

STATOR AND ROTOR STACKS

# POWERING THE FUTURE OF ELECTRIFICATION

High-induction soft magnetic materials  
for power-dense electric motors

## High-induction magnetic materials for high performance

Carpenter Electrification soft magnetic materials are used in over 75% of all generators and APUs installed on commercial and defense aircraft. We are a trusted partner for developing material breakthroughs to increase motor performance.

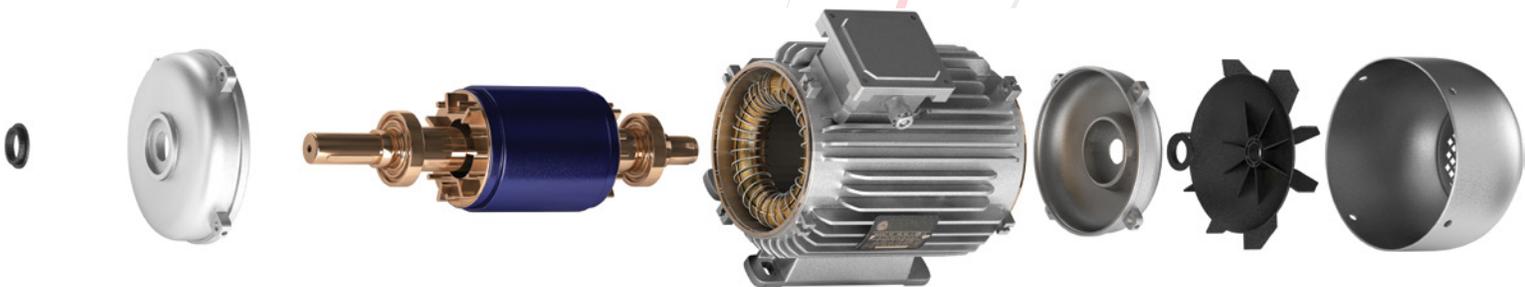
We bring this expertise to the e-mobility sector by collaborating with customers on the development and integration of high-induction magnetic materials into high-performance stator and rotor stacks, improving motor performance while reducing overall time to market.

### **HIPERCO® ALLOYS DELIVER**

**20-30%**  
smaller motors

**15-25%**  
higher torque

**UP TO 3%**  
increased efficiency



**75%**

of all generators and APUs in commercial and defense aircraft utilize Carpenter Materials

**80+ YEARS**

in soft magnetics development

**130+ YEARS**

alloy and production expertise

## THE MOST INDUSTRY-LEADING METALLURGISTS

and thousands more material and industry experts on staff

**100,000 TON**

annual production capacity

## BRAND PORTFOLIO

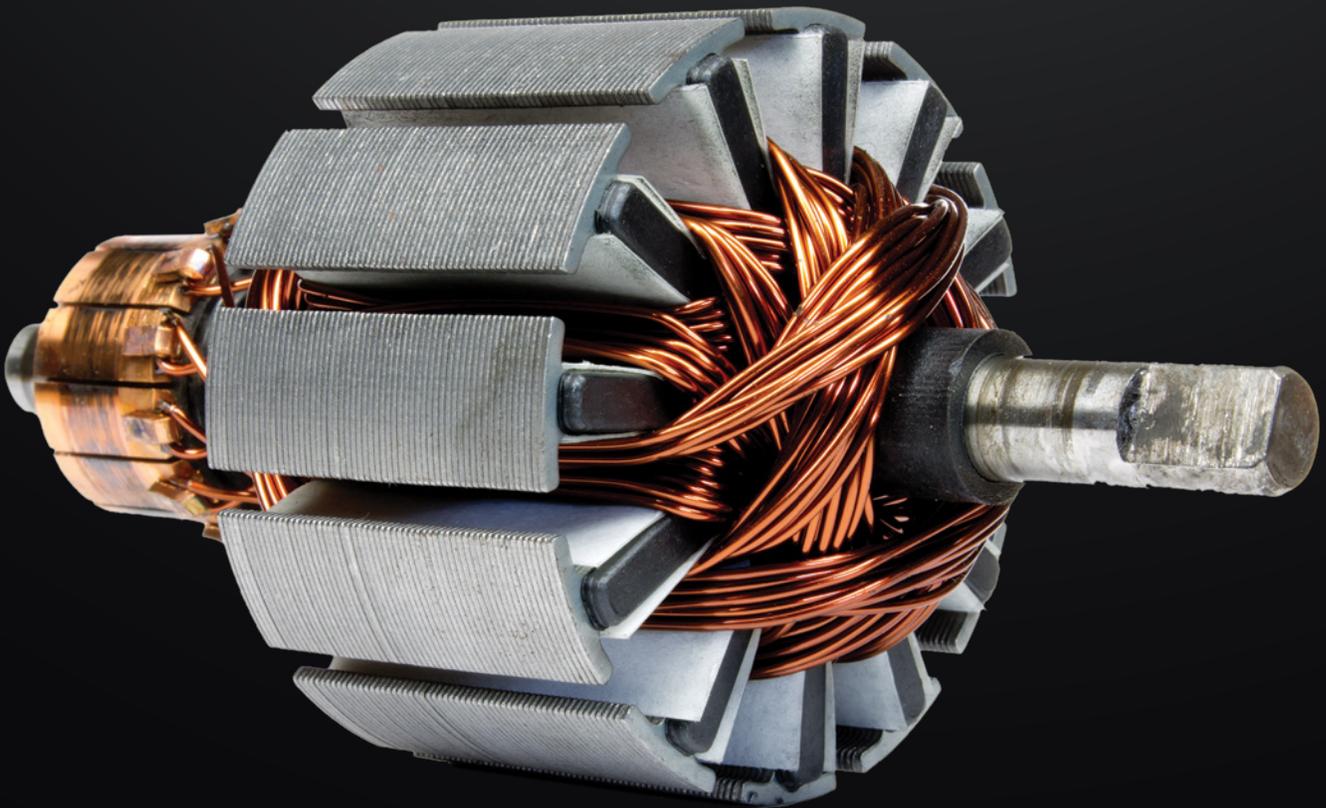
of proven soft magnetic alloys and high-performance stator and rotor stacks:

- High magnetic saturation
- High permeability
- Corrosion resistant
- Low core loss

## WORLD-CLASS R&D

expertise, equipment, and infrastructure for:

- Applied and basic research
- Modeling and forming
- Process and materials characterization
- Alloy development
- Additive manufacturing
- Soft magnetics
- Scaling up and going to market



## The choice for high torque and power-dense motors

Hiperco alloys provide the highest magnetic induction of any commercially available soft magnetic material, while exhibiting high permeability and low core loss properties. Hiperco is an ideal choice for high torque and power-dense motors. The enhanced responses of high-induction soft magnetic alloys help designers with flexibility in development to optimize the motor for the application, for example, between increased range capabilities or reduced battery sizes.

- Highest induction soft magnetic alloys
- Extensive library of materials and process recipes for performance best suited to specific motor designs
- Increase torque and power savings in the same size motor or reduce motor size while maintaining torque
- High-efficiency performance for high-frequency motors

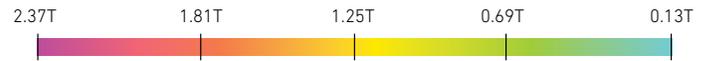
## Built for the most demanding motors

Improper stack processing can compromise rotor and stator performance. Carpenter Technology's materials experts have a deep understanding of structure-property relationships, such as the effect of the processing stresses on the magnetic performance during stack production. Our alloys and stack manufacturing methods for dimensional control, high strength, and tailored magnetic properties support the most demanding motor design requirements and production tolerances.

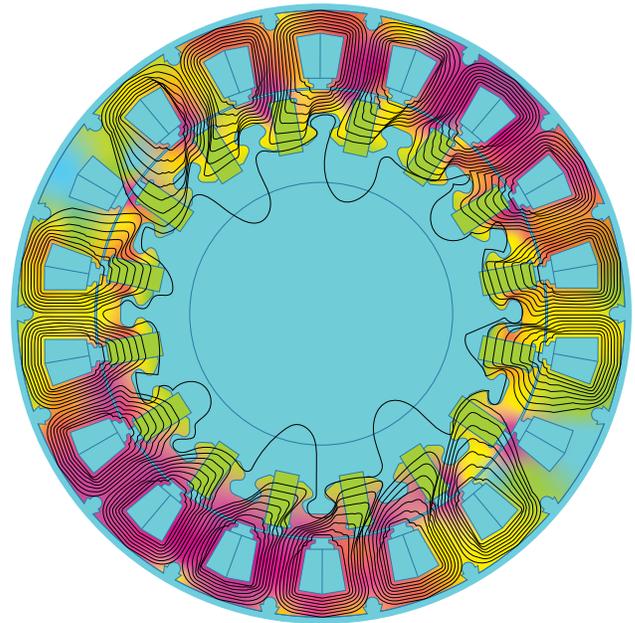
- Data-driven optimization of production processes for peak Hiperco stack performance
- Extensive range of process capabilities for prototyping through production
- Lamination thicknesses range from 0.1 mm to 0.5 mm
- Multi-material stacks

## Magnetic induction advantage

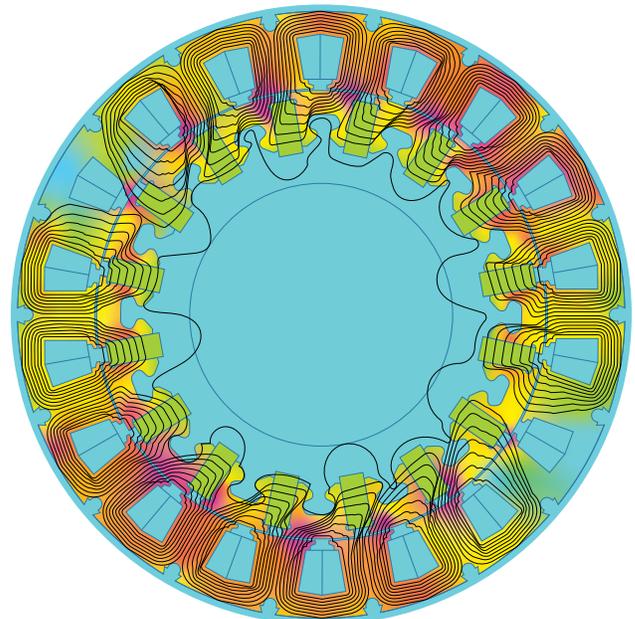
The superior magnetic induction of Hiperco stators and rotors is evident in the density plots below using identical current inputs.



Hiperco alloys



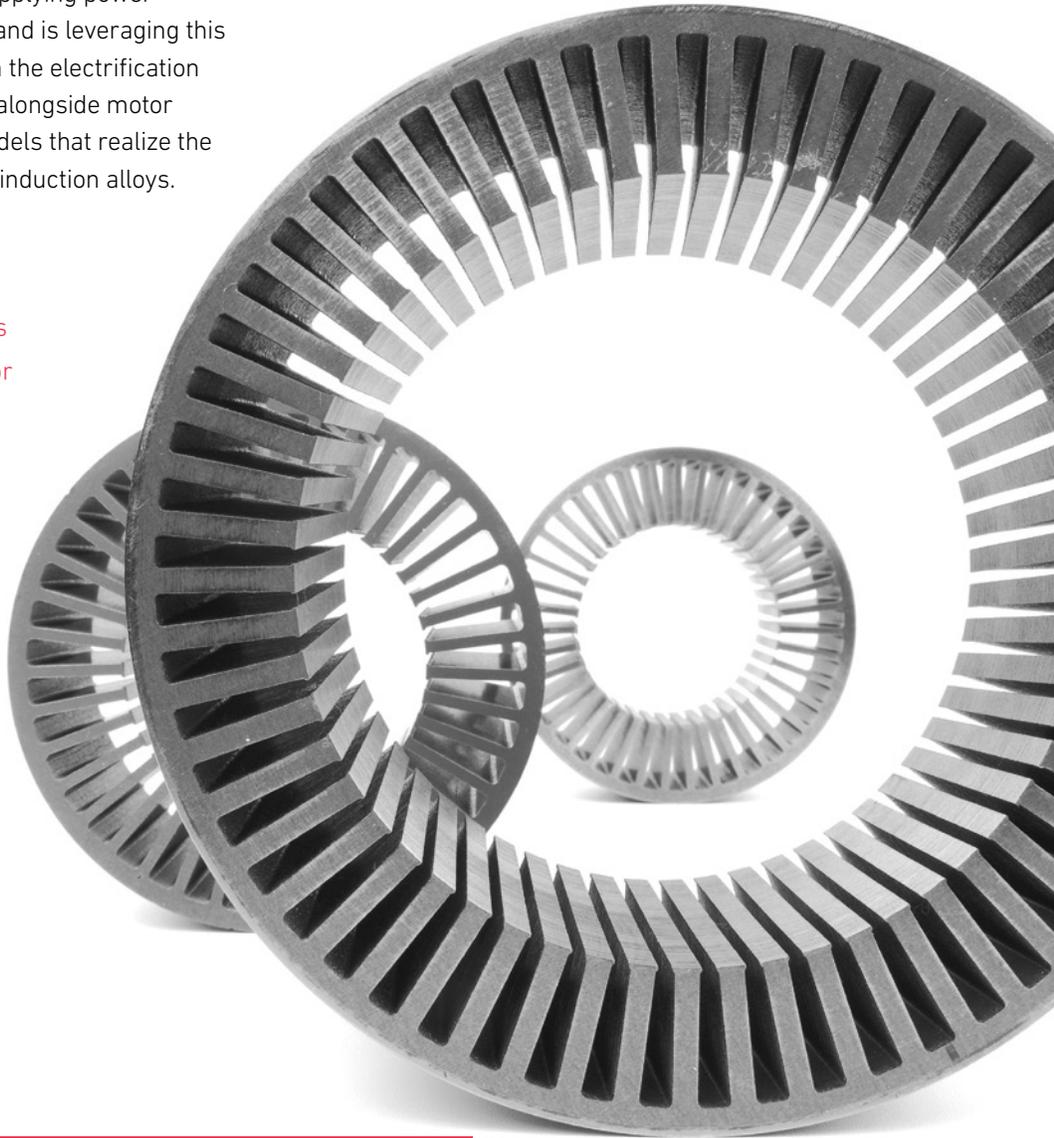
Electrical steel



## Proven power and performance

Carpenter Technology has a long history supplying power-dense materials to the aerospace industry and is leveraging this expertise to increase motor performance in the electrification revolution. Our application engineers work alongside motor designers to develop new power-dense models that realize the full performance benefits of high magnetic induction alloys.

- Over 80 years of specialized development expertise within soft magnetics
- Rapid customization of material properties
- Applications engineering support for motor design and integration
- Dynamic testing of stators and rotors to simulate in-service motor conditions



Higher saturation magnetization =

Higher magnetic force per unit of material =

Higher torque and smaller, lighter motors =

**NEW LEVELS OF PEAK PERFORMANCE**

## Your trusted partner in the electrification revolution

Carpenter Technology Corporation is a recognized leader in high-performance specialty alloy-based materials and process solutions for critical applications in the aerospace, defense, transportation, energy, industrial, medical, and consumer electronics markets.

**For additional information, please  
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