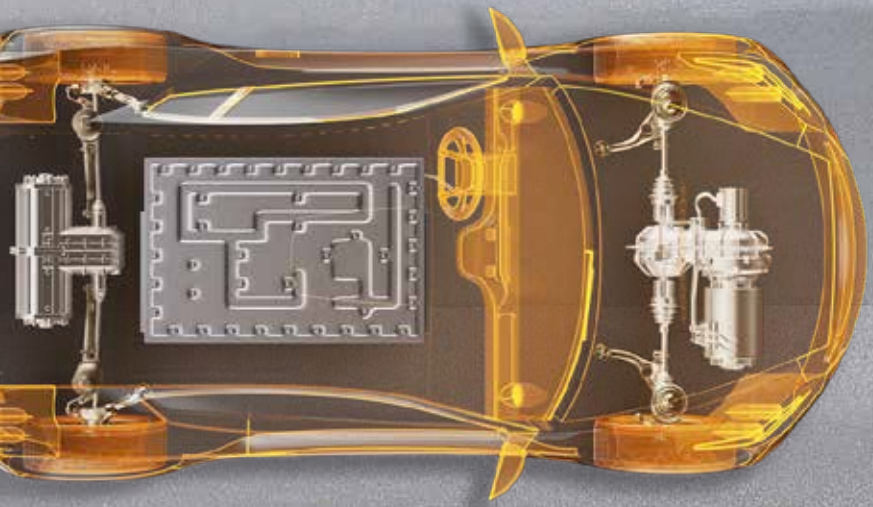
Innovation in Motion



# Drive the eVolution

## using Miba's wide range of eMobility parts

# Part of the eVolution: No eMobility Concepts Without Miba Components

Miba offers exactly the right components for all eMobility applications. Our outstanding development and system expertise combined with our long-term production experience allows us to offer a wide range of eDrive and hybrid drive systems. Together with vehicle manufacturers, we accelerate and successfully manage the transformation to eMobility – with Technologies for a Cleaner Planet.

We are aware that mobility and power generation will look completely different in the future and support our customers every day with pioneering technologies. We help them reduce carbon emissions, increase the efficiency of existing drive concepts, keep pace with the trend toward new alternative energy sources and much more.

# Interdisciplinary technology development to create value for our customers

**We are offering the full package for customized pin winding solutions starting from product expertise, development and design to the realization with our Miba production technology to the tailormade serial application.**

Due to the unique setup of having manufacturing equipment, product design and production experience under one roof (responsibility, comprehensive), Miba is able to create outstanding solutions for e-Motor products and platforms.

We are setting standards in pin winding technology with our expertise through close collaboration with our customers, across the globe.

**Electromagnetic Layout**
- Simulation of magnetic flux, currents, losses, saturation
- Heat transfer insulation concept
- Ideal geometry and material choice
- High torque density

**Winding Concept and CAD Design**
- Lowest eddy-current and pin voltage stress
- Uniform distribution and architecture
- Low number of different pin designs
- Proven production feasibility

**Prototyping**
- Short-term realisation of prototypes
- Close-to-serial production process & toolings
- Constant reproducibility of process

**Equipment**
- Ability to introduce advanced product innovations in highly automated assembly lines
- Customized production line for wide-range of stator designs
- Modular automatization concepts for various volume-scenarios
- Proven in-line inspection systems for closed-loop process control

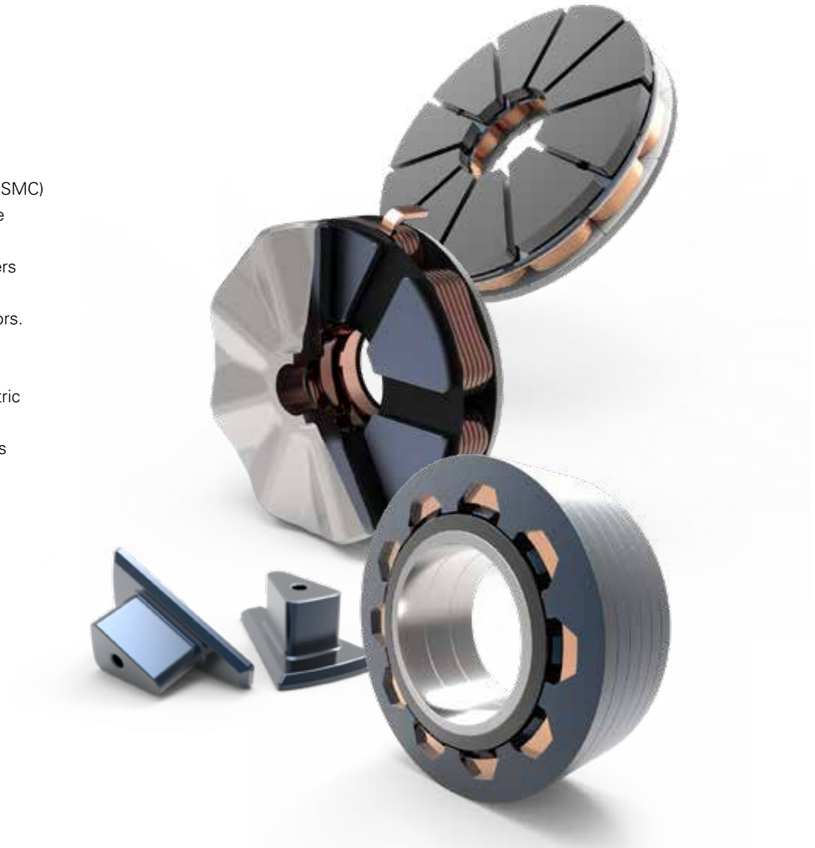
**Production**
- Agile adaptation of production lines to specific customer designs
- Short reaction time due to in-house equipment manufacturing
- 0 ppm policy

# 3D Flux Electric Motors

Miba electric motors with soft magnetic composite (SMC) allow efficient guidance of magnetic fields in all three dimensions (3D Flux). A unique combination of SMC with electrical steel (=hybrid soft magnetic core) offers the ideal balance of elevated material saturation and maximum flux utilization for advanced axial flux motors.

**Our services comprise**

- Highly customized development of advanced electric motor designs
- Sample manufacturing and pre-validation at various stages (A, B, C, D/PPAP)
- Serial production of e-motor components, subassemblies and frameless motors

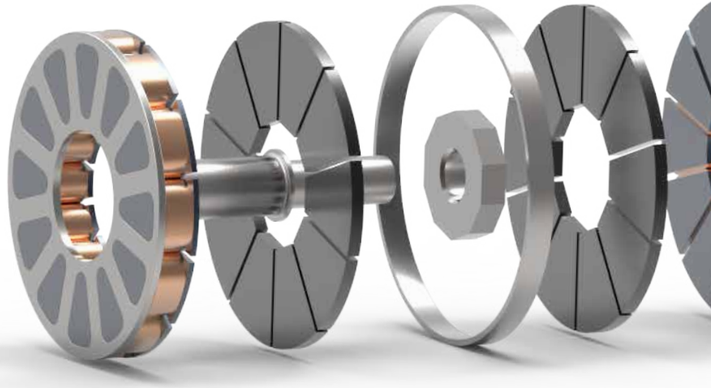


## APPLICATION FOCUS | AXIAL FLUX MOTORS

- High torque density due to unique hybrid core (electrical steel + SMC)
- Short length and disc shaped design allows maximum system integration
- Advanced rotor concepts for lowest inertia and minimized losses
- Marginal torque ripple even with low slot numbers and concentrated windings
- Single-sided (1 rotor + 1 stator) and double-sided (1 rotor + 2 stators) motor designs with optimized bearing loads
- Single-step-assembly of frameless motor structure

## RESEARCH FIELD | TRANSVERSE FLUX MOTORS

- Ideal solution for “high torque & low rpm” requirements (gearless)
- Inner and outer runner typologies offer maximum design freedom
- Simplified assembly process due to simple coil build up



# Products for eAxles and eGearboxes

## POWDER-METAL GEAR SOLUTIONS FOR eDRIVES

Components and assemblies with focus on NVH and light weight, high-revolution eMotors and high transmission spread

**Powder-metal gears**

- Vibration-damping properties that reduce the emitted noise
- Ideal for electric powertrains with high-revolution eMotors thanks to NVH advantages
- Allow complex structures to realize lightweight designs and additional functions

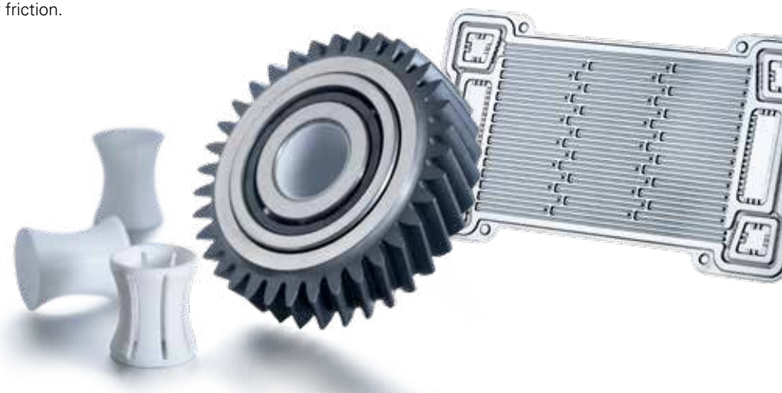
## COATINGS

**SPACECOAT® – Noise reduction solution**
SPACECOAT® provides a well-defined gear clearance during assembly, which greatly improves engine acoustics. The polymer coating allows a simple, fast, accurate and cost-effective assembly.

**MOTIONCOAT® SPlus – Direct coating in bearing areas**
MOTIONCOAT® SPlus is a running layer system that is applied directly to the component and features excellent tribological properties, mainly used to realize temperature and corrosion resistance, weight reduction, wear resistance and low friction.

**GRIPCOAT® Direct – Static friction increase**
GRIPCOAT® Direct is the first process for directly applying selectively a friction-enhancing coating to components. Therefore reducing space and weight or increased transmitted torque and force of joining's.

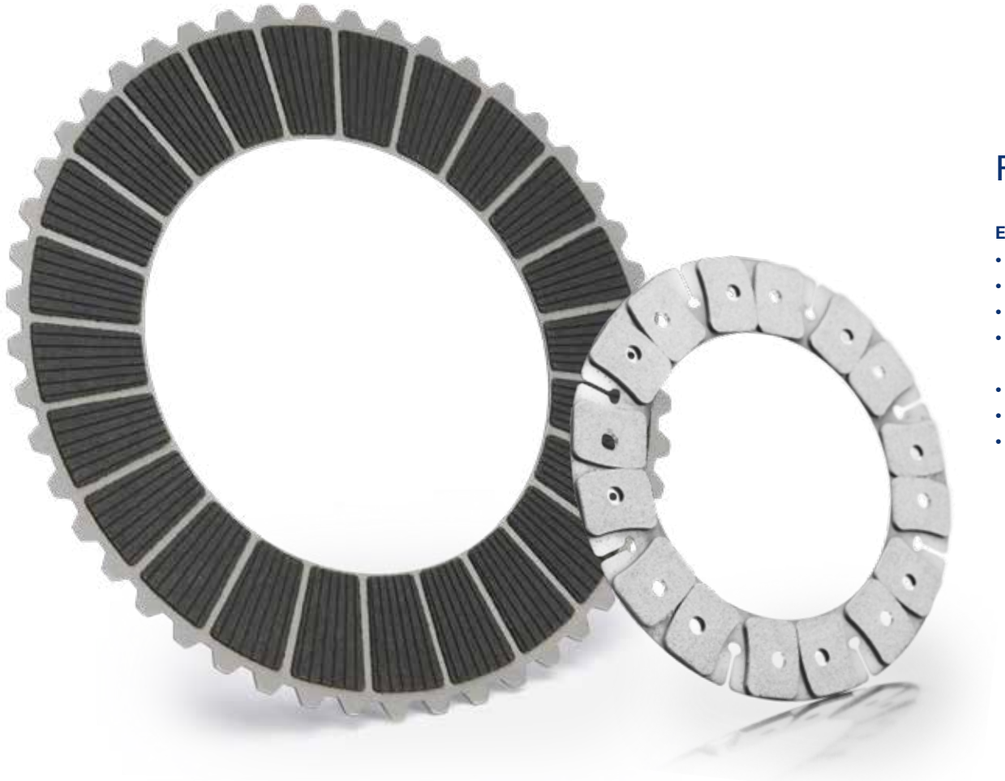
**FCELLCOAT - Bipolar plate coatings**
High electrical conductivity and corrosion resistance for best performance over long lifetime in fuel-cell applications.



# Friction systems to advance eMobility

**Ensuring driving enthusiasm with power shift and torque vectoring solutions.**
Our wide portfolio of adapted and dedicated friction systems supports torque transfer for top driving dynamics.

The key parameters are:
- Power density
- Efficiency
- Noise, vibration and harshness
- Total cost of ownership



# Power Fuses

**Emergency separation between HV-battery and car**
- Highest efficiency
- Low separation time
- High separation capacity ensuring safe operation
- Safe separation even without load current (active instead of passive tripping)
- Designed for welding to busbars
- Hermetically closed, compact, intrinsically safe component
- Fuse function integrated (passive triggered separation)

# Pre- and discharge resistors and cooling for electrical powertrain and battery management

## POWER RESISTORS

- Thick-film technology for high-power systems
- Used in power distribution units (PDUs) and motor-controlling units (MCUs)

**EBG resistors main advantages are:**

- small package size
- wide resistance range
- high reliability
- high safety
- high pulse capability
- easy mounting / handling

## VACUUM-BRAZED LIQUID-COOLED HEAT SINKS

- High-performance converters and switches
- Battery packs for vehicles

## CHARGING INFRASTRUCTURE

Components and assemblies with focus on passive power electronic components and thermal management

- Air-cooled heat sinks
- Water-cooled cold plates
- Vacuum-brazed heat sinks
- Heat pipes
- High-precision high-voltage resistors
- High-power resistors

# Game-changing solutions for the battery packs of the future

## BATTERY COOLING COMPONENTS

We focus on the development and production of battery components for electric drives, while providing our customers with robust, safe and clean solutions that are technologically always a step ahead.

With our FLEXcooler® we developed the most flexible, lightweight and slim liquid cooling system for batteries in the market, eliminating the need for gap fillers.


**Your benefits:**

## FLEXcooler®

The highly integrated cooling element with a flexible surface

**No Gap Filler / Thermal pads**
- 100% reduction of gap filler / thermal pads
- Reduced assembly effort
- ▶ Reduced complexity / cost

**Tolerance compensation**
- Flexible in shape and dimensions
- Non-rigid component
- ▶ Flexibility in design

**Suitable for all cell types**
- Cylindric, prismatic, pouch cells
- Module sizes / pack sizes
- ▶ Flexibility in design

**Lightweight & slim design**
- Smart material use
- Reduced installation space
- ▶ Up to 80% less weight

**Recyclability**
- Separation of battery cell and heat exchanger
- No mechanical connection
- ▶ Enabler for recyclability

**Safe and intelligent components**
- Non-electric conductive components
- Combination with iFLEXcooler® possible
- ▶ Increased safety

BATTERY SYSTEMS

# VOLTLABOR

powered by Miba Group

At VOLTLABOR we deal with robust and safe technologically sophisticated solutions for the storage of renewable energy. Depending on your application and its requirements VOLTLABOR chooses the ideal combination on cell chemistry, cell size and cooling concept. Thereby the designed solution is an optimum regarding reliability, cost effectiveness and longevity. Already the prototypes are built with highest VOLTLABOR quality standards which is the basis of the serial production.

## pack

**Engineered to customer specifications**

The Vpack's density and stability results in a unrivalled high power output.

## module

**Adaptable and dependable**

The fully adaptable module system with sensitive temperature regulation and high-precision and laser welded cells, can be quickly assembled into different battery dimensions in the high-end field.

## Home Storage System

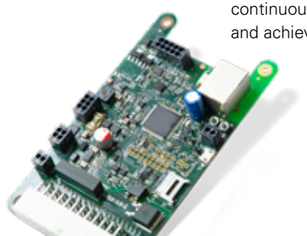
**High-end energy storage system.**

- Modern lithium-ion battery technology with a particularly high energy and power density
- Up-to-date system monitoring
- Wall-mounted device and web browser
- Easy to retrofit and compatible with common inverter brands

## BMS

**Technology that thinks and steers ahead**

A major part of the VOLTLABOR concept is the intelligent VOLTLABOR BMS. Self-learning management technology by VOLTLABOR continuously adapts data to increase performance and achieve optimum operating conditions.



## macro cell

**No Matter the Scale**

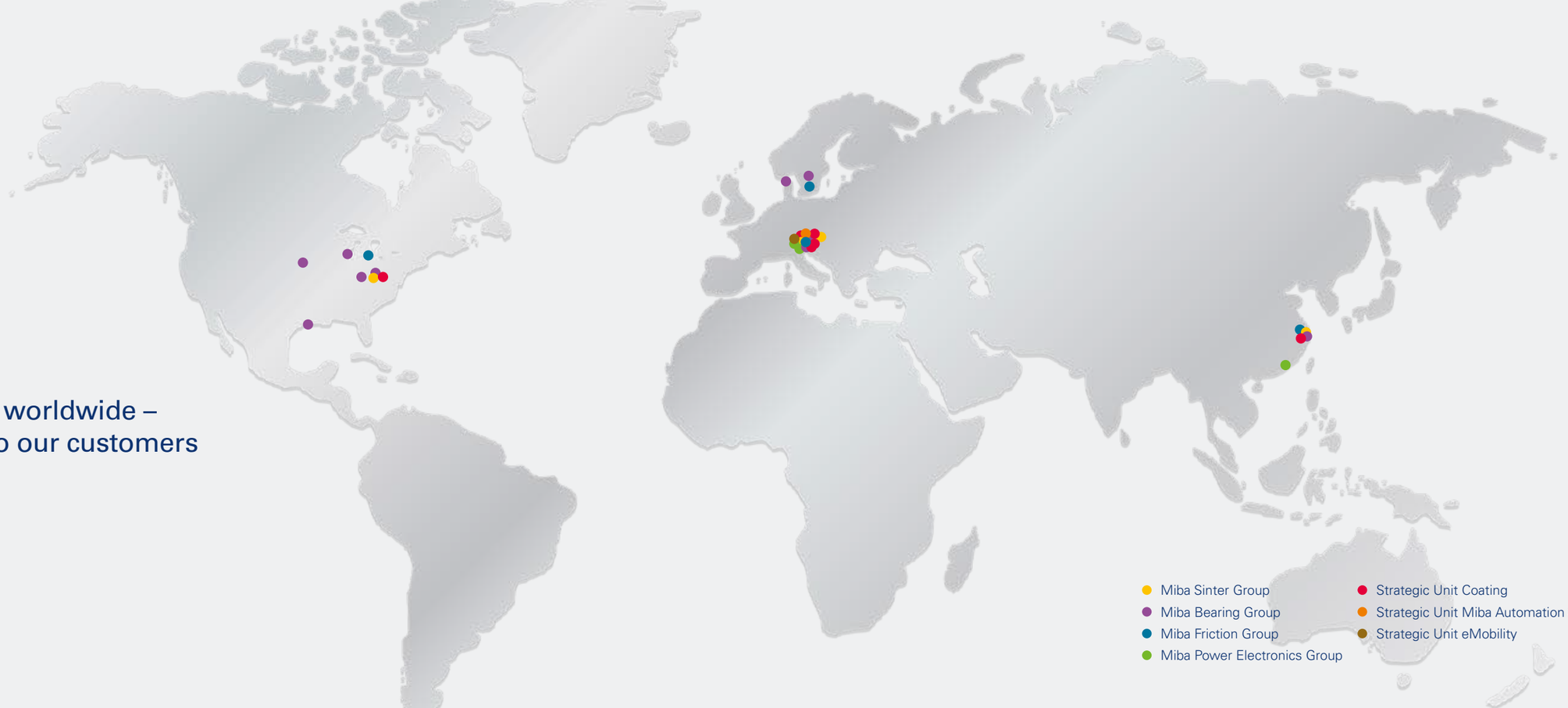
With several integrated safety features and a smart overall design the Vmacrocell is the foundation of every battery pack.

## 48V System

**Standardized products for rapid prototyping applications**

- Quick and easy support-tool for engineering
- Fast, simple and scalable
- Smart Master/Slave System for electrification of pilot projects

## 30 production sites worldwide – we produce close to our customers



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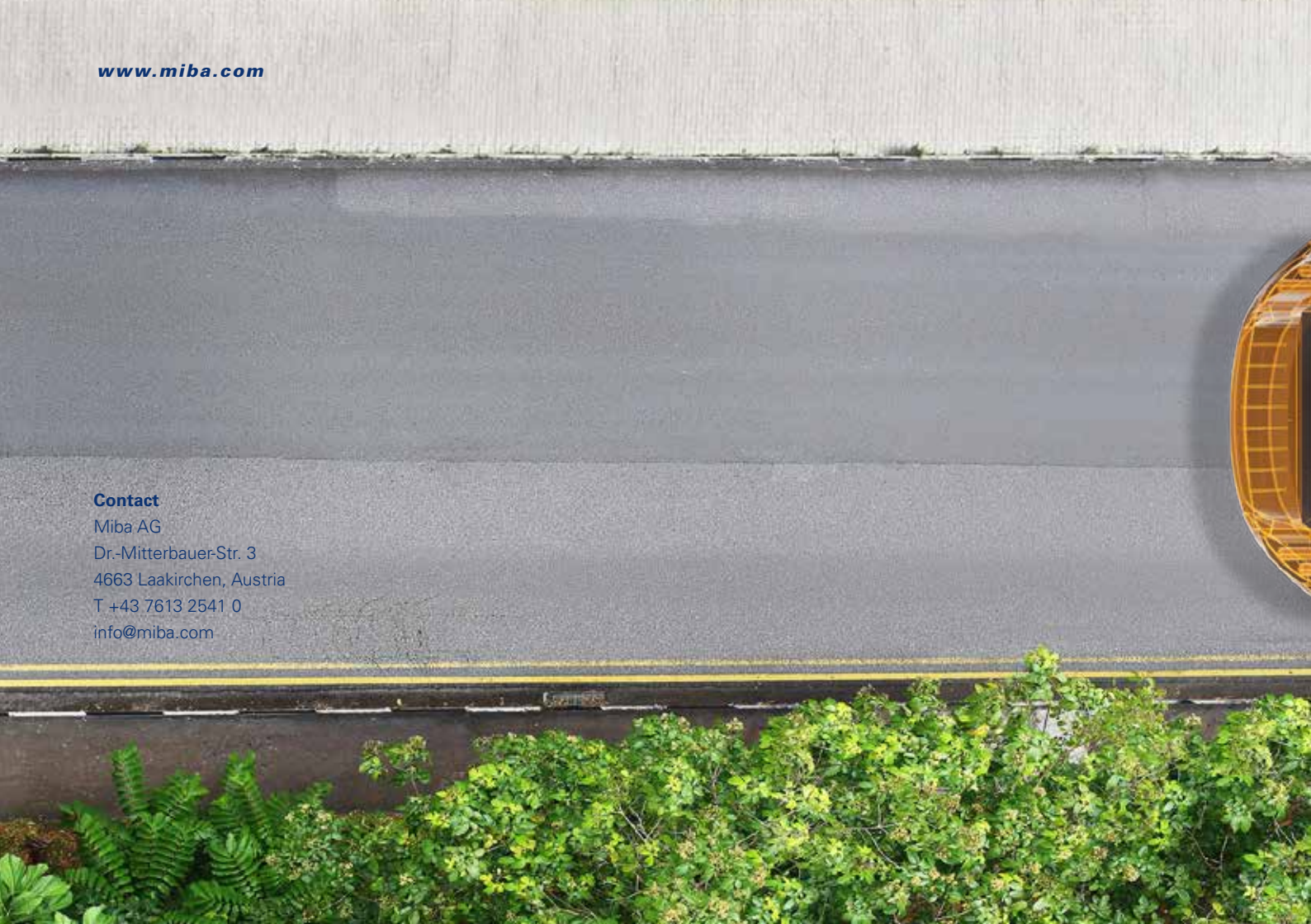

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