



MIM-basierte NdFeB-Magnete als Schlüsselkomponente
moderner Antriebs- und Sensorsysteme

■ PRECISION IN METAL



AGENDA

- Company presentation
- Requirements of magnetic systems
- Metal Injection Molding of NdFeB magnets
- Production process
- Customized magnetic orientation
- Case studies



OBE FAMILY HOLDING



1904

Start as a
tooling company
for jewellery



1970

Invention of the
spring hinge for
eyewear industry



1996

Introduction of
**Metal Injection
Molding (MIM)**



2019

**Spin-off MIMplus
Technologies
GmbH & CO. KG**



2021

Introduction of
sinter based
**Additive
Manufacturing**



2023

High-performance
MIM magnets
(complex shape
and field)

2

Companies
OBE and MIMplus

4

Production sites
Germany, Italy, China, Vietnam

550

Employees
world-wide

50 MIO €

Turnover
in 2024

25.000 m²

production floor
world-wide

■ KEY FACTS MIMPLUS

DESIGN FREEDOM. TOUGH MATERIALS. CO-ENGINEERING.



Branches

Medical Engineering, Aerospace, Automotive, Electronics, Robotics, Luxury, Industry



Core Technologies

Metal Injection Molding
Sinter-based Additive Manufacturing



Research and Development

with well equipped lab (10% of Turnover)
and Engineering Support



In-house tool shop

From prototypes to mass production tools



Plus Services

Post Processing & Assembly

ISO
13485:2016

IATF
16949

EN 9100
Start 2025

ISO
14001:2015

ISO
9001:2015

EMAS
1221/2009



REQUIREMENTS

- Modern drive and sensor systems require small, complex permanent magnets
- Conventional production of small sintered magnets requires extensive post-processing
- Assembly of rotors with tiny magnets is cost-intensive
- Bonded magnets with complex magnetization are often unsuitable due to insufficient magnetic flux density





Metal Injection Molding of NdFeB magnets: A new solution for advanced magnet designs

■ HIGH DESIGN FLEXIBILITY

RARE EARTH MAGNETS IN METAL INJECTION MOLDING

- Sintered NdFeB magnets with **maximum freedom of shape**
- Available magnet grades up to N48SH (with GBD)
- Tailored magnetic fields
For example: Halbach arrays without assembly
- No post processing Material utilization of >93%
- MIMplus is the world's only manufacturer able to produce MIM **NdFeB magnets** at industrial scale.

COMPLEXITY & FIELD ALIGNMENT

Polymer
Injection
Molding

Metal
Injection
Molding

Press
Sintering

PERFORMANCE & MINIATURIZATION



WINNER OF

VR -
INNO
VATION
DER AWARD

2025



PRECISION IN METAL

ADVANTAGES

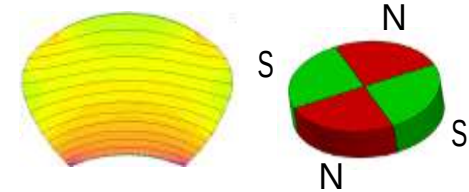


01

High design flexibility

02

Application-specific
magnetic fields



03

Energy product comparable to press sintered magnets

04

Miniaturization
e. g. for medical or electronic applications

05

Functional integration
e.g. for magnet assemblies

06

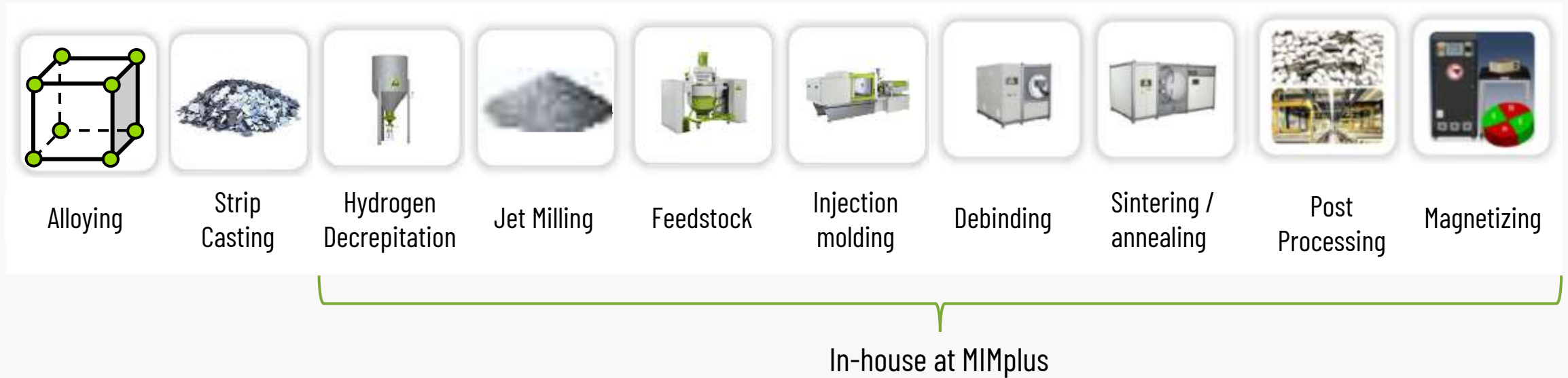
Mounting or bonding structures





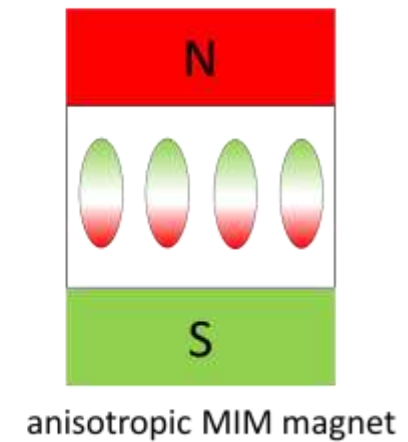
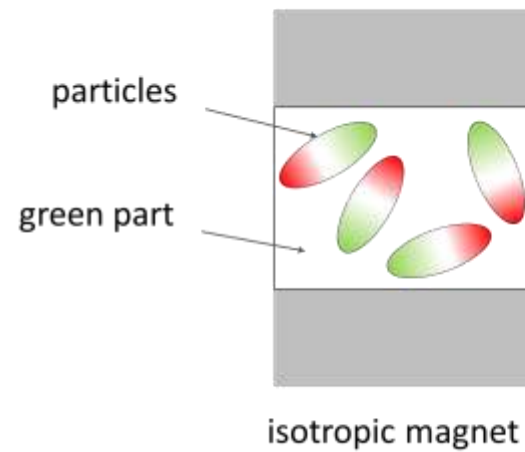
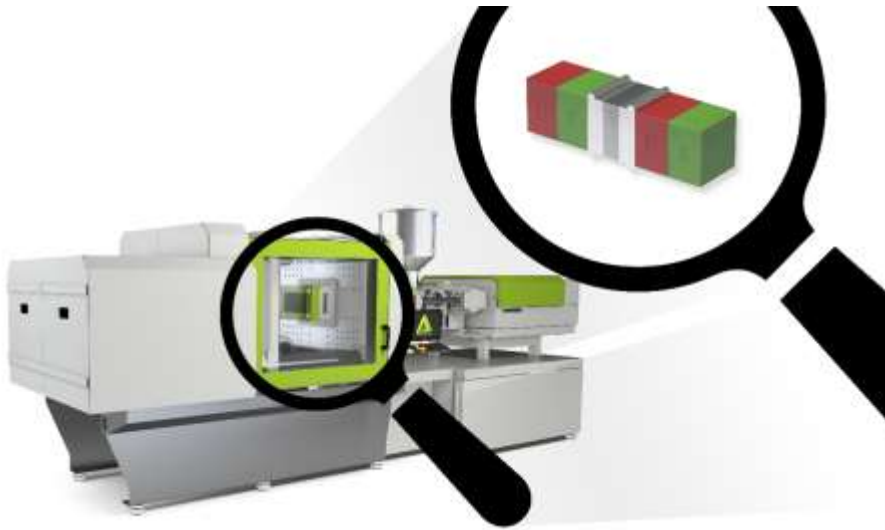
THE PRODUCTION PROCESS

THE PRODUCTION PROCESS



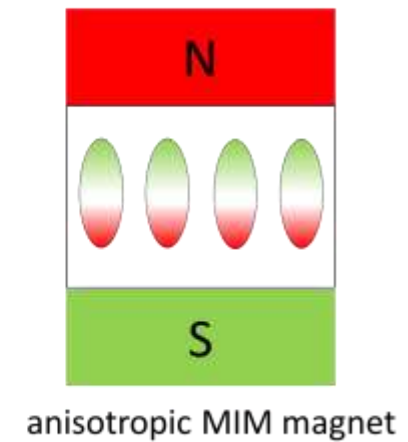
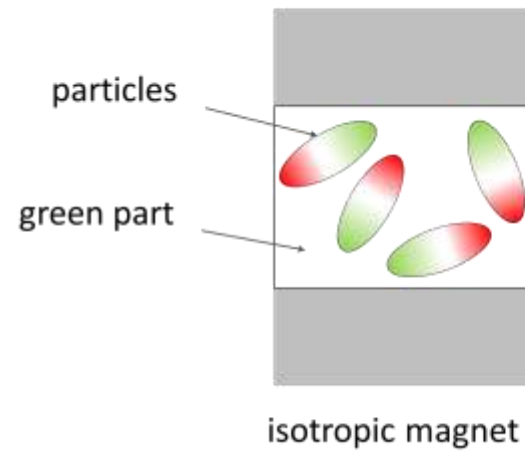
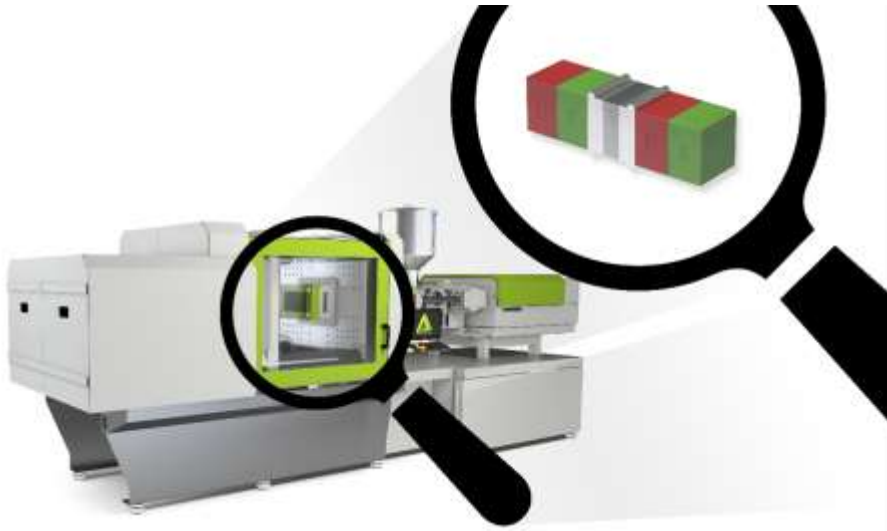
INJECTION MOLDING

- Special tooling with internal magnetic field
- Every powder particle in the feedstock behaves like a single magnet
- Magnetic field in tool allows alignment of particles in the green part – customized magnetic orientation



INJECTION MOLDING

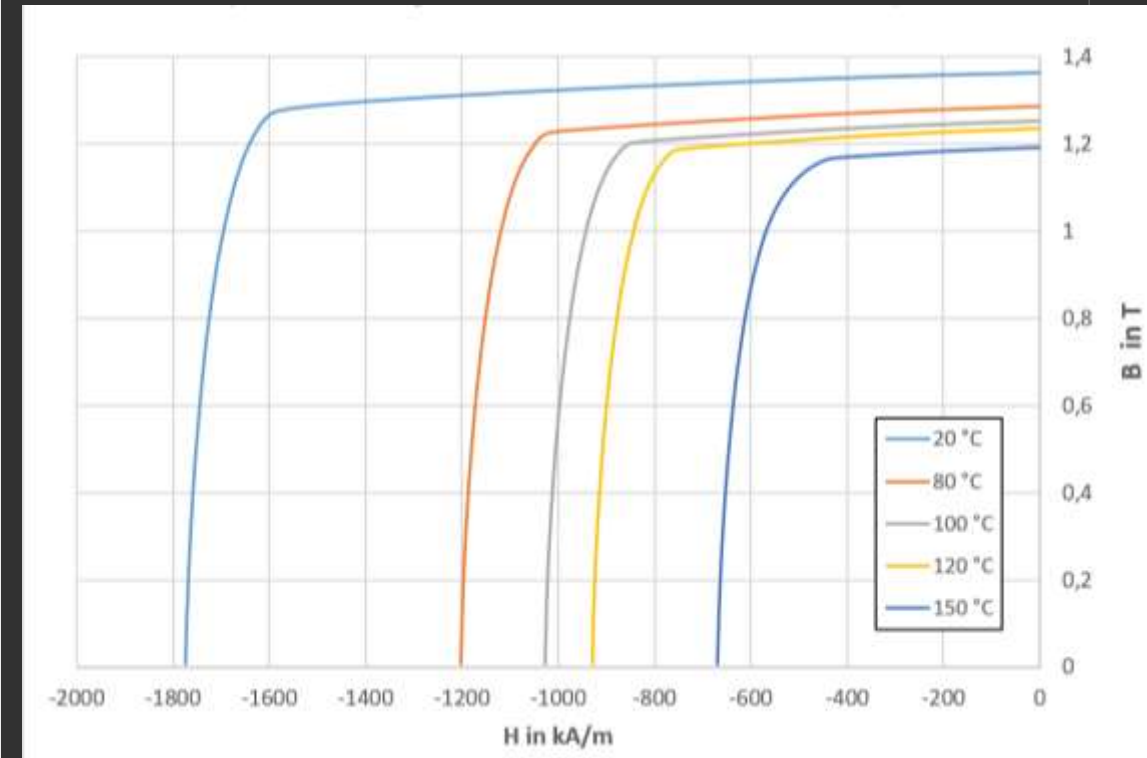
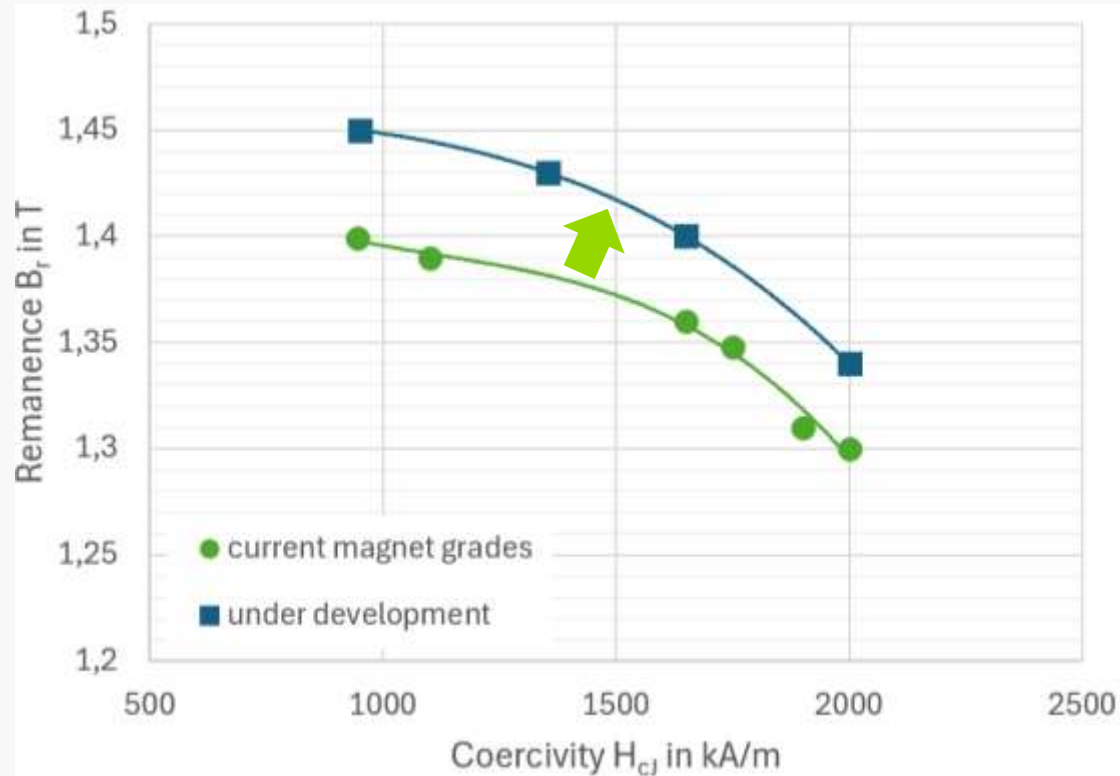
- Tooling design and production of toolings in-house at MIMplus
- Multi-cavity toolings can be built depending on design of part and magnetization



MAGNETS IN MIM

AVAILABLE MAGNET GRADES

- MIM magnets are **sintered magnets**
- Constant improvement of magnet grades
- Typical state of the art magnet grades are and will be available



PROPERTIES

- MIM magnets are sintered magnets with equivalent properties

- **Density**

MIM magnet: $7.45\text{--}7.55\text{ g/cm}^3$

- **Mechanical properties:**

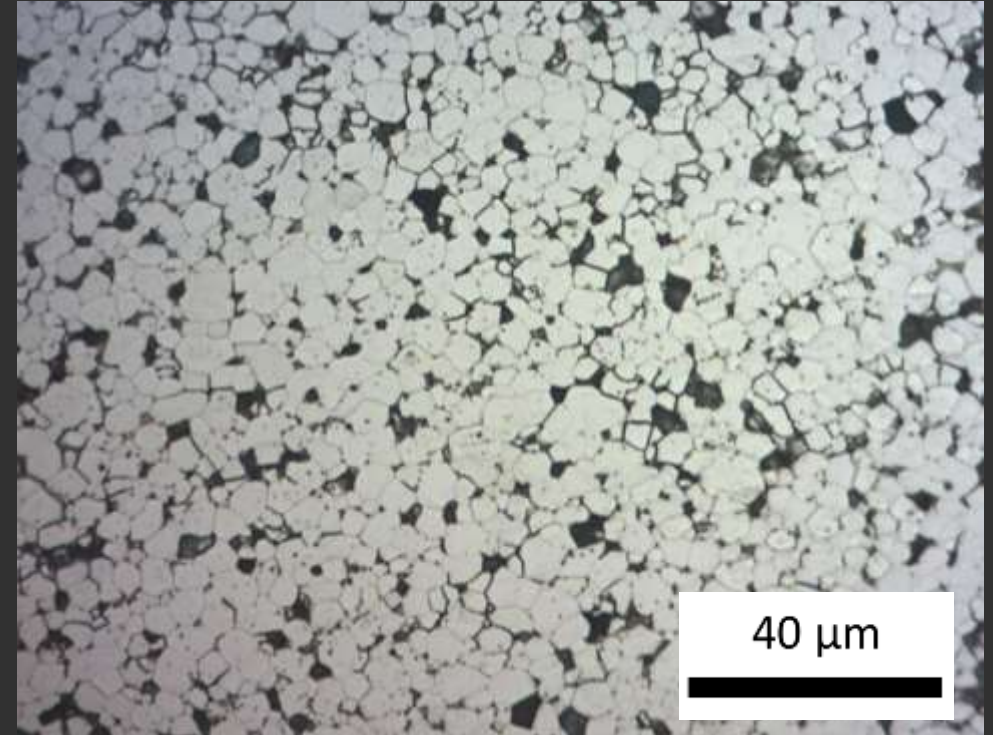
Vickers hardness: 550-570 HV10

3-point-bending strength: >200 MPa

- **Electrical conductivity / specific electric resistance**

MIM magnet: $770\text{ 1/}\Omega\text{mm}$ / $1.3\text{ }\Omega\text{mm}^2/\text{m}$

Segmentation possible. Thin segments can be easily injection molded without post-processing



POST PROCESSING

- State-of-the art post processing technologies can be applied
- Tumbling
 - Deburring
 - Rounding of edges
- Corrosion protection
 - Electroplating
 - Epoxy
 - Passivation
- Grinding for tight tolerances
 - Centerless grinding
 - Flat grinding





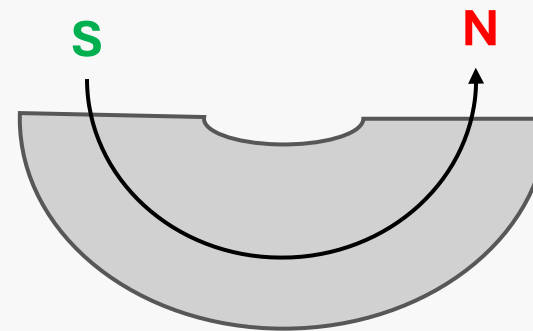
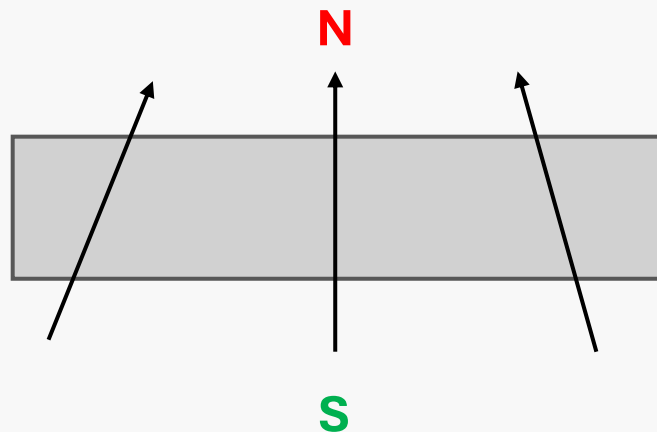
CUSTOMIZED MAGNETIC ORIENTATION



MAGNETIC ORIENTATION

- MIMplus technology can be applied for production of customized magnetic orientation
 - Focused orientation
 - Halbach magnetization
- Tooling concepts developed and tested + magnets characterized
- Alignment can be tailored by MIMplus tooling technology

Examples:

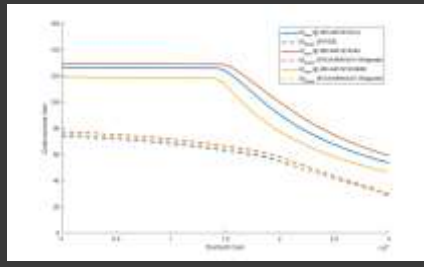




CASE STUDIES

■ CASE STUDY 1

FREEFORM SHAPE



01

Motor sports application

02

Higher performance: +10%

03

Higher material utilisation

04

No post processing – improved sustainability

05

Reduced use of Heavy Rare Earth elements due to new design

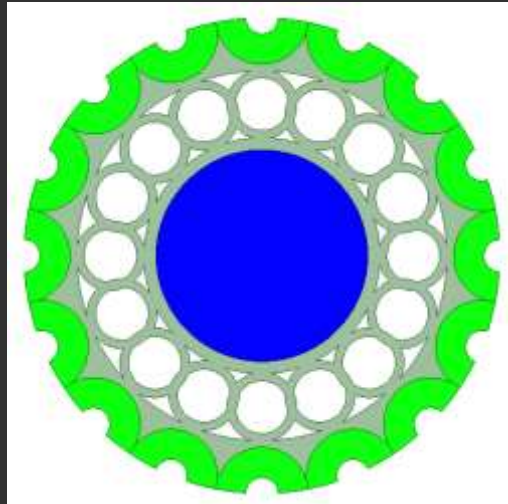
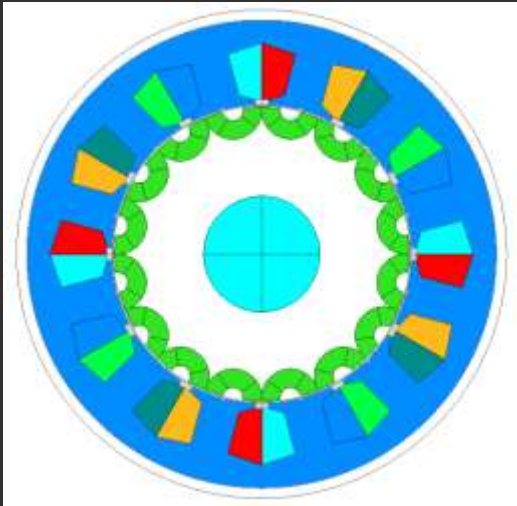
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Considerable cost advantages



■ CASE STUDY 2

HALBACH LENSE



01

Industrial motors application

02

Performance increase: + 60% - 100%

03

Improved productivity of industrial motors

04

Reduced use of Heavy Rare Earth elements possible

05

Innovative motor design thanks to MIM as sole manufacturing process



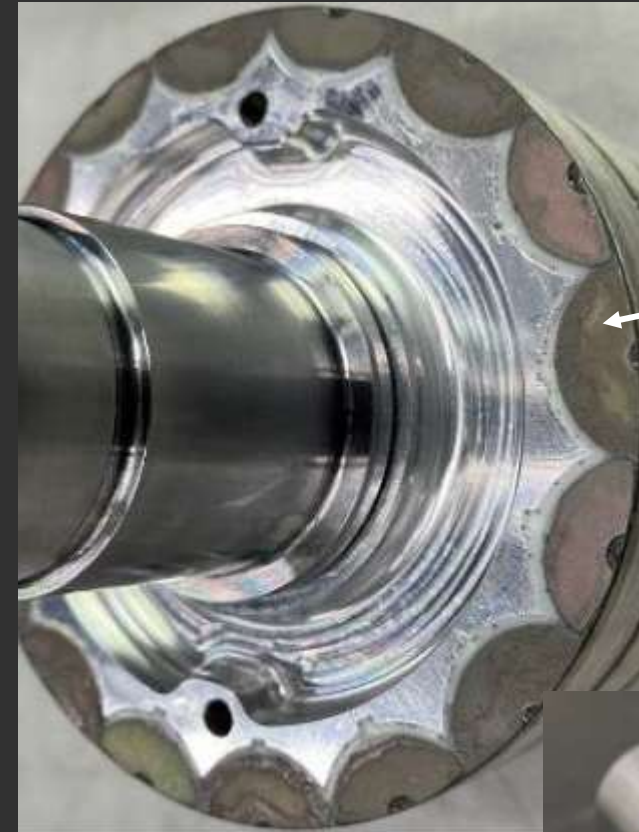
■ CASE STUDY 2

HALBACH LENSE

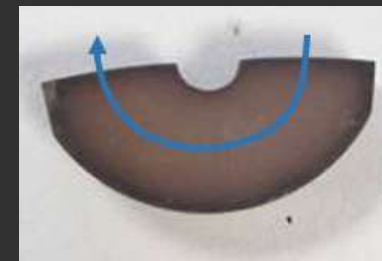
- **Single piece Halbach segments**
- Siemens built and tested 2 demonstrators
- Product development at Siemens depends on the availability and results of further market analyses

Motor performance:

Servomotor	Reference standard motor	Motor with MIM-magnets
Mmax [Nm]	90	180



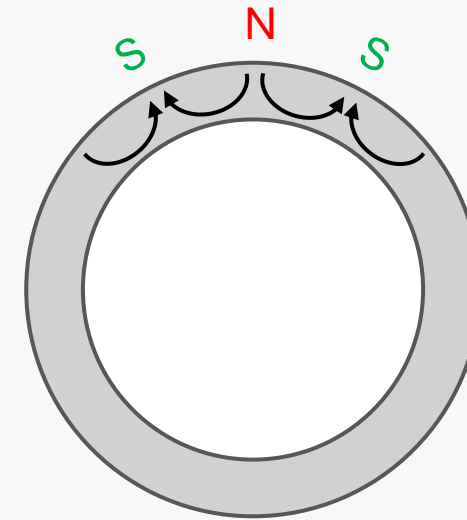
MIM magnets



■ CASE STUDY 3

HALBACH CYLINDER

- Application: Small motors
- Ring with Halbach magnetization on outer diameter
- >20 poles
- Dimensions: OD = 25 mm
- No assembly of magnets necessary → one-piece design
- Customized magnetic orientation realized during injection molding



Magnetic orientation



SUMMARY

- Next-generation sintered magnets through Metal Injection Molding
- Complex geometries without post-processing
- Tailored magnetic orientation
- New possibilities for high-performance drive and sensor systems





THANK YOU!



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