

# Company Profile

## AKRO-PLASTIC



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Member of the Feddersen Group

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# Innovative and Application-Oriented Plastic Compounds

## From 1988 to Today: Providing Customer Satisfaction With Tailor-Made Solutions

The construction of the Brohltal/Ost production facility, which was expanded in 2012, means AKRO-PLASTIC can today keep pace with the steadily increasing demand and growing requirements for plastic compounding in one of Europe's leading state-of-the-art production facilities.



Since we began operating in 1988, we have grown to some 475 employees and a global production capacity of over 165,000 tonnes annually. Our focus is on individuality and innovation. As a result we don't concentrate merely on offering a broad product line ranging from standard compounds to special compounds; much of our focus lies in cultivating a comprehensive expertise in the application-orientated use of polymers. Our core competence lies in highly reinforced, impact-resistant and highly mechanically high performance polymers with the strictest specifications. We offer a particularly gentle compounding of sensitive polymers.

The basis for the constant development of our know-how is a process concept which is known as ICX® Technology (Innovative Compounding and Extrusion Technology). This production concept was developed in cooperation with our sister com-

pany FEDDEM GmbH & Co. KG. This enables us to manufacture identical products at our production sites in Germany, China and Brazil. AF-COLOR, a specialist in the production of high-quality technical masterbatches, has been operating under its own name since 2004 as a branch of AKRO-PLASTIC GmbH within the international corporate alliance of the Feddersen Group. The customers of AKRO-PLASTIC include globally active companies, as well as medium-sized plastics processors. Here we produce tailored compounds for large customers, such as automotive manufacturers with production sites on various continents, globally active OEMs from the electrical and electronics sector, as well as small batches for small-scale processing facilities. But they all have one thing in common: high demands. That is why we are more than just a producer. We see ourselves equally as a service provider. Not only do we con-

tinually work to advance our products, we are also industry trendsetters with our certified Quality Assurance-Management system and accredited testing laboratory. In 2014, we joined BIO-FED, another branch of AKRO-PLASTIC GmbH which is located in Cologne, and operates in the segment of biopolymers, especially biobased and/or biodegradable plastics.

K.D. Feddersen Holding GmbH is the sole owner of all companies within the Feddersen Group. The non-profit K.D. Feddersen Foundation is its sole shareholder. It operates an assisted-living facility in Hamburg. We use most of our earnings to support the work of the Foundation. An aspect of humanity which we also carry over to our daily contact with customers and suppliers, true to the motto of our company's founder, Karl-Detlef Feddersen: "Trading for the people – through global trade".

## Ultra High-Tech Production Lines – Investing in the Future

Ongoing investment in state-of-the-art plant technology and in-depth training for our employees in all sectors are essential components of our corporate philosophy. It is how we ensure continuous process control for our sophisticated customers and the custom products we make for them.

Since 2005 we have been successfully represented in China with our own production facility. We serve the high demand in the domestic market with our production site in Wujiang in Jiangsu Province. With

five compounding lines at present, we have a yearly production capacity of 20,000 tonnes. Another production site was opened in Itupeva, Brazil in 2015. From there we serve the Latin American market with

four extrusion lines at present and an annual production capacity of 15,000 tonnes. Both plants are designed to accommodate growth.

## We Offer Our Customers:

- Ultimate production flexibility
- Deliberate focus on specific polymer solutions – individuality is our speciality. It is where we see our best competitive edge – top quality, custom-made for each of our partners. Where others are downsizing their portfolio, we are implementing a strategy of diversity.
- Expertise for the benefit of all. We use the knowledge of application-orientated polymer processing that we have gained through collaboration with global companies to advance smaller customers as well.
- Comprehensive material specifications give our customers the assurance that they will be able to meet the high standards of their clients through consistent quality.



## Using Synergies

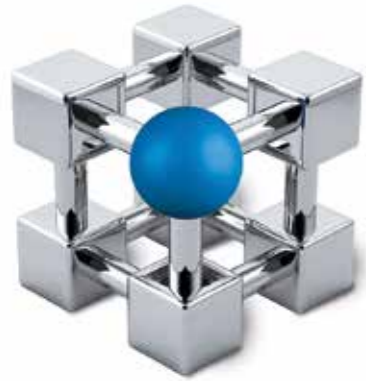
The cooperation between the individual company divisions within the Feddersen Group creates added value for our customers. With our distribution partner K.D. Feddersen GmbH & Co. KG and its European subsidiary, which specialises in the market development and distribution of engineering plastics, we can make use of technical expertise in engineering plastics. With its global branches, K.D. Feddersen Ueberseegesellschaft mbH completes the global distribution network.

In addition, we are also vertically integrated with FEDDEM GmbH & Co. KG company group with regard to the construction of compounding lines. M.TEC Ingenieurgesellschaft für kunststofftechnische Produktentwicklung mbH, a provider of knowledge-based services, has been part of the Feddersen Group since 2018. We use the resulting synergies to ensure that you are successful.

# Innovative Compounding and Extrusion Technology

## Our Production Concept

Increasing pressure on order lead times, consistent product quality, growing product variety and global



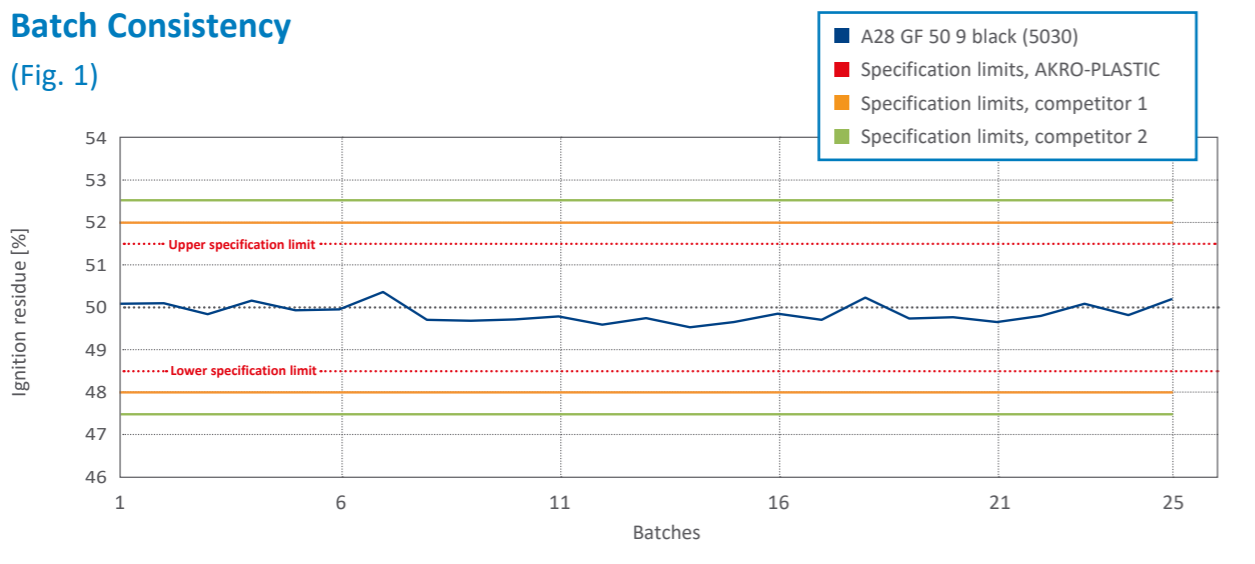
availability at competitive prices shape the business environment for compounds. The key to meeting these challenges is to ensure that production is as flexible as possible. For this reason, we have developed the standardised machine concept ICX® Technology (Innovative Compounding and Extrusion Technology) in partnership with our sister company FEDDEM GmbH & Co. KG. Thanks to the identical manufacturing concept at all AKRO-PLASTIC locations in Germany, China and

Brazil, international companies can be supplied locally with identical products, provided the raw materials support this. This concept leads to significant time and cost savings in material validation.

Figure 1 shows the fluctuations in the glass fibre content of AKRO-MID® A28 GF 50 9 black (5030). With a resulting average of 25 batches, this is 49.87 %. Figure 2 shows the formula that benefits from ICX® technology.

## Batch Consistency

(Fig. 1)



## Working Methods and Maxima

(Fig. 2)

# ICX® Technology

Innovative compounding and extrusion technology

$$\text{Customer value (CV)} = \frac{\text{Quality (Q)} \cdot \text{Flexibility (F)}}{\text{Price (P)} \cdot \text{Time (T)}} \hat{=} \text{Investments}$$

## Batch Consistency and Steady Quality

The most important thing we can provide our customers is batch consistency and consistent quality in every lot. This allows you to produce at the highest quality level while maintaining low rejection rates. We have developed our processes and installed them uniformly worldwide.

All process steps are permanently and centrally controlled and monitored by accredited measurements from our own laboratory in Niederrissen. This is one of the principles on which, for example, we can technically realise an ash content with a dispersion of <0.5 % in a compound reinforced with 50 % glass fibres. From the vibration-free construction of our gravimetric dosing systems, to the kneading unit-free extruder screws made of the low-wear extruder steels (HIP) of our sister company FEDDEM GmbH & Co. KG, through to preventive maintenance, this site and process technology ensures compliance with



this quality level. The benefit of using this applied ICX® Technology is that you can also narrow your specifications to produce better products with the same cost.



### Niederrissen

AKRO-PLASTIC capacity:  
>120,000 tonnes per year  
26 extruders

AF-COLOR capacity:  
Around 10,000 tonnes per year  
8 extruders



### Suzhou, China

Capacity:  
Around 20,000 tonnes per year  
5 extruders



### Itupeva, Brazil

Capacity:  
Around 15,000 tonnes per year  
4 extruders

# Global Network

Our global network of plastic distribution experts allows us to support you anywhere in the world. Talk to one of our specialists and find out more.



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# Compounding Technology

## In-House Cutting-Edge Technology



A good compound needs a good formula, constant raw material and excellent process technology. Over the last few years, this has been developed as ICX® Technology together with our sister company FEDDEM GmbH & Co. KG. We possess unique expertise in this backwards integration into machine technology. We can therefore adapt our extruders to the formulas and not vice versa. As shown below,

this allows us to vary the process length of our extruders typically between L/D 32 and L/D 52. So we can ensure a shorter or longer familiarisation period for the additives. Our mobile extension units can be mounted within a very short time, while the remaining peripherals in front of and behind the extruder remain unchanged. Our kneading-block-free compounding technology offers great advantages,

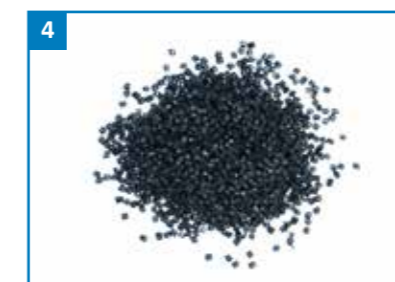
especially for components subject to high mechanical stress, as we enable optimum incorporation of the fibres even at high throughputs and also achieve benchmark values in the strengths. Even high-impact compounds benefit from our systems. Since we incorporate the impact modifiers gently, they can perform to their full potential without short-chain, weakening degradation products.

## Types of Pellets

Our formula-adaptable compounding lines allow the production of different types of pellets. Strand pellets or cylindrical pellets (1) are

the standard processes for engineering plastics. Die-face pellets (2) are used for the biodegradable M-VERA® products from our BIO-

FED branch or for the pelletising of highly filled products with up to 70% filling level (3). We use micro-pellets (4) for special processes, such as additive manufacturing, in order to ensure optimum intake behaviour for small pelletising units. Long fibre pellets (5), made with the latest LFT technology allows us to produce rovings with very high strength products.



# Laboratory Services

## Expert Knowledge About Material Testing



Are you looking for a competent partner for your material analysis? We offer a solution for every requirement.

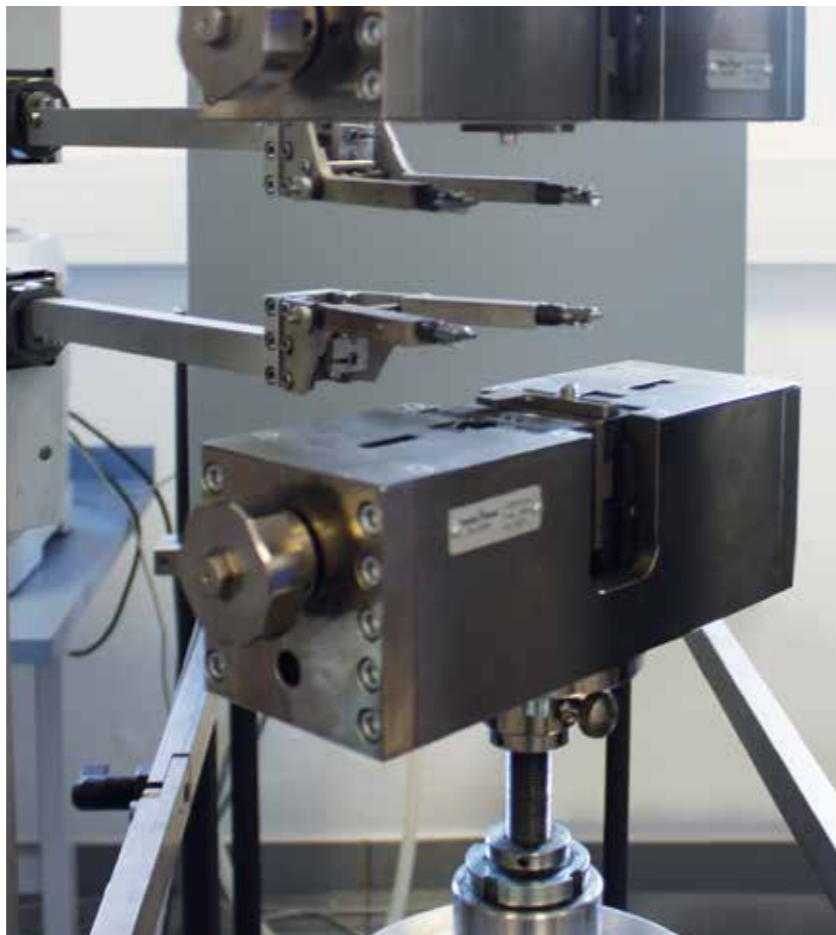
As one of few mid-sized providers of plastics production and compounding services, we can offer you

the option of certified materials testing. Our testing laboratory was accredited by the German Accreditation Council with DIN EN ISO 17025. You, the customer, benefit from our experienced laboratory staff – experts whose technical knowledge is continually developed. In addition to common methods such as the tensile testing to ISO 527 and the Charpy or Izod impact test, the mechanical plastics testing laboratory also offers more complex tests such as the instrumented falling dart test according to ISO 6603-2. Mechanical tests can be carried out in the temperature range of -40 °C to 150 °C, relevant for most thermoplastics. In addition, in the analytical laboratory the thermal properties of plastics are investigated by means of DSC or TGA and the composition of com-

plex formulations by different analytical methods. Also application-specific requirements such as oxidation, chemical or stress cracking resistance are checked in close consultation with customers by the wet chemical laboratory.

Different test specimens are needed for the material tests. These are manufactured in our in-house Competence Centre. We are happy to provide an offer for material testing after a detailed examination of your requirements.

We rely on the laboratory's capacity daily to ensure the compound properties. AKRO-PLASTIC carries out batch-related measurements of the tensile modulus, the residual moisture and the ash content of reinforced compounds as standard.



# Quality Management

## Our Certified Quality and Environmental Management Systems

Outstanding quality, satisfied customers, a corporate management policy of environmental stewardship and a healthy work environment for our employees – these are our commitments. In this way, we ensure the long-term economic success of our company. These certifications are at the same time part of a comprehensive, integrated management system we call AKRO Excellence. The system, established in 2008, also governs the legal matters pertaining to our production sites.

We are certified to the following standards:

- ISO 9001:2015
- IATF 16949:2016
- ISO 14001:2015
- BS OHSAS 18001:2007
- ISO 50001:2011
- ISO/IEC 17025:2005 (DAKKS accreditation)
- + Annex to accreditation



THE AUDIT COMPANY



# Toll Manufacturing

## Customised Thermoplastic Compounds

Benefit from our comprehensive expertise in contract manufacturing and benefit from our decades of experience in process development and compounding. We have extensive and in-depth knowledge in plastics production and manufacturing. With state-of-the-art equipment, we produce high-quality, customer-specific thermoplastic compounds.

The ICX® technology, which goes far beyond the heart of our production equipment, the twin-screw extruder with variable process lengths, ensures optimal and consistent product quality. The machine adapts to your product. Our state-of-the-art dosing systems ensure precise dosing of the individual raw material components, so that your compound is produced exactly, with no defects and with the least variances on every order and in any batch size. We offer you extrusion pelletising or underwater pelletising for cutting pellets and can package them as required in bags, big bags, octabins or as a bulk transport.

With our two production sites in Niederzissen and identical production sites in China and Brazil, you can rest assured that all products will be delivered on time and in accordance with the highest quality standards. In addition, you have the opportunity to grow with us and to offer your product to your customers worldwide with the same quality. We rely on long-term partnerships and joint growth, based on coordinated strategies and we are your reliable partner for toll manufacturing.

Whether high temperature, high performance, thermoplastics or thermoplastic elastomers, we have the expertise and technology to produce your product. With us you reduce the time span from formula development to series production (time to market). You reduce production time and lead times, reduce your own manufacturing complexity and optimise your manufacturing capacity. We process PA, PBT, PET, PC, ABS, PP, PE, POM, PPA, PPS, PEEK and a variety of other polymers. Our systems are particularly suitable for incorporating glass fibres, mineral or carbon fibres with high filling content into your compounds.

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## From Small Orders to Full Service

In toll manufacturing, we offer a flexible, efficient production environment as well as our constant high quality standards. We can flexibly expand this core service with you. We are happy to help you with the necessary raw materials, which you provide us. In addition, we also coordinate the purchase of a few additional components with you, such as additives. We can also take on the complete procurement process for you upon request. You define the raw materials and we buy all the materials for you. Of course, this service is just as transparently documented as every single production, for which you receive a detailed list of raw material consumptions. 100 % traceability of raw material batches and consumption is simply a matter of course for us.

You have an application idea, perhaps also a specifications and do not know how to translate the necessary requirements for the plastic into a formula? Or you have a formula, but are thinking about ways to improve the properties of the final product or reduce the formula costs? Then you are in the right place! We develop or improve these formulas for you, which are still owned by you. You decide who produces them on your behalf.



# Competence Centre

## Extensive Application Development at AKRO-PLASTIC

The AKRO-PLASTIC Competence Centre develops innovative materials based on in-house manufacturing processes and extensive material testing in order to scale and identify the quality-determining influences on series processes.

Particular emphasis is placed on compound development for reliable plastic-metal bond applications (PST process) as well as on the generation of process-optimised materials for the fluid injection technique.



## Plasma SealTight® (PST) – Plastic-Metal Bond (System Partnership Between AKRO-PLASTIC & Plasmatreat)

In order to meet the demand for reliable metal-plastic composite components, an innovative system solution based on chemical adhesion between metal and plastic has been realised in collaboration with Plasmatreat. First, the metal substrate is cleaned, activated, and coated in the Plasmatreat-developed PST process before being overmoulded in the injection moulding process. The

most important requirement of an adhesive metal-plastic composite is the coordination of the coating process and special plastic additives. This innovative process opens up new possibilities for the realisation of media-impermeable bond and structural components.



## Fluid Injection Technique (FIT)

The fluid injection technique is particularly suitable for complex and highly functional integrated components, such as fluid pipes or hollow sections, which are manufactured in one process. The process-optimised plastic compounds of the AKRO-PLASTIC are characterised by improved surface qualities and constant residual wall thicknesses while expanding the processing window. In addition, our Competence Centre

offers you the option of manufacturing one and two components in conventional water-pressure or projectile-internal pressure processes on systems from PME fluidtec GmbH.

# Our Product Portfolio

## The Right Plastic for Every Application

In our own range we develop and produce technical compounds based on standard polyamides (PA 6.6 and PA 6), partly aromatic polyamides, polyesters, polyketone and PEEK (see table below). We modify our products according to your customer requirements with glass fibres, carbon fibres, flame-retardant additives or impact modifiers.

Our products are specified by a unique code in brackets, e.g. AKROMID® A3 GF 50 1 black (2387). This code defines the formula and the process technology as well as the

associated material specification in all of our worldwide production sites. This facilitates global deployment and globally consistent specification of our products.

Furthermore, AKRO-PLASTIC GmbH offers special compounds, for example in the field of electrically neutral plastic applications and plastic-metal adhesion. In product development, our mission to „inspire customers with our plastic products“ always comes first. We are happy to develop the right product for you together with you.

Our products are suitable for processing in injection moulding and in extrusion. Due to the large product variety, our products are used in a wide range of applications, from automotive design to mechanical engineering, the electronic and electrical sector, and the sports and leisure industry.

Trade Name	Polymer	Melting Point
AKROMID® A	PA 6.6	262 °C
AKROMID® B	PA 6	220 °C
AKROMID® C	PA 6.6/6 blends	260 °C
AKROMID® T	Polyphthalamid	approximately 320 °C
AKROLOY®	PA 6-I/6-T	255 °C
AKROTEK® PK	aliphatic polyketone	220 °C
AKROTEK® PEEK	PEEK	342 °C
PRECITE®	PBT	225 °C



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## AKROMID® A/B/B+/C

AKROMID® A (polyamide 6.6), AKROMID® B (polyamide 6) and AKROMID® C (PA 6.6/6 blends) provide high strength and a high degree of stiffness while providing easy workability. AKROMID® B+ is a specially developed polyamide 6 with lower moisture absorption and high mechanical properties, even when conditioned. Therefore, it is ideally suited for the substitution of polyamide 6.6 applications.



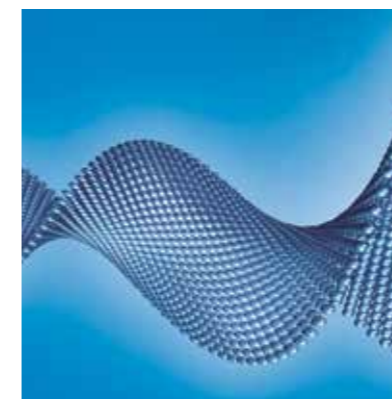
## AKROLOY® PA/PARA and AKROMID® T

Our metal replacement products are used wherever increased requirements such as higher temperatures, more consistent performance for conditioned polyamides, or especially the need for good surface finish are required. A major advantage of aromatic PA compounds is the reduced influence of moisture on the mechanical properties.



## PRECITE®

Includes the product group of thermoplastic polyesters based on PBT, PET and various blends such as: PBT/ASA or PBT/ABS for complex applications. PRECITE® is characterised by high rigidity and toughness, combined with very good heat ageing and high abrasion resistance. Moreover, PRECITE® is exceptionally dimensionally stable and can be equipped with up to 50 % glass or carbon fibres. The ICX® technology used makes it possible to produce PRECITE® components with particularly tight tolerances.



## AKROTEK® PK

Polyketone (PK) is an absolutely versatile material with outstanding properties that no other polymer can match in this combination. Freshly injection-moulded polyketone has the largest strain of more than 300 % in comparison with all other semicrystalline polymers, almost independent of moisture. Furthermore, the polymer is characterised by superior chemical resistance and very good tribological properties.

# Our Product Portfolio



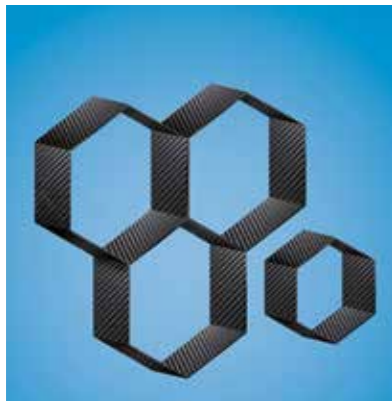
## AKROMID® HI – Impact Modified Compounds

Plastic materials are increasingly being used in applications that require toughness and resistance to impact. Certain plastics such as AKROMID® HI, with their excellent toughness, are perfectly suited for applications such as cable ducts, cable connections, fasteners and clamps, window frames, housings and protective covers. AKRO-PLASTIC offers good batch consistency and a wide range of different polymers, in both unreinforced and reinforced, cold impact or dry impact resistant form.



## Electrically Neutral Compounds

The automotive industry is increasingly using electronic components and integrated circuits (IC). However, the elevated temperatures occurring here can severely limit the service life of components. AKRO-PLASTIC have a new product line of electrochemically neutral polyamide compounds with heat stabilisers and lubricants without halogens or metal soaps. This product line bears the extension „EN“, for Electrically Neutral. We state the bromine and iodine content <1 ppm on all acceptance certificates of EN products.



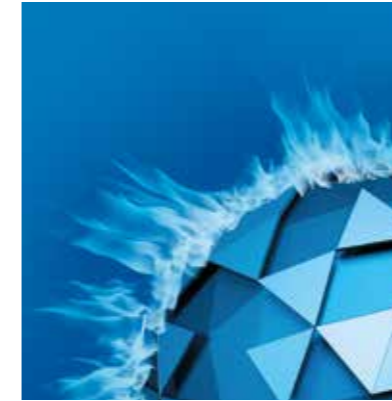
## ICF – Carbon Fibre Reinforced Compounds

Called „ICF“, our carbon fibre reinforced type series based on PA 6.6, PA 6, PK and partially aromatic PA combines high strength with lower density at an attractive price. Further advantages of the products include the good thermal conductivity, the low thermal expansion coefficient and the electrical shielding. The compounds are equipped with a carbon fibre content of 10 % to 40 %. AKROLOY® PARA ICF 40, a polyarylamide-based compound, achieves 39,000 MPa with a flexural strength of 410 MPa, for example. The objective of the product line is to drastically reduce the weight of high-strength components. Weight savings of over 25 % are possible.



## Highly Reinforced Compounds

In addition to highly reinforced PA 6.6 types, AKRO-PLASTIC GmbH also offers highly reinforced compounds in the PA 6.6 + 6I / 6T and PPA range. Reinforcements with up to 70 % glass fibres are possible in PA 6.6, for example. Through our close cooperation with our sister company, the extruder manufacturer FEDDEM GmbH & Co. KG, we have an established machine technology which has been tried and tested over a number of years. It also allows us to manufacture highly reinforced products within proven, extremely close tolerances. However, it is not only the high batch consistency, but also the high strength and stiffness of the highly reinforced compounds that offer a significant advantage.



## Halogen-Free Flame-Retardant Compounds

AKRO-PLASTIC offers producers of electrical and electronic components a wide selection of flame-retardant compounds. All compounds in the FR product line are equipped with flame retardants that are free of red phosphorus, bromine, chlorine and iodine. A classification as FR-EN can be guaranteed in individual cases. The materials then contain no iodide or bromide. The portfolio includes unreinforced and reinforced polyamide 6.6, 6 and 6.6/6 grades that meet fire class V0 testing according to UL 94. There are also products available that have low smoke density and low smoke gas toxicity and are therefore suitable for use in airplanes, trains and buses.



## AKROTEK® PEEK/PAEK

With AKROTEK® PEEK, AKRO-PLASTIC completes the product portfolio in the area of high performance compounds. PEEK has some outstanding characteristics, such as continuous service temperatures up to 260 °C, very good chemical resistance and excellent tribological properties. Tribologically modified types are now also available, alongside conventional glass and-fibre and carbon-fibre-filled compounds.



## AKROMID® S/D

From a technical standpoint, PA 6.10 and PA 6.12 close the gap between PA 6, PA 6.6 and PA 12. They are characterized by significantly reduced moisture absorption compared with PA 6 and PA 6.6. Further outstanding properties are the very good chemical resistance and high resistance to hydrolysis caused by the polymer structure, as well as the improved weld line strength.



## AKROLEN® PP

AKROLEN® PP comprises the product group of PP compounds. AKRO-PLASTIC specialises in special compounds with glass fibre/mineral mixture. For example, they are used in the automotive sector for fuse boxes and housings.