Putting The Circular Economy Into Practice

Taking innovative ideas
from pitch to product

growthgarage.mcam.com

MITSUBISHI
CHEMICAL
GROUP

INTRODUCTION

Growth Garage is a business accelerator program from Mitsubishi Chemcial Group. Our mission is to support and grow new ideas using our technologies and advanced engineering materials to help tackle some of today's most significant engineering challenges.

A key aim of our sustainability strategy is creating a circular economy. Sustainability, or KAITEKI, is at the centre of everything we do and the ideas we support. We are inviting engineers, designers, entrepreneurs, innovators, start-ups, businesses and students to submit their ideas, technologies, products and services as part of our Growth Garage Composite Engineering Challenge.

What is KAITEKI?

KAITEKI is the Japanese word for 'well-being'; for Mitsubishi Chemcial Group however, the term has a much broader, more profound meaning which reflects the sustainable well-being of people, society and our planet Earth.

KAITEKI is an original concept of the Mitsubishi Chemcial Group that proposes a way forward in the sustainable development of society and the planet, and serves as a guide for solving environmental and social issues. KAITEKI can contribute to making people's lives better by adopting three key terms – 'Sustainability', 'Health', and 'Well-being' – and by saving our resources and protecting our environment. We strive to align the whole company, its operations and products to these values. They guide our business decision making and drive our commitment to invest in the research and development of technology and strategies around the circular economy.

Sustainability means meeting our own needs without compromising the ability of future generations to meet theirs. More than ever before, we believe that achieving excellence demands planning with the future in mind – while taking decisive action in the present.

"We must transform every element of our take-make-waste system – how we manage resources, make and use products, and what we do with the materials afterwards. Only then can we create a thriving circular economy that can benefit everyone within the limits of our planet."

https://ellenmacarthurfoundation.org/

Henning Bloech
Global Director Sustainable Solutions, Mitsubishi Chemical Group – Advanced Materials

To find out how Mitsubishi Chemcial Group is putting KAITEKI into practice, we first spoke to Henning Bloech, the Global Director of Sustainable Solutions at Mitsubishi Chemical Group - Advanced Materials. We started by asking him about the partnerships they're making to enable the circular economy.

So far, we've made several investments in recycling technology and infrastructure. For example, we're expanding our capabilities to mechanically recycle engineering polymers that we're using in our products, even though some are complex and require very demanding applications to recover them. Recent investments include a specialized polymer recycling facility in Switzerland and CarboNXT, a company in Northern Germany, to recycle carbon fibre composite parts. Both are at the forefront of the circular economy.

How are you working across the supply chain to take back waste and end-of-life materials to recycle them and put them back into the system?
We partner with customers and our suppliers to collect and recycle our products and materials. Mitsubishi Chemcial Group is situated in the centre of the value chain, which puts us in a unique position. We have many different partners along the chain. Some are creating polymer feedstocks or selling stock shapes, which then go to the next tier of businesses that might use a CNC machine to turn them into parts. They, in turn, might sell them to an OEM (original equipment manufacturer) which makes the final product, and that might turn up in anything from a wind turbine to a plane or car to a manufacturing application.

We partner with suppliers to figure out how to help every part of the chain become more sustainable and circular. This may include more partnerships with external providers that specialize in reverse logistics, sorting and collecting materials, and potentially even processing some of those end-of-life materials.

Is there anyone else in the chemicals industry doing this?
Many companies are doing similar things in other sectors. For example, there are industry initiatives in the plastics industry, the building industry, and the apparel industry. I believe we're at the forefront of this within our industry, but I can see everyone moving in that direction. There is a lot of activity going on, and I expect to see industrywide initiatives as well as some across industries. We clearly see the need to take responsibility for our raw materials downstream, taking them back and recycling them as much as possible. And ultimately, we can only do this collaboratively. So if Mitsubishi Chemcial Group takes back a material, maybe even one we don't make, we have to find an outlet for it with businesses that can produce high-value products. So there need to be partnerships across the whole industry and the ecosystem we support.

What does KAITEKI mean to you?
I wasn't aware of the term KAITEKI before starting my position with Mitsubishi Chemcial Group. However, the concepts and management philosophy that KAITEKI represents are pretty familiar and reflect established sustainability principles. It allows us to tell our story a little differently but, ultimately, it is about balancing environmental, societal and economic sustainability. We are continually embedding those ideas into our business – with our business leaders, engineers, sales engineers and everyone else across the organization.

How are you using KAITEKI to close the loop on sustainability?
We recycle our own and our customers' waste wherever possible to enable a circular economy. We've reduced waste across our sites by utilizing our advanced materials and technologies. Meanwhile, our high-performance, lightweight materials help decrease our customers' manufacturing footprints and improve fuel economy, energy use and longevity in a diverse range of applications, from aviation to robotics.

As part of our commitment to the circular economy, we're collecting much of our manufacturing and processing scrap for immediate reuse. This enables us to reduce waste throughout our manufacturing and processing operations.

"The circular economy is a means to address many key environmental issues and ultimately reduce negative environmental impacts."

Henning Bloech

And wherever possible, we sort our manufacturing waste and recycle it back into high-value products both internally and externally. We've also implemented production processes to collect our customers' scrap, waste or unused products and recycle these without downcycling.

What are your biggest priorities over the next decade?
First, we aim to reduce our overall energy use while increasing our energy efficiency, therefore reducing greenhouse gas emissions. Globally, 21 out of our 40 sites already get their electricity from renewable sources. In addition, five of these sites also offset their remaining emissions.

We also have three goals that we aim to achieve by 2030…

2023	BECOME CLIMATE NEUTRAL
2025	ZERO PLASTIC WASTE TO LANDFILL 20% REDUCTION IN WASTE AND WATER USAGE
2030	ACHIEVE A CLIMATE POSITIVE STATE

What challenges do your customers face around circularity?
The circular economy is a means to address many key environmental issues and ultimately reduce negative environmental impacts. One approach may be to rethink our current products and designs. How would you design an existing product today based on current knowledge? Would you create it the same way and, if not, how would you design it to meet today's and tomorrow's needs? We aim to enable our customers to meet their sustainability needs and achieve their objectives.

Are there some products that really can't be recycled?
Unfortunately there are, at least based on current technologies and recycling infrastructure. Most challenging are products made with multiple materials which are bonded together. Sometimes some of the materials can be recovered, but rarely all. Take carpet, for example. We have been trying to recycle carpets for years, but it has proven very difficult and costly. In general, carpet involves many materials; it can be dirty and very complex to recycle back to its base materials at the end of its life. There are some solutions, such as mono-material products or specialized recycling processes, but generally the results have been somewhat disappointing. I believe the whole chemical industry needs to explore how we can redesign products that are currently difficult or impossible to salvage due to their design or the substances they contain. We need to be innovative and ultimately replace them wherever possible with circular products.

What role do the Growth Garage Challenges play in what you and Mitsubishi Chemcial Group are trying to do?
They offer an excellent opportunity to tap into a wider knowledge base and "hive mind." For example, when we look at decarbonization, there are a lot of opportunities to work with start-ups, academics, scale-ups and other businesses across industries to develop and share innovative approaches, solutions and best practices. We are always interested in inputs that make our processes and products more efficient and sustainable.

I'm also excited about the latest Growth Garage CE Challenge, which is centred around the circularity of specific products or materials. For example, it's easy if you have a single, pure polymer product that we mechanically recycle. In most cases, its performance is very close to a virgin polymer. Many of the advanced engineering polymers we produce or work with can be recycled many times without losing their properties. But we face some issues when, for example, we take back composite materials made up of different materials or polymers with specific fillers or additives. Let's say we have a polymer with glass fibres, a lubricant additive or carbon fibres to give it specific performance criteria. The polymer chains haven't changed even though these things have been mixed together, but we still need to figure out how to separate the different elements for recycling. It's great for us to find smart people and work with them to figure out how to solve these challenges and find sustainable solutions. We're really looking forward to both learning from and working with the winners.

We're also exploring different types of chemical recycling technologies for some of the more challenging mixed-waste streams.

In addition we're looking for new ideas to track and trace materials through the whole supply chain. For example, how can we get better access to waste and by-products when the end-user is done with them? For many end-of-life products, there's no coordinated system right now to trace the materials and get them back for recycling so that we can close the loop. This is becoming more important, not only for us but also for our customers. We know that many new businesses are starting up and are thinking through how to develop tracking systems and improve recycling infrastructures.

Tim Vorage
Tim Vorage, Founder and Senior Manager of the Growth Garage Business Incubator at Mitsubishi Chemcial Group.

Tim Vorage is the Founder and Senior Manager of the Growth Garage Business Incubator at Mitsubishi Chemcial Group. We started by asking him about the company's drive towards zero waste.

Our business model moving forward is all about transparency. We are trying to help our customers decrease their carbon footprint and move to zero waste. We are taking back materials from our customers' production so they can be recycled, reused and fed back into the loop. The issue is that not all the waste comes from our products, which we can trace, but sometimes comes from other suppliers, complicating the recycling process.

How are you putting the KAITEKI philosophy into action for your customers?
For me, KAITEKI is about future-proofing our customers' business. Forward-thinking businesses capable of significantly reducing their carbon footprint or tying their business model towards a circular economy will create a competitive advantage. This will ensure they'll find themselves better positioned to create more value in the next five to 10 years.

We are offering customers the support they need in helping them get there and show that they're a responsible and sustainable business. We start with providing our customers transparency on their current carbon footprint. This is followed by suggestions to jointly implement solutions to reduce their carbon footprint and minimize landfill by taking back waste from production (or even end-of-life) and feeding it back into the loop.

"Forward-thinking businesses capable of significantly reducing their carbon footprint or tying their business model towards a circular economy will create a competitive advantage."

Tim Vorage

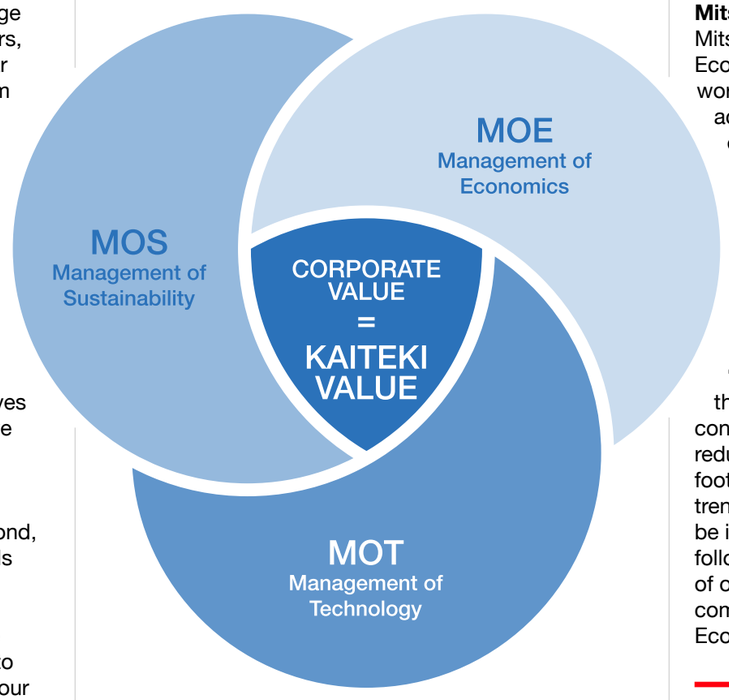
The issue we face around KAITEKI, or the circular economy, is that not everyone has experienced the benefits it could bring. By running the Growth Garage Challenge and creating proof-points with the winners, we can showcase the benefits of adopting a circular business model and, in parallel, build the ecosystem that is required for implementation.

Do you still have a problem recycling some of the things you produce?
We are developing an extensive takeback scheme. We're already working with some of our customers to help close the loop, and then scaling it to help even more customers. Some polymers, polymer mixtures or combinations with metal inserts are more challenging. However, we are committed to finding solutions for all issues that present themselves to our customers and us. For example, we may have a mixture of different polymers; they can also be in different colours, so sorting these for recycling can be challenging. The other issue we face is that if a polymer has gone through the recycling loop a second, third or fourth time, at a certain point those materials can lose some of their properties, often referred to as downcycling. Innovations are required to ensure that the polymers can 'repair' themselves along the recycling process. This explains why we reach out to innovators and entrepreneurs around the globe via our Growth Garage Challenges. They enable us to surface innovative ideas that can help eradicate some of the most significant issues we face today.

Mitsubishi Chemical Group's commitment to KAITEKI and the circular economy extends across all the different businesses within the group. Dr Lisa Weigand, Advisor Circular Economy for Mitsubishi Chemical Europe, works at the regional headquarters in Frankfurt. We began by asking her how the new generation of chemists and chemical engineers, like herself, see sustainability.

Dr Lisa Weigand
Advisor Circular Economy, Mitsubishi Chemical Europe

When you first think about chemistry, many people don't think about it in terms of sustainability. The public image of the chemical industry is often not very positive. What is interesting is that the chemical industry produces most of the materials we have around us. In pretty much every part of our lives, we use products made from materials that are produced by the chemical industry, such as plastics, which can be found in computers or food packaging, for example. I believe that the chemical industry can make an enormous contribution to manufacturing greener products by using fewer resources, less energy, innovative recycling technology or renewable resources, and by producing less CO2.



We also notice that more and more of our b2b customers and their end consumers put a focus on the sustainability of the products they purchase. We observe several trends here: the market asks for products with a low carbon footprint. These products contain recycled or biobased content, products that are safe and sustainable by design or are designed for recyclability. As the manufacturer of those products, the chemical industry has started working on all of those topics. Our company sees this as a priority for our business for decades to come.

Can you tell us a little about your role within Mitsubishi Chemical?
Mitsubishi Chemical Group established a Circular Economy Department in Tokyo, Japan, in 2019, which works on the implementation of the circular economy across our company. Its European counterpart was established in 2020 based in our regional HQ in Frankfurt, Germany, where I'm based. We work with all the different group companies that make up Mitsubishi Chemical Europe. We act as in-house consultants and work with our in-house clients on all aspects of sustainability. My work includes many different topics. For example, I advise the group companies on circular economy business models such as 'close-the-loop' or 'product-as-a-service', on how they can make their products more sustainable by using recycled content or biobased raw materials, and on how to reduce their product's carbon footprint and the carbon footprint of their operations. I also follow regulatory trends and advise our clients on new legislation that will be implemented in Europe. I study market trends and follow the development of new technologies. The aim of our Circular Economy Department is to transform our company to be a leader in sustainability and the Circular Economy.

You are working with Growth Garage on this latest Composite Engineering Challenge. Why are they so important to the business?
We are working towards implementing our KAITEKI philosophy and the circular economy in our company, but we can't do it alone. One company alone will not successfully transform the current linear business model into a circular one. This is partly because the chemical industry deals with very complex and intertwined supply chains.

Additionally, to make circularity and closed-loop systems work, we must constantly innovate with new technologies or business models. We need to partner with businesses across the value chain – big and small – to drive further change to increased sustainability. How important is collaboration for Mitsubishi? It is a crucial part of our DNA and is helping us ensure the well-being of people, society and our planet Earth - KAITEKI.

"To make circularity and closed-loop systems work, we must constantly innovate with new technologies or business models."

Dr Lisa Weigand

Peter Zeimentz

General Sustainable Solutions Manager, Mitsubishi Chemical Group Advanced Materials.

Mitsubishi Chemical Group Advanced Materials has recently launched a new offering, Statera™, which enables the transition to sustainable engineering without interruption or performance compromise. Through the new offering, they provide insight, expertise, and support to create tailored solutions that reduce carbon emissions and enable a circular economy across engineering applications. Statera™ includes a portfolio of new lower-carbon and circular products, the Sterra™ products, an extensive waste takeback program and quantified environmental footprint data.

We talked to Peter Zeimentz, who is responsible for bringing this new range of sustainable products to the market. He started by explaining where the raw materials for the new circular Sterra™ products come from.

The takeback program provides the raw materials for our new low-carbon and circular products by collecting production waste internally at MCG sites and from customers following proper sorting and recycling. As a result, we now have an industrial portfolio with the same performance as virgin materials but with significant recycled content and a substantially lower carbon footprint. As a result, our customers don't need to sacrifice the technical performance criteria by using our sustainable products.

Introducing Statera™: Circularity made seamless

Mitsubishi Chemical Group's comprehensive new offering enables the transition to sustainable engineering without interruption or performance compromise. Statera™ adds value through the entire supply chain, with material innovation, custom solutions, and global manufacturing that close the loop.

Sustainability without compromise

Oue new Statera™ offering makes circularity seamless. As a collaborative partner and an industry leader in advanced material development, we ensure our customers have access to our global scale, resources, regulatory guidance, and cross-industry expertise – helping streamline sustainable solutions with strategic, design, and technical support from start to finish.

Our low-carbon and circular applications are designed and tailored to a customer's application, with a holistic approach that enables us to co-create with them throughout the entire supply chain. Our sustainable engineering polymers are fit-for-purpose, regulatory compliant, and consistent in performance with virgin alternatives, enabling a confident transition to circularity. In addition to transparent and traceable products, waste, and processes, our methods and global scale enable consistent high-quality products – delivered on time, in full, and in a secured supply chain.

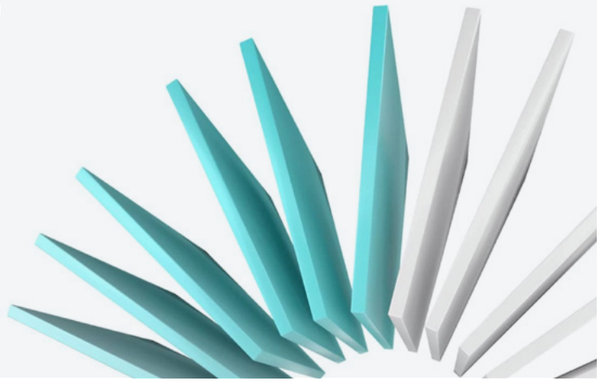
Closing the loop

The Statera™ offering includes extensive waste and scrap takeback programs. To address specific needs and simplify individual recycling processes, we develop custom takeback solutions for each of our customers, including support in waste stream management and logistics along the supply chain. Our suite of Statera™ products has similar recyclability to our other materials, and material acquired through these programs make up the feedstock streams and processing sites for the recycled raw materials that go into our products, ensuring a continuous supply.

Robust takeback programs allow ongoing lifecycles for our products, enabling circularity for us and for our customers. These solutions help us stay on track to reach our 2025 waste reduction targets, which include:

- 20% reduction in overall production waste compared to 2015 baseline
- Zero plastic waste to landfills

Find out more about Statera™ here



Typically, where are your customers in their sustainability journey?
European businesses seem ahead of those in North America and Asia. I think part of the driver is the perceptions of end-consumers with high expectations regarding sustainability. But also, regulations are getting far stricter in Europe with companies, for example, focusing on implementing everything required to make the EU Green Deal a reality and to work towards lowering their carbon footprint. There is also a lot of variation across the different market segments. For example, in any specific sector, you might have three to five front-runners who want to improve their sustainability significantly. If we can change perceptions among those trendsetters, we've found it easier to get other businesses on board.

What key challenges are you and your customers facing regarding circularity?
The key is overcoming the perception that recycled materials automatically equal low or poor performance compared to virgin materials. So that's something we need to change because it simply doesn't hold true, as seen from our tests. We conducted a market survey last year, finding that many customers are also unsure about regulatory and compliance requirements, especially surrounding recycling. That research also revealed that many businesses lack the knowledge to achieve their respective sustainability goals – something we aim to help with.

Are there some specific areas where your customers need your help?
There are two ways you can look at the challenges they face. Some regulatory issues create barriers, which means some businesses don't want to engage. But there is also the pressure for those companies to stay in business, which means they must comply with the rules. On the other side, it's about us convincing customers that we can supply high-quality products with recycled content that help them overcome any issues they may have. It's about trust. We have lots of expertise we're bringing to the market. For example, our experience is sorting different waste materials and using the right recycling processes for those products, which are all about giving businesses confidence in these new circular products. And we know we can't do everything on our own and thus work closely with our partners.

"The key is overcoming the perception that recycled materials automatically equal low or poor performance compared to virgin materials."

Peter Zeimentz

Vink Holdings Limited is the largest European distributor of plastic shapes and a member of the Plastics Family, one of the largest independent plastic businesses in the world. They supply plastic materials, specialist fabrication, and machining for industries as diverse as graphics and signage, building and construction, chemical and storage, manufacturing, automotive, public transport, and medical.

We began by asking Bas and Jeff about the ReVink circular program.

The program connects the dots between Vink, our customers who make finished products for end users, and the manufacturers of semi-finished plastics, such as our partner Mitsubishi Chemical, to create a circular loop. We collect plastic offcuts from our customers, supply chain, and internal departments to develop circular products that enable our customers to be their own raw material suppliers.

What makes the ReVink recycling scheme different?
The most significant difference between regular recycling and the takeback scheme we operate with Mitsubishi is that we recycle high-quality plastics to produce more high-quality products. In comparison, much of the recycling across Europe is downcycling. Our scheme is focused on maintaining the value of the materials being recycled. However, this only really works if the whole supply chain works together, but the chain is only as strong as its weakest link.

How do you persuade your customers to be more circular?
Twenty years ago, organisations were mainly orientated towards their shareholders. However, we are seeing a significant shift towards businesses becoming more stakeholder orientated. And what we are trying to engage in is that stakeholder dialogue that can put pressure on companies to be more sustainable. Over the last four years, we've talked to our customers, suppliers, shareholders, employees, and management team. The message we got back was that they wanted us to engage in the circular economy. To be successful, we not only need to compete on price, delivery times and quality, but also on sustainability. We firmly believe that if we don't engage in a sustainable and circular process, we won't exist in 15 or 20 years. As a distributor of semi-finished materials, we're currently a global market leader. We are trying to use that position in the market to convince our customers that they must invest in the circular process right now. Besides the commercial advantages of using recycled materials, people can do things more efficiently, be more innovative and ultimately create higher margins. So, changing perceptions among our customers and getting them to do things differently can be complex.

Bas Gepkens
Project Manager Innovation & Development, Vink Kunststoffen BV

Jeff Steltenpool
QHSE & CSR Manager, Vink Kunststoffen BV

How does the ReVink scheme work?
We are asking our customers to provide their offcuts to Vink rather than sending them for regular recycling. Although they are financially compensated, the output is downcycled and mostly sent to Asia rather than turned into high-quality products for use in the European market. We have a substantial raw material crisis going on in Europe. Prices are sky-high, and it's increasingly getting harder to access the right materials. So, we must convince our customers to give up the financial compensation from downrecycling in the short term.

However, the upside is that they are investing long-term in the industry's future sustainability. If they start engaging with the circular process, with the ReVink and Mitsubishi Chemicals schemes, they will contribute to the transition from a linear to a circular economy. And from a commercial point of view, this is very significant. As we recycle more and more offcuts, we will achieve greater economies of scale. If all our customers provide us with their offcuts, we can decrease costs, making the business model viable for everyone.

We can now offer our customers two options: buy a virgin sheet or recycled sheets, but there is no difference in price quality or material properties. If we can do this for every material we offer our customers, it will be far easier to get companies to buy into these new high-quality recycled products.

It's a real voyage of discovery, but we are learning something new every day along with Mitsubishi Chemical. The knowledge we've gained has enabled us to cater for our customers' needs more holistically, and adds value to our services. In addition, it's allowed us to develop a tailor-made process for every customer that adds real value to their business.

"Besides the commercial advantages of using recycled materials, people can do things more efficiently, be more innovative and ultimately create higher margins."

Bas Gepkens

Recycling Solutions

Recycling plastics conserves natural resources and demonstrably contributes to reducing greenhouse gas emissions that are harmful to the climate. Mitsubishi Chemical recognizes that sustainable development is a critical challenge and that the global business community has an important role to play in the achievement.

Our high-quality recycling products are produced according to highest and uniform quality standards. As material experts with extensive experience, we concentrate on the professional processing of thermoplastic materials and are known for high-performance engineering plastics. Here are some of the techniques we are using today:

RECYCLING

- Documented waste disposal
- Material purchasing
- Supply of containers and replacement containers; baling press available upon request
- Compaunding, pelletizing and material processing in compliance with customer specifications
- Recalling of partial lots
- Development of concepts for the disposal and recycling of your plastic-production wastes

GRINDING

- Labeling and sorting of the delivered material (from 100kg)
- Grinding, disposal of dust and metal residues
- All common thermoplastics (production scrap, sprues, chunks, large-volume molded parts, powders, foils, profiles, filaments)
- Freely selectable grinding range between 6mm and 10mm
- Return delivers in octabins or bin bags

REGRANULATION

- Regranulation of all common thermoplastics (production waste, sprues, moulded parts, regrind, foils, fiber-containing plastics)
- Homogenization to achieve uniform processing parameters (as per your requirements)
- On request compounding with additives according to your requirements
- Regranulates free from dirt particles and foreign matter, easy to process

COMPOUNDING

- Addition of colour pigments
- Colouting of granules accoring to your colour samples (RAL Pantone, HKS), from 300kg
- Addition of special pigments
- Improvement of technical properties
- Delivery in any desired, common packaging unit

SORTING, PURIFYING

- Pioneering inspection, analysis and sorting system for material purity at highest quality level (X-ray technology)
- Precise granulate inspection for metallic and organic contaminates under clean room conditions
- Intelligent combination of X-ray and optical technology
- 100 percent purity check – outside and inside – to exclude contaminated granulate

TOLL MANUFACTURING

- Toll contract processoing of all common thermoplastics
- Regranulation of your thermoplastic waste and residues
- Many years of experience, professional production area, quality management
- ISO 9001: 2015 certified
- 100% inspection of the plastic regranulate using latest analysis technology

“To meet the challenges of
tomorrow we have to nurture
the visionaries of today.”

Tim Vorage

To learn more about how you can participate in the 2022 MCAM Growth Garage Circular Economic Challenge, go to growthgarage.mcam.com and download the entry pack.

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