Concept 1865
—Rethinking Materials

BASF
The Chemical Company

Under full steam

The founding years in Ludwigshafen am Rhein
First view of the BASF production plant
in 1866, from a painting by Otto Bollhagen.

Concept 1865
— Rethinking Materials
The idea

Conspicuous with its wheels of different sizes, the velocipede was the first pedal-powered cycle in history. BASF has now rebuilt the 19th century bike – as a modern e-bike with plastics from the BASF product range. But why?

With its Concept 1865, BASF is taking a trip back into its own history – to the year 1865 –, when the Badische Anilin- & Soda-Fabrik (BASF) was founded and this was the point in time when Karl Drais' wooden »Dandy horse« was given its first pedals, which launched the bicycle on the road to global success.

As a tribute to this era of enthusiasm for technology and invention, BASF has embarked on an unparalleled thought experiment and asked: How would the first pedal cycle have looked if the pioneers of the bike had had today's advanced materials to work with? In cooperation with the DING3000 design studio, the company has developed a velocipede embodying the current state of the art technology. In doing so, the innovative one-off quotes the geometry and mechanics of the first pedal cycle. The crank directly drives the front wheel (39") which, in order to improve the transmission ratio, is much larger than the rear wheel (24"). The chain, sprockets and coaster brake are entirely omitted. Even so, the modern-day velocipede is much more than an appreciative allusion to bygone days. Technically it is ahead of its time. For the fully functional and ready-to-ride e-bike features such spectacular details as thin optical waveguides inlaid in the forks for the lights, softly sprung and at the same maintenance-free tires, and a detachable seat with an integrated battery. Overall, this modern e-bike makes use of 24 innovative BASF materials – materials that are sure to come to the fore as electromobility advances.

New materials for new ideas

By implementing its design study based on this thought experiment, BASF obviously does not intend to reinvent the bicycle, let alone the wheel. Under the slogan »Rethinking Materials«, the unusual e-bike is in fact an invitation to customers to join the company in developing new applications and product ideas utilizing advanced plastics. BASF has plenty of experience in this. Since its founding in 1865, the company has been researching new chemical products and helping customers from across industries to bring their ideas to fruition.

1865

The bone-shaker
The historic pedal-cranked bicycle still had wooden wheels.
Riding on the bumpy roads of the 19th century was very uncomfortable –
hence the nickname »bone-shaker«.
Image: »Bibliothèque nationale de France«

Today

The e-velocipede
BASF's specialists have teamed up with the DING3000 design studio to build
the velocipede of the 21st century. The ready-to-ride prototype
Concept 1865 with an electric drive is made almost entirely of modern BASF plastics.
Only the brake, axles and motor are still made of metal.

The astonishing story of the velocipede

A bumpy ride through history

The bicycle is the world's most frequently built vehicle. But, far from being as popular as it is today, cycling was long regarded as a hazardous leisure pursuit of the rich.

As we know, necessity is the mother of invention. And the bicycle is a classic example. In 1816, the »Year without a Summer«, the harvest failed all over most of Europe. Because of the famine, many farmers were unable to feed their horses. It was therefore perhaps logical that in the heart of this disaster area, Germany's south west, Karl Drais should invent a two-wheel »running machine« on which its user could propel himself, half running and half free-wheeling. The contraption known as the »Dandy horse« in the English-speaking world became very popular among younger members of the nobility, but soon gained a reputation as an expensive and dangerous leisure pursuit. The balancing involved was particularly hazardous. The authorities finally curtailed the advance of this technology with prohibitions. In Milan, London, New York and even Calcutta, the use of the Dandy horse was banned. Prohibitions held back progress for fifty long years.

Only with the rise of industrialization in the last third of the 19th century did innovation again flourish. BASF first saw the light of day in Ludwigshafen am Rhein in 1865, and the bicycle made rapid progress at the same time. All the rage and a milestone in its day was the velocipede, a French pedal cycle with a crank on the front wheel. Thanks to the inspiring combination of muscle power and mechanical translation, these cycles gradually ushered in the age of individual mobility. It is not clear who invented this bicycle with the large front wheel. Pioneers of its popularization were Pierre Michaux and his son Ernest. In as early as 1861, father Michaux converted a Dandy horse into a pedal cycle. The breakthrough came finally in 1867 when Michaux unveiled the velocipede at the Paris International Exposition. With partners he soon founded Michaux & Cie and embarked on mass production. Bicycles soon increased in numbers and became affordable.

Trouble with the authorities

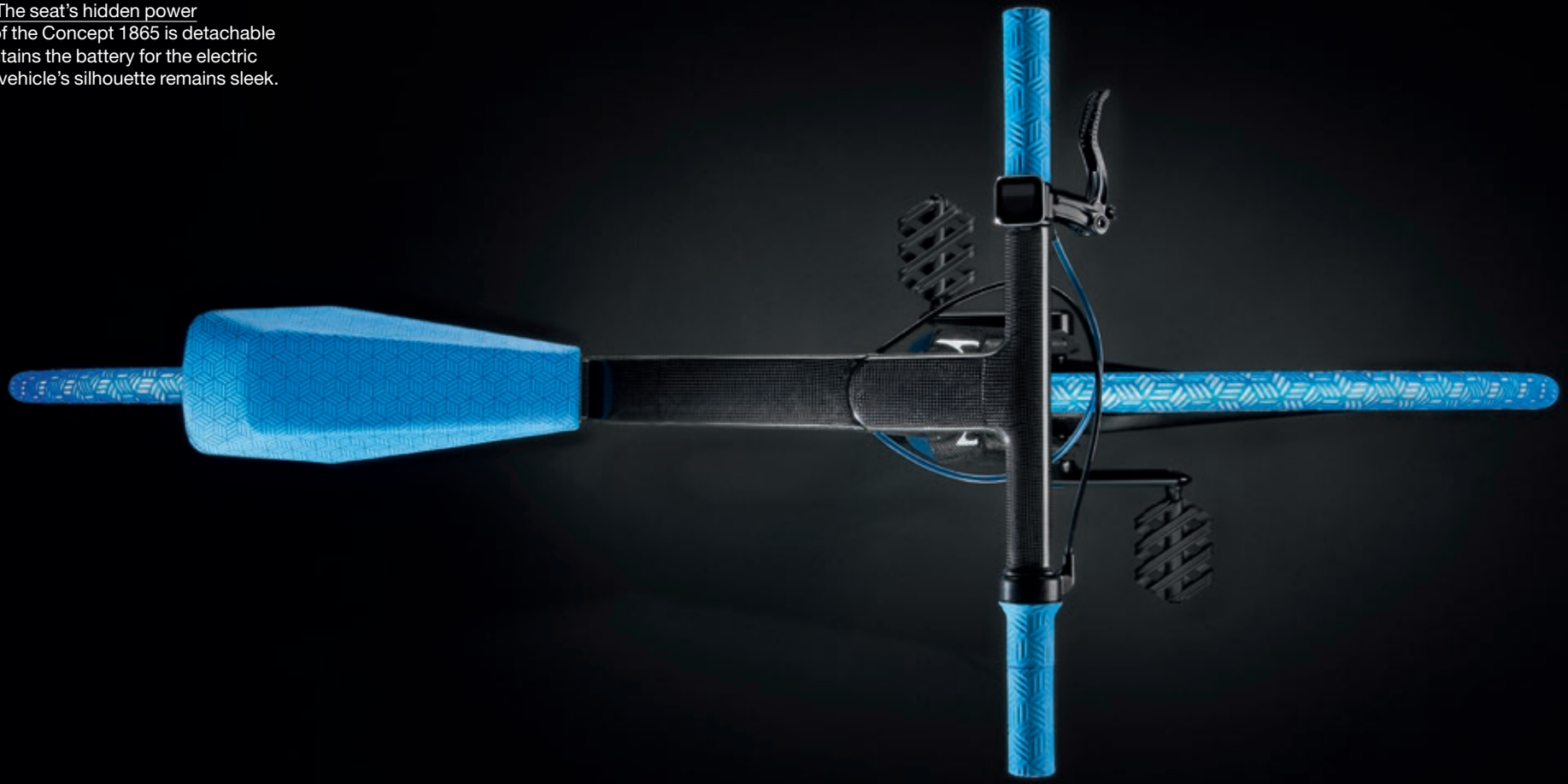
Of course, the unpracticed owners first had to learn to ride their steeds – a real challenge. In riding schools and gymnasiums they first practiced balancing, before maneuvering their cumbersome cycles out onto the bumpy streets where they caused traffic mayhem. Horses shied and carts and carriages tipped over. There was trouble with the police. And velocipede riders, like the very much faster »high-wheeler« riders years later, became the reckless drivers of the day. Only when the low-riding bicycle, technically very similar to today's bikes, arrived at the turn of the last century cyclists finally were welcomed into the fold of road users.

Women race pioneers
The finishing line for the first ladies' race on velocipedes in Bordeaux in 1868.
Image: »Bridgeman Berlin«


Concept 1865
Concept 1865

Typical velocipede
Velocipedes were known for their enlarged front wheels that improved the transmission ratio. However, the present-day velocipede rider is assisted by an electric drive.

The seat's hidden power
The seat of the Concept 1865 is detachable and contains the battery for the electric drive. The vehicle's silhouette remains sleek.



Elegant solution
Integrated LEDs concealed in the forks and inlaid optical waveguides render conventional lighting systems superfluous.

Concept 1865
— Rethinking Materials
The materials

The Concept 1865 utilizes a total of 24 materials from the BASF portfolio.

A
1 Front Wheel Rim
Ultracom™
S. 24

B
2 Tire Core
Infinergy®
3 Tire Profile
Elastollan®
S. 26

C
4 Crank
Ultramid® D HMG
5 Pedals
Ultrason® KR 4113
S. 28

D
6 Lights
Elastollan® LED
7 Brake Hose
Elastollan® Hose
8 Grips
Elastofoam® I
9 Accelerator Grip Cable
Elastollan®
S. 30

E
10 Decals
Elastollan®
11 Frame
Baxxodur®
12 Front Fork with Stem and Handlebar
Elastolit® R
S. 32

F
13 Fork Core
Kerdyn®
14 Fork Core
Elastolit® D
S. 34

G
15 Seat Mount
Ultrason® E2010 C6
16 Seat Latch Mechanism
Ultraform®
17 Seat Suspension
Cellasto®
S. 36

H
18 Seat Cover
Elastollan®
19 Seat Housing
Ultradur®
S. 38

I
20 Seat Cushioning
Elastoflex® W
21 Battery Insulation
Neopolen® P
S. 40

J
22 Rear Wheel Rim
Ultramid® Structure
23 Brake Disk
Ultrason®
24 E-motor Cover
Ultramid® B
S. 42

A

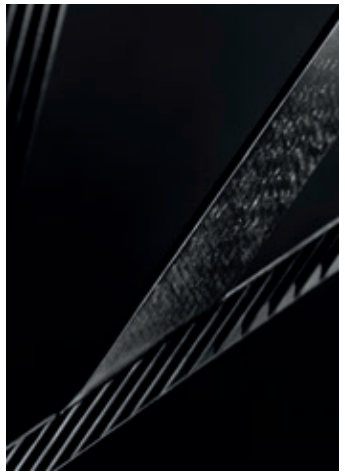
1
Thermoplastic rims offer vast design freedom. But that's not all:
Mass-produced, they could well
become an inexpensive alternative to metal rims.

1 Front Wheel Rim
Ultracom™

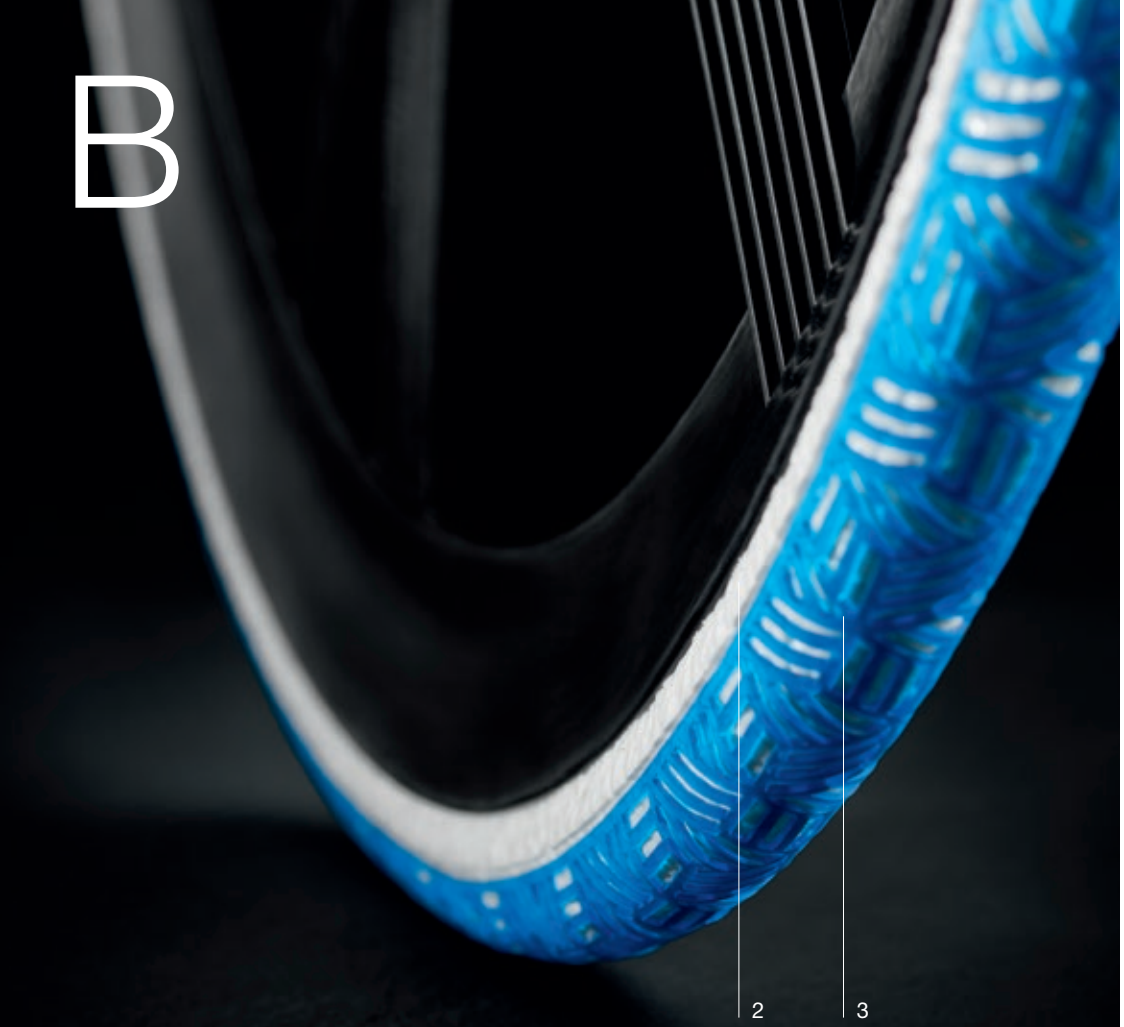
Ultracom™ stands for a package of three components: continuous fiber reinforced semi-finished products, adapted overmolding compounds and the complementing engineering support. In a single process step, Ultralaminate™ and Ultratape™ – reinforced continuous-fiber laminate and tape semi-finished products – are thermoformed and subsequently stiffened with a structure of short-fiber reinforced Ultramid® COM. In this process, the BASF specialists combine the mechanical superiority of continuous fibers with the processing benefits of short glass fibers. With the aid of the proven Ultrasim® simulation tool, the components are designed on the basis of models that take into consideration material and processing characteristics of Ultralaminate, Ultratape and the overmolding compound Ultramid COM.

Ultramid® is the name given by BASF to partially crystalline, thermoplastic polyamides. This class of materials features high mechanical strength, rigidity and thermal stability. In addition, polyamides show good toughness at low temperatures, positive sliding friction behavior and trouble-free processing.

BASF's Ultramid grades are PA molding compounds, often reinforced with short or long glass fibers based on PA 6 and PA 66. The range is supplemented with various copolyamides such as PA 66/6 and partially aromatic polyamide. Because of their outstanding properties, these materials have become indispensable for many different components and machine elements and for high-grade electrical insulating materials. Polyamides also harbor great innovation potential owing to their high amenability to modification with additives and fillers.



B



2
Infinergy® is the first expanded thermoplastic polyurethane.
It is light, durable and very elastic,
while also displaying outstanding resilience.

3
The bright blue tire profile made of Elastollan® is still
undergoing trials. Its remarkable resistance to wear and abrasion make
it an exciting prospect for this application.

2 Tire Core
Infinergy®

The 19th century pioneers of the bicycle used solid rubber tires. This type of tire never really caught on because it was considered too heavy and too hard. For the tires of the Concept 1865, BASF has carried out its first tests with expanded thermoplastic polyurethane (E-TPU), a light, durable and very elastic material. Together with adidas, BASF has used this innovative particle foam for the midsole of the Energy Boost running shoe. It is produced by expanding TPU granules in an innovative process. Afterwards, individual oval-shaped beads, which are about 5 to 10 millimeter across, are compressed with air pressure and fused together with steam. This way Infinergy® combines the properties of a particle foam with those of a thermoplastic polyurethane. This combination gives the material outstanding processing characteristics and excellent resilience. Even during continuous use, this property also known as rebound is retained. Further benefits are Infinergy's low density, good tear resistance and temperature stability.

3 Tire Profile
Elastollan®

For the bright blue, semi-transparent tire profile, the BASF specialists used the material Elastollan®. This material from the group of thermoplastic polyurethane elastomers (TPU) is still undergoing trials as a tire profile, but it is already impressive with its unbeatable wear and abrasion resistance and very good resistance to cutting and tear growth. These properties enable the tire to run just as well on tarmac surfaces as on sandy and stony ground. Its performance is enhanced still further by its high elasticity at high and low temperatures and low rolling resistance.

Thermoplastic polyurethane (TPU) is of huge importance for the Concept 1865 e-bike. This versatile class of materials, which BASF markets under the Elastollan® banner, can be found in such diverse applications as tires, seats, forks, brake hoses, optical waveguides and decals. It is characteristic of polyurethane that the hardness of the plastic can be finely adjusted to suit the application. Elastollan is therefore suitable for sports and leisure items, shoes and textiles as well as for demanding applications in the automotive industry and electrical/electronic engineering. Elastollan is supplied as a granulate ready for injection molding or extrusion.

4 Crank
Ultramid® D HMG

Innovative plastics solutions are increasingly capable of replacing metals. This even applies to the crank which is exposed to huge compressive and tensile forces when the rider mounts the bike or cycles up a steep slope.

The Ultramid® D used here is a polyamide (PA). Due to its high content of glass fibers and the polymer's composition, it is used in highly stressed components and where high rigidity is required – as expressed by the suffix HMG (High Modulus Grade). Materials of this group are easy to process and show good surface quality. Outstandingly, for polyamides, the effect of moisture on the material properties, dimensional stability and low creep tendency is minimal.

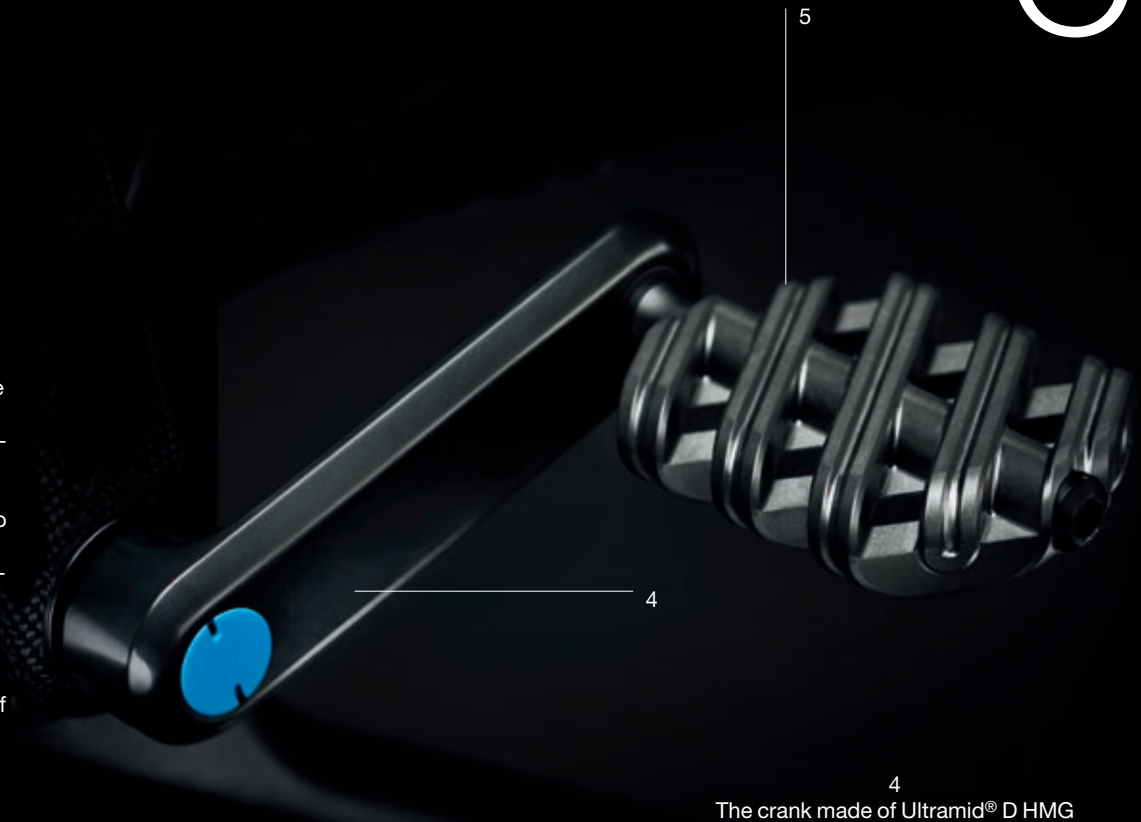
5 Pedals
Ultrason® KR 4113

Ultrason® KR 4113 is a true high-performance plastic. Owing to the outstanding sliding friction behavior and dimensional stability of this Ultrason grade, the designers of DING3000 were able to dispense with ball bearings on the pedals. The outcome is maintenance-free and low-wear bearings for everyday use on the roads. These characteristics are achieved by integrating carbon fibers, graphite and polytetrafluoroethylene (PTFE).

The Ultrason® grades are amorphous thermoplastics with high-temperature stability from the polyether sulfone family. Their spectrum of properties permits their use in top-of the line technical parts and highly stressed mass products. They can be processed with the conventional methods for thermoplastics. Ultrason is used in those applications where other engineering plastics prove inadequate with regard to thermal or hydrolytic resistance. The unusual performance profile of the Ultrason grades enables them to replace thermosets, metals and ceramics.

Its outstanding resistance to many engine oils, high mechanical strength and excellent dimensional stability in the temperature range of minus -50°C to +180°C permits the use of Ultrason in control units, rotors and housings in oil circulation system.

C



4
The crank made of Ultramid® D HMG withstands high stressing, such as when the rider mounts the cycle or climbs steep hills.

5
With Ultrason® KR 4113 integral pedals completey out of plastic could be provided. Due to the outstanding sliding friction behaviour and dimensional stability of this material the bearings are low-wear and maintenance-free.

6 Lights
Elastollan® LED

Truly inspirational are the optical waveguides of aliphatic Elastollan® inlaid in the two forks of the Concept 1865. A flexible solid profile of the highly transparent, non-yellowing material permits an extremely uniform and energy-saving light whose source is impossible for the eye to locate. This is facilitated by LED lamps integrated in the forks and ingenious printing on the rear of the profile that reflects the light. The flexible material whose color and shape can be adapted to customer requirements offers an abundance of creative possibilities that are sure to delight not only designers.

7 Brake Hose
Elastollan® Hose

Brake hoses have to resist wear and the fluid they contain while remaining flexible. Hoses made from Elastollan® fill the bill and have proven effective for years. They exhibit optimal bursting behavior under pressure, are highly wear resistant and permit the tight bending radii that are essential on bikes. The transparent Elastollan used here also renders the oil inside visible and thus makes it easier to check bubble-free filling and hence reliable braking behavior. Thanks to these transparent hoses, designers now have the option of color accentuation with dyed oils.

D

8 Grips
Elastofoam® I

Elastofoam® I flexible integral foam has proven to be a highly versatile material. This is due not least to its blend of a light, flexible foam core and a compact and tough skin. The foam is particularly pleasant to the touch, while displaying excellent mechanical properties and outstanding resistance to abrasion. In addition, the surface can be given a decorative structure in the mold. Elastofoam I is typically used for armrests, treatment tables, steering wheel covers and gear lever knobs.

9 Accelerator Grip Cable
Elastollan®

Tried-and-tested Elastollan® cable sheathings achieve the highest standards of protection of valuable power and control cables. They are flexible and very suitable for applications outdoors as they are resistant to stone chipping, water, ozone and cold. It was just what the DING3000 designers were looking for, as it is also possible to adjust its degree of hardness ad libitum. The arc of the accelerator cable is now just as elegant as that of the much stiffer brake hose.

10 Decals
Elastollan®

Elastollan®, with its good amenability to printing and embossing while also being elastic and impact resistant, is an ideal material for the protection of surfaces. Elastollan is used not only for protecting such highly stressed items as skateboards and skis, but also for their embellishment. On the Concept 1865 e-bike, the cut- and tear-resistant material has a similar function as it protects the sensitive carbon-fiber-reinforced material from scratches and stone chipping and even the frame graphics printed on from the rear are excellently protected by this highly transparent, non-yellowing film. The Elastollan film also displays resistance to hydrolysis and microbes.

E

Matrix Systems

The frame and the fork unit with the stem and handlebar derive their strength from a reinforced continuous-filament of carbon fiber fabrics. BASF has two different matrix polymers – epoxy and polyurethane systems – available for these composites. These new, high-strength lightweight materials are produced by Resin Transfer Molding (RTM). In this process, fabrics of carbon fiber are laid in a heated mold. After injection of the low-viscosity reactive resin system and the ideally complete wetting of all fibers, polymerization gets underway. The component can be demolded as soon as the reaction is over.

11 / 12
The Elastolit® R polyurethane matrix and the Baxxodur® epoxy resin system are two different matrix systems for fiber-reinforced plastics that BASF has in its portfolio.

11 Frame
Baxxodur®

Under the Baxxodur® brand name, BASF supplies epoxy resin systems for the efficient production of fiber composite materials. The carbon fiber fabric of the frame is embedded in this matrix.

What makes Baxxodur special is its rapid and complete wetting of glass and carbon fibers, the enormous mechanical strength of the components and the high quality of the composite material. Of key importance is the individually adjustable production process with a longer processing time and reduced component curing time. The product line comprises various epoxy resins and hardeners, with the focus on such applications as wind power and automotive.

12 Front Fork with Stem and Handlebar
Elastolit® R

The carbon fiber fabric of the unit comprising the front fork, stem and handlebar is embedded in the Elastolit® R polyurethane matrix. The brand unites BASF's compact PU reactive resin systems distinguished by their broad processing window and easy demolding thanks to an adapted internal release agent. Displaying customized reactivity, they are compatible with all conventional fiber types and sizes. The fiber-reinforced components produced exhibit high resistance to continuous loading and excellent damage tolerance.

Structural Foams

On the road the bicycle fork is exposed to severe impacts and shocks. The fork crown where the two fork blades meet is highly stressed. By filling the carbon-fiber-reinforced fork with structural foam, the forces can be dissipated throughout the entire structure and vibrations are absorbed. BASF offers two materials for this:
Kerdyn® and Elastolit® D

13/14
Under the Kerdyn® and Elastolit® D brand names, BASF has two different structural foam systems as the core material for sandwich elements.

13 Fork Core
Kerdyn®

Owing to its high temperature stability and resistance to chemicals, the extruded structural foam Kerdyn® based on polyethylene terephthalate (PET) is an excellent choice of core material for composite materials. The structural foam available in sheets or blocks is used in the interior of wind turbine rotor blades, as it withstands continuous static and dynamic loads and endows the rotor blades with long-term strength. The material is used for reducing weight in boat building and is also suitable for lightweight construction in the transportation and construction industries. Kerdyn has exceptionally good mechanical properties and is compatible with many different processing techniques.

14 Fork Core
Elastolit® D

With their low volume weight, Elastolit® D foams serve as spacers between the fiber-reinforced laminate cover layers and thus enhance component rigidity. Customized PU reactive resin systems are available for different sandwich construction methods. These systems can be used for the production of three-dimensional, compression-resistant molded foams for the RTM process or a pressing process. These systems can also be used for the subsequent foam-filling of profiles.

In addition to their adaptability to different processing avenues, these systems' main advantages can be found in their good mechanical properties, high temperature stability, excellent adhesion to different cover layer materials and their amenability to functional integration.

15 Seat Mount
Ultrason® E2010 C6

The e-bike's battery is concealed in the interior of the seat. To facilitate regular recharging of the battery, the mount has a bearing- and maintenance-free mechanism making it possible to mount and clip on the saddle. Based on its good sliding friction behavior, inherent flame retardance and insulation properties, carbon fiber-reinforced Ultrason® E2010 C6 is ideal for both the battery's electrical plug connector and the seat mount.

16 Seat Latch Mechanism
Ultraform®

Ultraform® is the trade name for BASF's thermoplastic copolymer polyoxymethylene (POM) product range. The Ultraform grades combine high rigidity and strength with excellent resilience, favorable sliding friction behavior and good dimensional stability – even when exposed to mechanical forces and at elevated temperatures or in contact with chemicals, fuels and other media. Designers will be interested to learn that the material is capable of producing complex geometries and intricate, aesthetically sophisticated structures by injection molding, such as loudspeaker and ventilator grilles.

Ultraform is also an ideal material for fuel tank modules, fuel filter housings, clips and closures, toy components, conveyor belt chains and medical devices.

17 Seat Suspension
Cellasto®

Cellasto®, the compact microcellular polyurethane, is used in applications where vibrations have to be absorbed or noise abated. Customised Cellasto spring aids are used mainly in cars to isolate vibration. This durable material also serves as the basis for the seat suspension on the Concept 1865 e-bike.

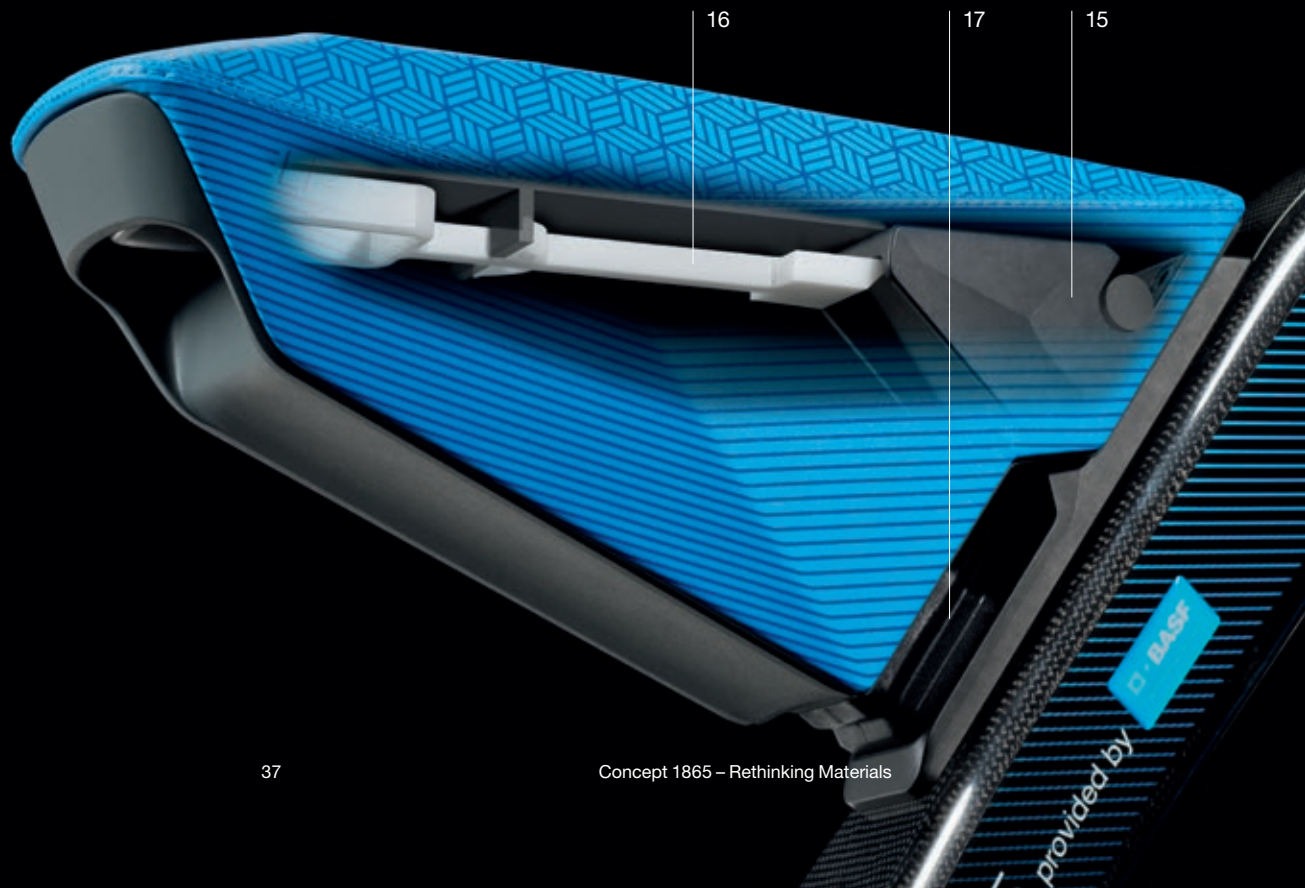
Thanks to their low transverse expansion and deformation under pressure and good long-term behavior, Cellasto components deliver enhanced seating comfort. They can be used in confined spaces and always ensure a gentle impact thanks to its progressive deflection. As dampers and isolators, they can be found in elevators, feed rollers, office chairs, wheelchairs, bike forks and door locks.

G

15
The axle of the detachable seat rests in the U-shaped recess of the seat mount made of Ultrason® E2010 C6.

16
The seat's sliding catch exploits Ultraform®'s good sliding friction properties: The spring-loaded slide is pulled at the rear to unlock and remove the seat.

17
The seat of the Concept 1865 is supported by a Cellasto® spring element for excellent sprung comfort.



18 Seat Cover
Elastollan®

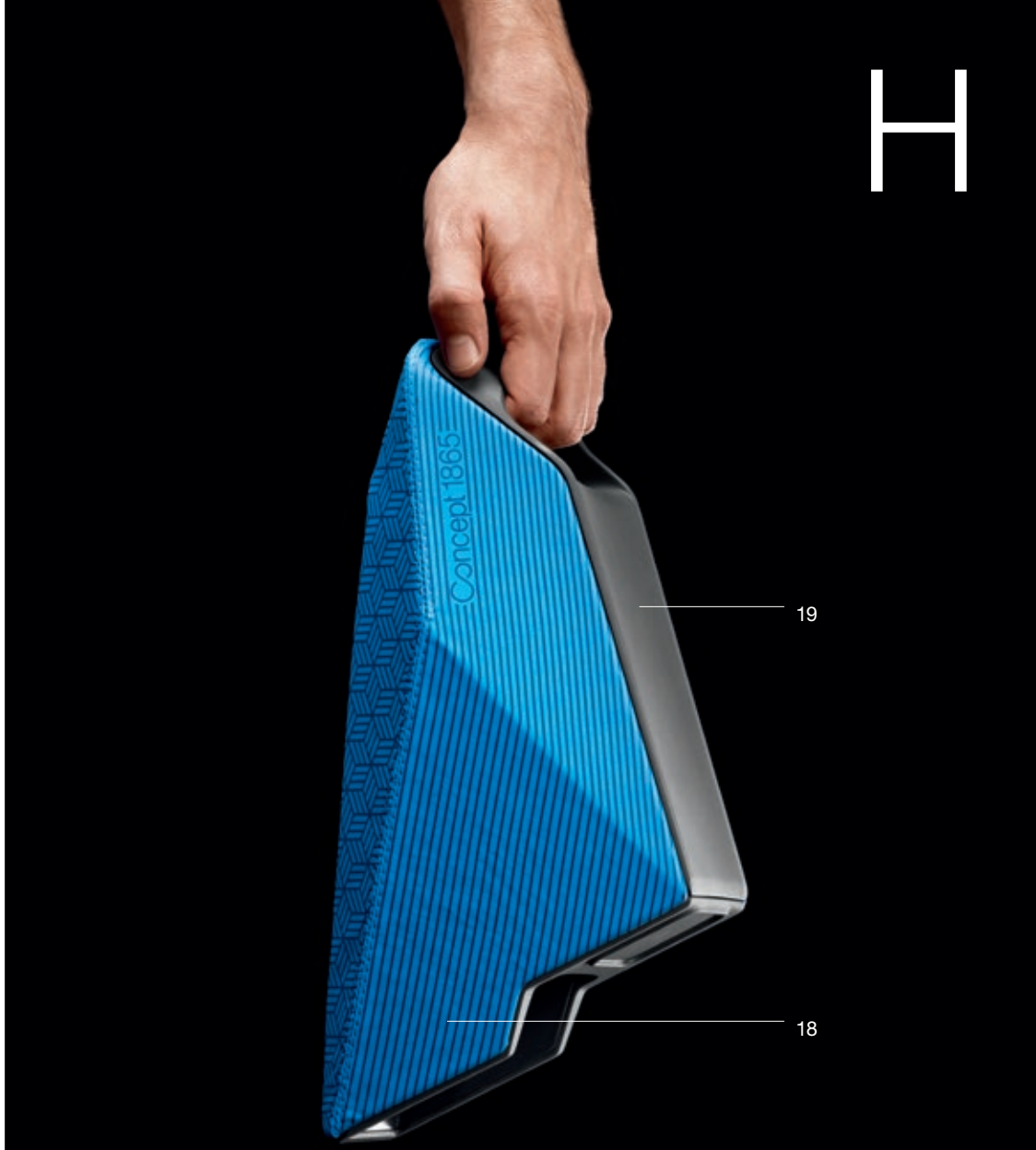
Films made of Elastollan® display impressive resistance to abrasion and scratches. These are important properties for a hard-wearing seat with a long service life. As a result of their unusual flexibility and elasticity, excellent adhesion to foams and nonwoven fabrics, these films are also suitable as protective layers for other seats as well. Elastollan films are also breathable and resistant to UV, ozone and hydrolysis. Their good printability, limitless scope for coloration and replication accuracy permit broad design freedom.

19 Seat Housing
Ultradur®

Due to its special combination of characteristics, Ultradur® is no less ideal for imparting strength to the seat than for serving as an electrical insulating material for the batteries concealed within. In addition to high rigidity and good shape retention on exposure to heat, BASF's polybutylene terephthalate (PBT) displays outstanding dimensional stability, good weather resistance and excellent long-term electrical and thermal behavior. Of special importance in terms of electromobility is its low water uptake and hence the almost complete independence of its mechanical and electrical properties from the climatic conditions of its application. Parts made of Ultradur are highly dependable and durable and are capable of significantly improving the electrical safety of components and subassemblies. Its applications include battery cell carriers, plug connectors, electronics housings and control units.

18
The abrasion- and scratch-resistant film of Elastollan® makes the seat hard-wearing for a long life.

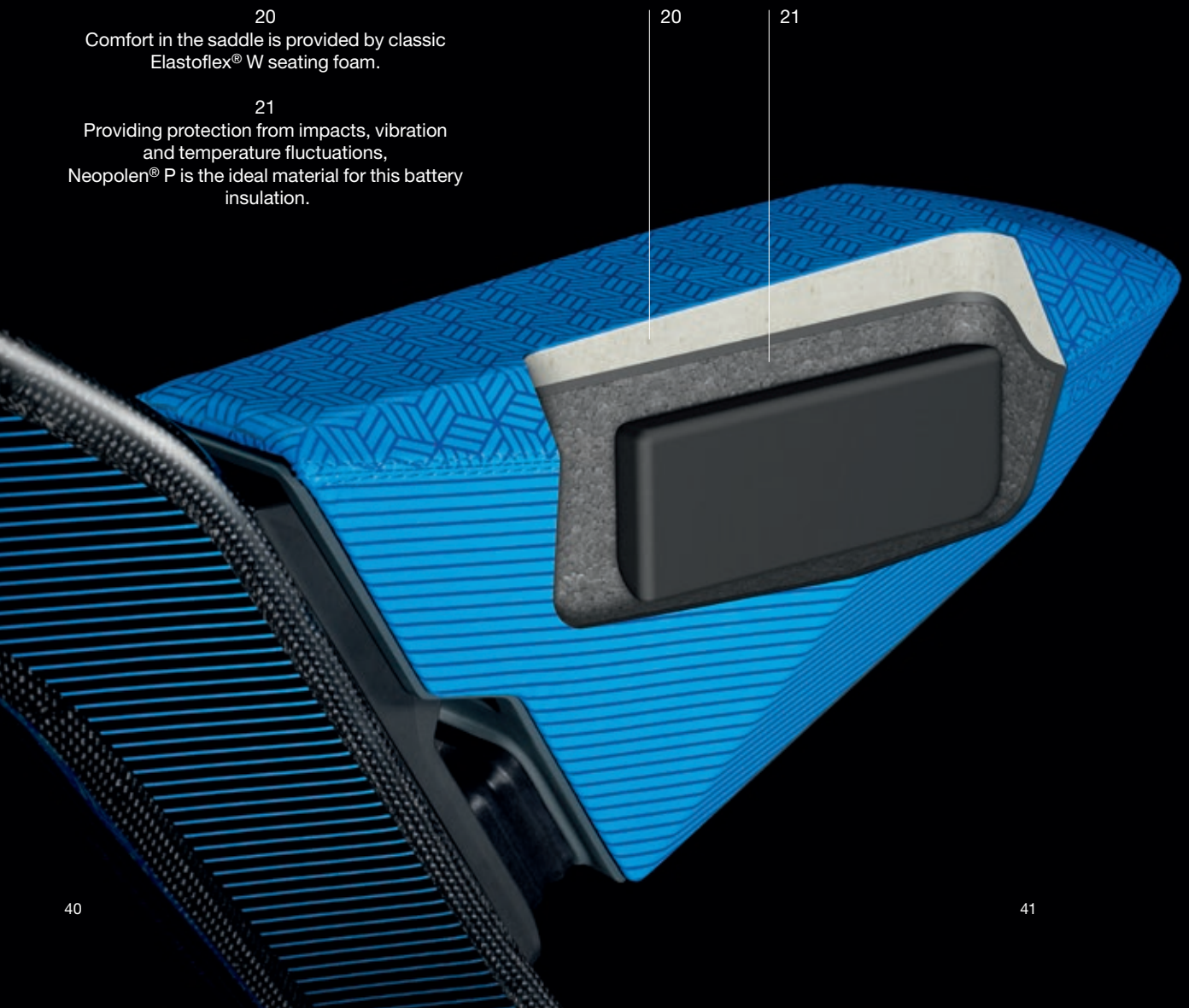
19
With its rigidity, weather resistance and low water uptake, Ultradur® gives the seat its mechanical strength while also serving as an electrical insulating material for the battery it contains.



H

20
Comfort in the saddle is provided by classic Elastoflex® W seating foam.

21
Providing protection from impacts, vibration and temperature fluctuations, Neopolen® P is the ideal material for this battery insulation.



20 Seat Cushioning
Elastoflex® W

To cushion the seat, BASF's specialists chose their proven Elastoflex® W seating foam. This flexible molded foam is used very often in the furniture and vehicle sector for seats, armrests and backrests. As a multi-zone foam, it can be produced with different rigidities in a single processing step, and inserted lining fabrics can also be foamed directly. The system's good flow offers designers vast creative scope and also permits the foaming-in of upholstery cores, for example.

21 Battery Insulation
Neopolen® P

As a housing insulation material, multifunctional Neopolen® P protects the integrated battery from impacts, vibrations and temperature fluctuations. Even when exposed to multiple shocks, this material displays extremely good energy absorption while also featuring low weight, excellent resilience and outstanding temperature stability.

Neopolen P is an expanded polypropylene of mainly closed-cell foam beads that can be processed in automatic processing equipment into a variety of moldings. Its main fields of application are in vehicle engineering, re-usable packages and transport containers, and in HVAC applications.

22 Rear Wheel Rim
Ultramid® Structure

Mass produced thermoplastic bicycle rims could become an alternative to metal rims as they eliminate the time-consuming and hence costly fitting and adjustment of the spokes. Since Ultramid® Structure displays exceptional impact resistance and toughness at very low and very high temperatures, it is highly suitable for such an application. Much longer than those of standard short glass-fiber products, its reinforcing fibers form a glass fiber mesh during injection molding and thus improve performance in terms of distortion, creep and energy absorption. Ultramid Structure is therefore capable of replacing metals in all applications where energy absorption and toughness are demanded together with weight reduction, e.g. in crash absorbers, seat structures, battery carriers, engine bearings and other structural components.

24 E-motor Cover
Ultramid® B

You can hardly tell that the Concept 1865 is an e-bike. Despite its electric motor, the cycle has a sleek silhouette with clear lines. For aesthetic reasons, the motor integrated in the rear axle has been discreetly concealed behind a cover of polyamide. The blue cap in fact has another important function as well; it protects the motor from the wet, dirt and stone chips. For such applications, the plastics of the Ultramid® B family are ideal, even if the requirements can vary according to the design of the electric motor. The Ultramid B portfolio offers customers a broad array of material types. If heat discharge is important combined with dimensional stability and outstanding electrical properties, a type filled with glass fibers and minerals can be supplied and flame retardant alternatives are also available. If however, as on wheel caps, a blend of impact resistance, surface quality and dimensional stability are called for, Ultramid B is a popular choice.

23 Brake Disk
Ultrason®

Thanks to a carbon fiber fabric embedded in an Ultrason® polymer matrix, the brake disk retains its necessary rigidity and shape even at elevated temperatures. Owing to its outstanding mechanical properties over a broad temperature range of up to 200 °C and its inherent flame retardance, Ultrason, processed as a Reinforced Thermoplastic Laminate (RTL), is frequently used in airplane construction.

23
A brake disc has to withstand high temperatures, so it is made of a carbon-fiber-reinforced sheet material with an Ultrason® matrix on the Concept 1865.

J

22

24

22
An alternative to metal rims, Ultramid® Structure displays outstanding impact resistance and toughness even at very low or very high temperatures.

24
The electric motor is concealed by a blue cover of Ultramid® B that provides protection from the wet, dirt and stone chips. Materials with special performance profiles are available to suit any special requirements.

The project partners

Concept, design, construction, scheduling and project management
DING3000 PRODUCT DESIGN
Carsten Schelling, Sven Rudolph,
Ralf Webermann
ding3000.com

Assistance
Peter Kraft Design
peterkraft.info

Design engineering and mentoring
Thomas Mertin
thm-carbon.de
Stefan Stark
sts-bike-design.de

Implementation
Fiber-reinforced components:
THM Faserverbund-Technologie GmbH
thm-carbon.de

Cast parts:
rpm rapid product manufacturing GmbH
rpm-factories.de

Model making:
Grüne Modellbau
gruene-modellbau.de

Saddle upholstering:
Susan Jäger
polsterei-jaeger.de

Get more Information and
watch the movie on:
www.concept1865.basf.com

Graphic design, text, photography and movie
Graphic design:
Stapelberg&Fritz Büro für Gestaltung
Roman Heinrich
stapelbergundfritz.com

Text:
Petra Schmidt
psaboutdesign.com

Photography:
Rafael Krötz
rafaelkroetz.de

Movie:
Nord Nord
nordnord.tv

Equipment, components and advice
Coating of grips:
Bomix
bomix.com

Brakes:
BrakeForceOne
brakeforceone.com

Semi-finished parts for seat latch mechanism:
Gehr Kunststoffwerk GmbH
gehr.de

Electrical engineering:
Lutz Rother
bike-emotion.org

LED-engineering:
Mentor GmbH & Co. Präzisions-Bauteile KG
mentor-bauelemente.de

Molded tire core profile:
Schaumaplast Nossen GmbH
schaumaplast.de

Front wheel hub:
Star Candy components
facebook.com/starcandyinc

Get more Information and
watch the movie on:
www.concept1865.basf.com