial geometries for a new component are calculated in the available clearance area, and exact specification profiles are determined for selecting the material and process. Regardless of whether iron, aluminum, or magnesium are used, the component is first created as a virtual design. The latter is based on GF Automotive’s expertise of material properties and an analysis of all metallurgical aspects and production limits. It includes simulation of the component’s behavior, both under realistic conditions and under extreme overloads.

GF Automotive has extensive capabilities in iron and aluminum sand casting, aluminum gravity die casting, as well as aluminum and magnesium pressure die casting. Our expertise in machining ready-to-install cast components, combined with surface treatment and joining technique capabilities, allows us to develop and produce an optimal product.

On this basis, GF Automotive produces over 110 million components a year for the chassis, drive train, and bodies of passenger cars and commercial vehicles. Our customers benefit from material, process, and product development, in-house material and component testing, the simultaneous development process, and individual support by engineers on site. They receive innovative products with tested, reproducible quality—for new models that hit the market in ever shorter development cycles. These are solutions that set today the standards of tomorrow—solutions from a single source.

The sooner GF Automotive is brought into the development process of a new series, the shorter the lead time to series production.
How can CO₂ emissions be reduced with casting?

By automating production and reducing component weight.

The sustainability of a company can be seen in its innovations and in the way in which it produces them. GF Automotive is meeting the climate challenge. With cutting-edge, largely automated production—and with lightweight components that reduce the overall weight of a vehicle, and thus its propulsion requirements and ultimately its CO₂ emissions. A small step toward a greater goal—GF Automotive.
Material and its potential
Competence in materials

Iron from sorted scrap metals, aluminum and magnesium from primary and secondary material flows—these are the materials whose capabilities are being utilized at GF Automotive. An example: Iron was—and still is, for many—considered to be heavy and brittle. This outdated opinion used to be justified for gray iron, but it no longer applies to modern nodular iron, a ferrous material containing spherical graphite.

GF Automotive has proven this impressively with the SiboDur family of materials. Named after the additives Silicon and Boron, and the word Durability, this cast iron is characterized by previously unknown ratios of strength and elasticity. Stronger and tougher than aluminum, and cheaper than steel, SiboDur opens promising horizons for nodular iron. Whether it is for highly stressed safety components in the chassis, such as steering knuckles, control arms, and wheel carriers—or for engine components, such as crankshafts and connecting rods.

SiMo 1000, too, demonstrates that nodular iron has not nearly reached its limits. This innovative, highly temperature-resistant iron casting material easily withstands heat up to 900°C without scaling. This makes it predestined for exhaust manifolds and turbocharger housings—also because it has a significant cost advantage over current solutions, such as high-alloy cast iron or sheet steel. In addition, GF Automotive produces more and more aluminum and magnesium components, from doors to crankcases. All of these steps serve the goal of reducing overall vehicle weight, in order to contribute indirectly to a reduction in CO₂ emissions.
What used to be considered in isolation and designed on a drawing board, now undergoes virtual simulation addressing all aspects of the development process. Based on carefully derived material property data, precise component dimensions are calculated, linear and non-linear finite element analyses are performed, and noise and vibration behaviors are anticipated. Part of this process includes the calculation of service life and component testing, which incorporates X-ray spectrometry, microstructure analysis, and corrosion testing.

This phase also covers functional integration of media- and pressure-carrying components, for example. The same applies to composite construction, using different materials such as iron and aluminum. Using mold filling and solidification simulations, even the casting behavior of materials is visualized in advance at GF Automotive. How fast, how hot, how well the casting process runs can all be seen on the computer, so that actual, cost-intensive test runs can be reduced to a minimum.

Essential issues in the area of design, which GF Automotive is addressing, lie in the field of bionics. By applying natural construction principles to cast components for chassis, drive train, and bodies, material is reduced wherever it does not play a load-bearing role. This requires that the casting process and materials are precisely matched. Thus, hollow or particularly thin-walled components can be manufactured with the same or even better strength and deformation characteristics. This is, once again, evidence of GF Automotive’s expertise in lightweight construction.

Form is boundary
Competence in design
Masters of transformation

Process competence

The material selection and component requirements determine which technology will be used for casting. Thanks to precise simulation processes, the result is available with nearly one hundred percent certainty, even before actual casting takes place. Whether it is sand casting, pressure die casting, or gravity die casting—GF Automotive understands each of these processes.

Sand casting, in particular, has been improved and redesigned in recent years, because it is inexpensive, very flexible, and nearly universally applicable to both aluminum and iron casting. With LamiCast, GF Automotive has developed a low-turbulence refinement of this process that is particularly well suited to casting lightweight, thin-walled, large-area, or complex aluminum components.

In addition to the casting process, the properties of aluminum cast components can be optimized through heat treatment. Using local hardening processes, such as roller burnishing, shot peening, and inductive hardening, GF Automotive has increased the surface hardness and service life of cast iron components.

The accomplishments made by the company in the area of innovative joining techniques are also setting new standards. With different materials and precise location welding of cast iron without filler material, GF Automotive has been able to position castings as a real alternative to previously typical steel components.

600,000 t is the weight of iron and light-alloy cast components that GF Automotive produces and ships every year. That is roughly the weight of 60 Eiffel Towers.
What will the drive train of the future look like?

We can’t reveal that, but it will be smaller and lighter.

As a partner with automobile manufacturers, we are part of trend-setting developments right from the beginning and contribute our share: Whether in downsizing, the reduction of engine size, or with lightweight and temperature-resistant materials, such as SiMo 1000 for diesel engines; or with complex gear parts that are manufactured as compound castings. What drives us is progress—GF Automotive.
Whether it is to improve driving enjoyment, or expand on a technological advantage, or whether the future of the automobile itself is on the line—nearly anything is possible. GF Automotive develops and produces components for chassis, drive train, and bodies of passenger cars and commercial vehicles, for nearly every brand, for every category, from compact cars to premium models. With quality and reliability that customers find to be excellent—and award GF Automotive for.

Newcast Award 2007
for the best functional integration in a cast component.

Volkswagen Group Award 2007
for the development of the SiboDur wheel carrier.

ZF Supplier Award 2007
for top quality, outstanding technology, innovative solutions, efficient logistics processes, and competitive cost structures.

IMA Award 2008
for the Smart cross member in the category of Design/Automotive.

Every brand wants the best of us
We give it to them
supplies more than raw castings. Machining, coating, as well as assembly and joining of components round out the spectrum of services of our company. After the actual casting, components are machined and outside parts are assembled or welded in place. In a state-of-the-art cathodic immersion painting line, cast iron components are given a high-quality coating.

The high level of automation in production and great flexibility with simultaneously high process reliability guarantee efficiency in manufacturing and the quality of our solutions.

The product spectrum at GF Automotive covers the entire range of cast components—from steering knuckles and wheel carriers, to links for front and rear axles, to brakes and subframes. Besides engine and transmission supports, transmission and axle housings, the company produces intake manifolds, exhaust manifolds, drive components, and turbochargers. From aluminum doors to magnesium instrument crossbeams.

But it’s not just our products; our customers benefit from our vertical integration and flexibility. Because GF Automotive
Nearly every vehicle has one of our parts in it
Whether in the chassis, drive train, or body
What does the highest form of safety look like?

That depends on the component, but it is surely a cast form.

On the street, life, health, and well-being depend on components that most people pay no attention to. We do. As safe as steel, as inexpensive as casting. GF Automotive casts brake calipers, wheel carriers, and many other safety components for the chassis, which meet the highest quality standards—and save lives. Because they react predictably in unpredictable situations, and thus protect us from the impact of reality. Safety knows no compromise. Neither do we—GF Automotive.
Another sign of our development expertise
Our company’s growth

The European foundry industry stands out in a global comparison. It has done its homework and is ready for the future. For non-ferrous metal casting, it is actually in the lead, ahead of the USA and China. GF Automotive is right there in this trend.

Along with GF Piping Systems and GF AgieCharmilles, GF Automotive is one of three business units, and the largest in sales, in the Georg Fischer Group. Worldwide, GF Automotive is one of the leading providers of iron and light-alloy cast components for the automotive industry.

This is based on a clear strategy and figures that point to success. Annual sales have more than doubled since 1998.

With strategic acquisitions and investments in in-house research and development, GF Automotive has consistently backed lightweight construction and has expanded on its traditional competences in iron casting and light-alloy expertise in a very short time. Today, about 55 percent of annual sales are from iron casting, and 45 percent from aluminum and magnesium casting.

The results are evident. Whether in downsizing, in CO₂ reduction through weight savings, in the mix of materials or functional integration—just to name a few—GF Automotive has given new momentum to current development trends in the industry.

110,000,000 parts are produced annually by GF Automotive: around 2,000 products for chassis, drive train, and body used all around the world in nearly every model of car.
With 13 production locations on three continents and three research and development centers in Switzerland, Germany, and China, customer proximity and performance are ensured around the globe. At nearly all of these locations, only one casting process is used respectively, whether sand casting, gravity die casting, or pressure die casting. This has proved to be the best condition for specialization, and a foundation for numerous innovations. The new research and development center in Schaffhausen, Switzerland, and the iron foundry in Kunshan, China, are also clear signs of the innovative power of the company. With production locations in China, GF Automotive is counting on the growing significance of Asian markets.

This multitude of foundries combines the advantages of local production with a cross-locational production flexibility that ensures reliability of supply. The goal of the company is to increase its permeation per vehicle in the future and to continue to provide competitive structures and processes. We are dedicated to continuously increasing our competence in lightweight construction and to opening and expanding new markets in Asia and Eastern Europe. The foundry industry continues to develop—and GF Automotive is shaping its future.
Can casting save resources at all?

Counter question: If not casting, then what?
If not us, then who?

Casting products move through a cycle of becoming, dying off, and returning anew. It all begins with the careful selection of sorted, recycled materials by teams of specialists around the globe. We ourselves consistently manufacture products that are one hundred percent recyclable—and we recycle them ourselves. That is what we mean by using raw materials consciously. Using resources sensibly—GF Automotive.
No question about it: demand for raw materials is growing worldwide. China and India are driving an unprecedented dynamic. This certainly has an impact on prices. The other side of the coin is the climate problem, which becomes more significant with every barrel of oil consumed.

In the middle are companies like GF Automotive, which calculate economically on one hand, and need to meet environmental policy requirements on the other. The art lies in finding the right balance between the demands of people, the environment, and the economy. Under these conditions, sustainability is simply a prerequisite for middle- and long-term success.

That is the reason why GF Automotive is diligent about its non-renewable energy sources, such as oil, gas, and foundry coke. The same diligence is applied to selecting raw materials that the company processes—iron, aluminum, and magnesium. Using modern techniques, we are investing in the recycling of energy and raw materials. Around the world, teams of specialists are engaged in buying the required raw materials. Long-term supply contracts with strategic partners from the raw materials and energy industries secure sustainably competitive structures.

Strictly documented and thoroughly backed up, the sustainability measures are published regularly in the sustainability report of the Georg Fischer Group. It is an expression of reliability regarding the conscientious use of resources and responsible treatment of our environment.
Everyone knows how riding comfort feels—but how does it sound?

Nicely quiet, if the chassis parts come from us.

We at GF Automotive simulate virtually the noise, vibration, and harshness behavior of our components, and can thus precisely determine what will be quieter, lighter, and have less vibration than the rest. This is the reason why, for example, our steering knuckles with integrated brake line connection not only increase safety, but also dampen noise levels. More comfort on the road—GF Automotive.
The solutions that GF automotive develops are innovative and meet the highest quality demands. They are solutions from a single source, resulting from close cooperation with our customers, and developed on the basis of mutual trust and respect. This starts with consultation by our on-site engineers, and ends—often not at all. Because one successfully completed project generally leads to another.

The customer relationships that we maintain are, in fact, stable and long-lasting. This is not only due to the development and implementation expertise that we provide, nor only to the efficiency and competitiveness of our solutions, but also to the reliability and value added overall that make GF Automotive stand out when working together day to day. It is the ability to move more with lightness, through competence in casting. This benefits our owners and employees, our business partners, and our customers. It is backed by over 200 years of success, starting with the founding of the company in 1802—and continuing today, in the environment of the 21st-century globalized world.

We hope to have given you a first impression of it with this brochure. You are cordially invited to find out for yourself. Here, on site with us—or at any of our locations near you.
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