Maezio™
An advanced composite material that is ready for mass-production
Lightweight material solutions are in greater demand than ever. It’s exciting to see how advanced composites have been part of that story, reinventing cars, electronic devices, sporting equipment and consumer goods that touch our lives on a daily basis. All of these are incredible applications that inspire us to think where composites can take us in the future.

At Covestro we have a young composite material that’s really strong, light weight, and beautiful - Continuous Fiber-Reinforced Thermoplastics (CFRTP), trademarked Maezio™. It ticks many boxes of advanced composites but also has a unique offer of its own. It’s infinitely tunable, can be processed efficiently at scale and recycled at the end of its life cycle. We believe Maezio™ is a genuine answer to the world’s growing demand for lighter weight materials, and a perfect example of what scalable and sustainable composite solutions look like.

Our partners see it the same way: the world’s top electronic brands are interested in bringing Maezio™ into next generation laptops. Leading luggage manufacturers see opportunities in even lighter and stronger suitcases. And the automotive industry is really excited about our material. The breadth of applications is enormous and the way we can touch consumers’ lives is dramatic.

Over the following pages we want to tell the stories of Maezio™ - how this new material is empowering innovation across industries. It’s also about the people and their stories that make this material special. At Covestro we have an amazing team around the world that is entrepreneurial and goes beyond what they have to do on a day-to-day basis in an all-out battle to bring Maezio™ to the mainstream.

To deploy solutions that get next-generation products into consumers’ hands, partnerships need to be formed within the industry. That’s why these stories are also about collaboration with people along the value chain, without whom it is absolutely impossible to bring any new innovation into the market.

We believe we have cool stories to tell, and that the people we’re writing about really have passion and drive for the bigger picture - they are here to tune the world with composites. And that’s an invitation we really would like to extend to everybody in the composites industry and beyond.

David Hartmann
Head of Covestro Continuous Fiber-Reinforced Thermoplastics
A new premium material

It is always challenging for designers to work with new materials – from a creative perspective, as well as pulling it off technically in terms of material performance requirements and finding the manufacturing solutions and partners. So it really is a big deal when a product is brought to market using a material technology that is new for the category.

Shao Qingru, CMF designer at Casarte, the premium brand of the Chinese appliances giant Haier, knows this first hand. "Up until now, as a design team we have been quite limited in terms of material selection, typically relying on metal to provide the performance and aesthetics that we require at the premium end of the scale. At the volume of products that we typically design for at Casarte, it is just not very easy to find new materials to work with."

According to Qingru, "A lot of the time, we try different processing and decoration methods on the usual material selection as a way of differentiation, but typically we reach a limit fairly quickly. New materials are hard to come by and in great demand for brand building and product differentiation." In this context, it is easy to understand that Qingru thinks of it as an industry breakthrough that Casarte successfully launched a high-end air conditioner in early 2018 that uses Covestro CFRTP, trademarked Maezio™, for the main housing of the product.

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Shao Qingru, CMF Designer, Haier Casarte

products on behalf of the Casarte team to do so, however. "Previously, my understanding of composites has been that they were prohibitively expensive and difficult to form. It has been a very pleasant surprise to see how we have been able to deal with challenges along the way in making this product reality using Maezio™. Compared with aluminum, which would be our previous go-to material for high-end products, it is also impressive to see how it has been possible to simplify and reduce the number of secondary finishing processes along the way, as well as being able to feature the beautiful, natural surface texture of Maezio™ simply using a clear coat for extra protection."
For Casarte, there is a clear rationale for using premium materials in their products. For anyone paying attention, it is clear to see that home appliances and consumer electronics design in general is shifting slowly but surely towards becoming an increasingly invisible part of everyday life. The "domestication" of technology brings with it a new breed of home electronics that is there when you need it, but seamlessly blends into the background the rest of the time. Materials play a huge role in this transition, with home appliance brands rediscovering and applying materials and processes that you would be more likely to associate with furniture and interior details than air conditioners or kitchen appliances. Haier is one brand that has been paying close attention to these trends and tendencies in contemporary design, and becoming exceptionally successful in the process.

Although it is perhaps not yet a household name outside China and Asia, Haier is in fact the world’s largest white goods and home appliances brand by market share. Design and R&D are at the heart of Haier’s success and the company has made significant investments in this area, including building fourteen design centers across three continents and launching the high-end Casarte brand in 2006. In a very short amount of time, Haier has amassed an impressive number of international design awards, including 75 iF Awards, possibly the most well-known and respected international design award out there. High-quality design and materials are at the foundation of the Casarte brand, which is further reflected in the marketing of Casarte products that typically relies heavily on emphasizing the use of premium materials. In this context, it is only natural that the Casarte design team should be interested in innovative, advanced materials with premium qualities like Maezio™.

In describing the depth and richness that Qingru sees in the surface texture of Maezio™, she points out a very tangible benefit of the material. "Maezio™ is a very attractive material for us in that it has a natural, organic surface pattern right from the start, unlike metals like aluminum that requires some combination of finishing processes like sandblasting, brushing and anodizing before it is ready to go into the product. All of this add-on decoration can sometimes feel a little excessive, whereas Maezio™ is a natural and has a beauty to itself! For me, the combined aesthetic properties of Maezio™ represents something of a breakthrough in the appliances industry. Since being introduced to the material during a visit by the Maezio™ team to the Casarte design studio, Qingru has also been impressed by the more technical aspects of the material. "The light weight and strength of the material makes me think of a sports car or some very exclusive, high performance product like that. In that context, it has been a very rewarding experience to learn more about how easy it is to form and fine tune Maezio™ to meet certain requirements, but at a much lower cost than what we would expect from conventional thermoset carbon fiber composites."

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For the Maezio™ team, the project has certainly brought some challenges. “For a start, the product is about 1.8 meters tall, so we needed to produce two very large sheets for the cylinders that make up the bulk of the volume of the air conditioner,” says Li Yilan, market development lead for Maezio™. “This presented some initial challenges in terms of finding the right partners for forming and finishing such large parts, but we were able to resolve these issues and I am proud to say that we now have a robust value chain of very capable partners that can take on every aspect of challenging projects like this, from forming and finishing to assembly.”

“Maezio™ has a very different look and feel to conventional woven carbon fiber composites. Aesthetically it just looks natural, organic and not overly engineered”

Chen Jinming, Manager, Suzhou Yichangtai Plastic Co.

It also helps that it is straightforward to design with Maezio™, especially in comparison with thermoset composites. “For sure, there are limitations to how the material can be formed, probably most notably for very deep shapes that require the material to stretch a bit inside the mold cavity. A slightly larger draft angle is also needed compared to what designers might be used to with injection molding, for example. But we quickly built a good relationship with the Casarte design team in terms of sharing creative ideas and design guidelines, which could then be tested using our simulation tools before making decisions about big investments in tooling and supplier capacity.”

Chen Jinming, entrepreneur and general manager of Suzhou Yichangtai Plastic Co., Ltd, Covestro’s forming partner for the Casarte air conditioner project, agrees. “We have been in the plastics and composites industry for more than two decades, but if you ask me about the future, I see huge potential for unidirectional carbon fiber composites like Maezio™. Besides giving designers and engineers the ability to fine tune the fiber direction and performance of the material, Maezio™ also has a very different look and feel to conventional woven carbon fiber composites. Aesthetically it just looks natural, organic and not overly engineered.”

From a design perspective, Qingru does not hesitate in summing up her experience of working with Covestro and partners. “On a personal level, I am very proud that we managed to use an advanced carbon fiber composite in this product. Like I said before, new materials are difficult to find, not to mention design with a way that makes full use of the unique properties of the material, and finally successfully launching a product in the marketplace.” Having successfully taken the Casarte air conditioner project through the entire process from idea to launch, Qingru still sees it as just the beginning of bigger things to come from Maezio™. “We are currently developing several ideas that we plan to make available as soon as possible including making wider selection of fibers available to designers, including glass fiber and high performance synthetic fibers like aramid. (“We are also working very hard to be able to provide our resins beyond poly carbonate as the matrix or binder in Maezio™, including TPU which would give the material completely different properties for an entirely new set of applications.” Lastly, we are exploring many different finishing options, some of which we successfully tried with the Casarte design team, but chose not to use in this particular case for various reasons. We are very keen to pick it up where we left it and pushing things even further going forward.”
If you were to take a look at statistics for the major marathons around the world, you would find that on average less than a quarter of the runners who finish do so in less than four hours. In other words, if you are able to finish a marathon below the 4:00 mark, it makes you a member of a fairly exclusive club. But that doesn’t stop a much wider group of recreational runners from making their personal goal to accomplish this hallmark achievement. The same relentless drive is what motivates Axis Liu, Head of Design at the Chinese athletic wear start-up Bmai. In overseeing and continually evolving the design of the Bmai flagship running shoe Mile 42K, which was specifically designed for runners who aspire to join the sub-four hour marathon club, Axis and his team are always looking for new materials and processes. “Materials are one of the key drivers in our creative process and we absolutely rely on materials that are lightweight and provide better support, stability and overall performance to remain relevant and competitive as a brand.”

It’s easy to understand Axis’ passion for materials—it all boils down to simplicity in terms of equipment, just put on some shoes and off you go. Or, if you are serious about realizing your personal best as a runner, just put on some carefully engineered, surprisingly lightweight and snug shoes that have taken years to develop for a dedicated team of designers and engineers. And then off you go. Ask any major sportswear brand and they will say that the link between the natural potential of athletes and the quality of their equipment is extremely strong in running, just because there are so few parameters to play with beyond the shoes.

Ever since the first running shoes were introduced a long time ago, it has been a race for ever lighter, reinforcing and more cushioning materials. Carbon fiber-based composites tick a lot of boxes in terms of high performance and light weight—properties that have a very real and tangible impact on runners’ performance. While this is all well and good for high-end “expensive” athletic shoes, so far carbon fiber composites have been held back by lack of cost-effective and scalable manufacturing processes, driving up the price and making it difficult to integrate them into high-volume products. But all of this is about to change with Maezio™ and an exciting new collaboration with Axis and his team at Bmai.

“We absolutely rely on material innovation to remain relevant and competitive as a brand”

Axis Liu
Head of Design, Bmai
At the time of writing, it may be that few outside China have heard of this rising star of the thriving Chinese start-up scene, but since Bmai was launched in 2014 it has earned the respect of dedicated athletes. The name Bmai may seem a little arbitrary, but it is in fact laden with meaning. As well as being a Chinese transliteration of “be myself”, Bmai also has a nice double meaning in that the characters 必迈 (bì mài) can also be interpreted as “will go forward”, a nod to the team’s relentless drive to make high-performance sportswear more widely available and help athletes push themselves to new accomplishments.

The Bmai design studio consists of a team of designers with a wealth of experience in the industry, including at the Chinese sportswear giant Li Ning, which is where Axis started out as a designer. At Bmai he is firmly steering the team’s collective efforts towards making products that will attract serious athletes, but with an equally attractive price tag. “For me, it is all about creating outstanding user experiences while keeping costs down.”

Naturally, thorough exploration of new and innovative materials is a key component in creating these outstanding user experiences. “I would say that I spend about a quarter of my time looking specifically at new materials, but that’s only half the story – it is equally important that we create strong stories that consumers can understand and relate to when we add new materials into our products. When I first found out about Maezio™ it didn’t take long for me to realize that this material would be extremely valuable to me as a designer in terms of technical performance and manufacturability, but I also realized straight away that there is a very strong story to be told about this material’s ability to provide stiffness and support at very low weight that I know will resonate with our consumers.”

Axis met his match in terms of a shared passion for materials-led design in David Hartmann, Head of Covestro Continuous Fiber-Reinforced Thermoplastics. Very shortly after being introduced to each other, plans were made for creating a limited edition version of the Mile 42K Lite, using Maezio™ in the shank—a support wedge between the in- and outsole of the shoe that helps stabilize runner’s feet. Maezio™ is an obvious candidate for the job – thin, lightweight and strong, as well as easy to form and integrate into the design.

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Left and opposite: Early sketches of the Bmai Mile 42K Lite running shoe

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decisions about what solutions are right for us. In this context, Maezio™ absolutely fits the bill.” Given that the high-spec Mile 42K Lite shoe is available at the very reasonable cost of RMB 399, or about $60/€50 at the time of writing, it does present a viable and very attractive offer to the ever-growing community of recreational marathon runners. “It’s extremely exciting to think about the role of advanced composites in mass-market applications in the future, helping more and more consumers unlock their natural potential in sports and pretty much every other area you can think of,” says David.

For Axis, the collaboration on the Maezio™ special edition of the Mile 42K Lite is also just the start. “I’m dreaming of a material that offers a combination of multiple functions, like different densities or degrees of flexibility in different areas and directions. Of course, we are already providing different mechanical properties in different places in our shoes using a selection of different materials, but it would be awesome if we were able to achieve this using a single material! So I’m extremely excited to hear that the Maezio™ team are already experimenting with other resins beyond polycarbonate, like flexible TPU, as well as other types of fibers beyond carbon that could be seamlessly combined within the same composite system.”

This ability to move fast and test new ideas rapidly is a key strength of the team according to David. “Right from the time when I was first introduced to Axis and found out more about Bmai, I knew he was very serious about material innovation. I set up a meeting very soon after that, but not with the intention to try and make a case that carbon fiber composites are completely new in athletic shoes – in fact, several high-performance running shoes and football boots from big brands have used carbon fiber composites in the past. The value of Maezio™ is that this high-performance material is applicable in a much wider range of applications compared with conventional thermoset composites. We are able to do this through the unique potential for fine-tuning Maezio™ in terms of our expertise in pairing polycarbonate resin with carbon fiber, as well as specifying the number of layers that go into the material, and controlling the fiber direction of each individual layer. Lastly, we have a built a value chain of world-class partners for forming, finishing and assembling Maezio™ into products.”

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For Chris Lefteri, founder and director of the design consultancy Chris Lefteri Design, materials and processes have always been at the core of innovation. “It’s very difficult for me to see how it would be possible to do any kind of meaningful product design without thinking about materials, so I’m always very excited when I find out about new materials, processes and other developments in the world of materials.”

“I remember being in a meeting at Covestro when someone showed me a sample of a sheet material without telling me much about it. I was very impressed with the light weight and stiffness of the sample, but at that stage it was a little difficult to wrap my head around what kind of material it really was. It certainly didn’t look like any carbon fiber composite material that I had seen before. It was just very intriguing”, Chris says about seeing the material for the first time.

At the time, Maezio™ was still in development and it quickly became apparent to Chris and the team at Chris Lefteri Design that this was a unique material that needed a strong story to communicate its very specific properties and aesthetics. “In that initial meeting, I also remember accidentally tapping the surface of the sample with my ring. I was rather surprised with the quality of the sound, which would typically make me think of metals rather than composites. Everything about the material, from the stiffness and light weight to the look and feel, and now even sound of the material, felt very premium to me and instantly made me think of applications in everything from consumer electronics to the automotive industry’.

Exploring the creative potential of Maezio™

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Later on, Daniel Liden, partner at Chris Lefteri Design, was invited to join a workshop with the Maezio™ team in Germany. “I had been asked if I could join the workshop to give my perspective on potential uses for the material in consumer electronics. At that point, that recently finished a very challenging project that used a thermoset carbon fiber composite material in an emblematic way, both in terms of the look and feel of the product, but also in how it was marketed. Ultimately, the project was successful in the sense that we had been able to use an advanced composite material in a high-volume, but I felt that it came at a very high price in terms of design compromises that we were forced to accept. For that reason, I must admit that I had rather low expectations going into the Maezio™ workshop. But in the end it turned out to be a good thing”.

In bringing up some of the more frustrating aspects of the recent experience with thermoset composites, Daniel gave the Maezio™ team some very concrete questions to illustrate how the material can simplify the design process and bring completely new design opportunities to the table. “Looking back at the thermoset composites project, I was particularly unhappy about a fairly unsophisticated logo solution, which to be honest had me off composites. In learning more about Maezio™ I realized that we were on the verge of a break-through that logos and finishes that are compatible with polycarbonate can be applied to Maezio™ composites, for the simple reason that it uses polycarbonate resin as the binder, or base material.”

According to Daniel, the rest of the workshop continued in this way. “It was a very early discussion between us and the Covestro team. For pretty much every challenge that we threw in their direction, they were able to show how the material can provide good, scalable solutions. For example, the forming solutions that we had explored for thermoset composites seemed fairly clunky compared with thermal compression molding with Maezio™. I remember being particularly impressed by the ability to add features like hooks, ribs or bosses during the forming process in a single step. By the end of the workshop, my preconceptions about composites in high-volume manufacturing had been more or less turned upside down and I left with a head full of ideas and feeling very excited about this new material.”

One of those ideas was to develop a Maezio™ sample to showcase the many technical advantages and benefits of the material, as well as less tangible but equally important aesthetic opportunities. “We spent some time trying to pin down and really drive home the value of the material from as many perspectives as possible. What would be the best way to illustrate stiffness, for example? Obviously, the best way to illustrate this property of the material would be to pick up the sample and bend it and feel it. But perhaps stiffness can be referenced in a way that it becomes apparent in the shape of these...
were the kind of very basic questions that we asked ourselves when we started sketching and prototyping ideas that eventually led to the final sample design”, according to Daniel.

A wide range of concepts and shapes were explored and prototyped. “It’s an opportunity to get to explore a new material in this way and we had a lot of fun, exploring different shapes, features and finishes.” The final shape was selected for its ability to demonstrate key physical properties of the material, but also for its ability to become a tool for showcasing forming potential, finishes and other design opportunities that are unique to Maezio™. “I’m really happy that we are able to show with the sample how it’s not just possible, but actually rather easy to add things like apertures, tight edge radii, or on a very detailed level even controlling the direction of the fiber in Maezio™ parts. There are just so many parameters to play with.”

Beyond technical performance and aesthetics, the ability to customize almost every aspect of the material is another key benefit that Daniel and the team wanted to highlight with the sample. From specifying the type of fiber, resin and additives to the number of layers of tape in the final part, Maezio™ composites offer extraordinary potential for fine tuning for performance, manufacturing and design. “Personally, I found the exploration of surface finishes particularly satisfying. Coming from my thermoset composite experience where we had been forced to accept a less than ideal solution for the logo, the ease of adding in-mold features like embossed and debossed details, decorative film transfer or even inserts with Maezio™ is really impressive to me,” says Daniel.

For Chris Lefteri, the potential of the material to redefine what “premium” means to consumers really stands out. “Materials are fundamental in defining premium experiences. The scalability and unique properties of Maezio™ has the potential to open up carbon fiber composites to a much wider range of applications and industries. It occupies a very special place in the world of materials in that it can offer cost efficiency in what is essentially a premium material. I’m really excited to see where designers and engineers will go with it.”
For additional information about Maezio™, please scan the QR CODE to go to our website

Or visit -
www.maezio.covestro.com

Write to us on -
maezio@covestro.com

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