



首钢智新迁安电磁材料有限公司
SHOUGANG ZHIXIN QIAN'AN ELECTROMAGNETIC MATERIAL CO., LTD.

新能源汽车驱动电机用 无取向电工钢产品手册

NON-ORIENTED ELECTRICAL STEEL FOR ELECTRIC VEHICLE MOTOR

首钢智新迁安电磁材料有限公司
Shougang Zhixin Qian'an Electromagnetic Material Co., Ltd.



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Chapter 1 Company Profile

第一章 公司介绍

首钢智新迁安电磁材料有限公司

SHOUGANG ZHIXIN QIAN'AN ELECTROMAGNETIC MATERIAL CO., LTD

首钢智新迁安电磁材料有限公司是北京首钢股份有限公司于2018年3月22日在河北省迁安市设立的子公司，主要产品包括无取向和取向电工钢产品，集电工钢研发、制造、销售和服务于一体，坚持“高端高效、绿色环保”的产品定位，不断推进电工钢工艺技术研发及产品更新换代，为电力、电子及交通等领域提供解决方案。

首钢电工钢产品广泛应用于家电、工业电机、无人机、新能源汽车、配电变压器、特高压输电变压器等领域，产品性能和尺寸精度达到行业领先水平。

Shougang Zhixin Qian'an Electromagnetic Material Co., LTD. is a subsidiary of Beijing Shougang Co., Ltd. established in Qian'an city, Hebei Province on March 22nd, 2018. The main products include non-oriented and grain-oriented electrical steel. It integrates research and development, manufacturing, sales and service of electrical steel, adheres to the product positioning of "high-end, efficient, green and environmental protection", constantly promotes the research and development of electrical steel process technology and product upgrading, and provides solutions for the fields of power, electronics and transportation.

Shougang electrical steel is widely used in household appliance, unmanned aerial vehicle(UAV), new energy vehicle(NEV), distribution transformer and UHV transmission transformer. The performance and dimensional accuracy reach the industry leading level.



Chapter 2 Product Introduction

第二章 产品介绍

首钢新能源汽车用电工钢产品 | Shougang Product

- ▶ 6个系列标准产品
- ▶ 定制化产品

- ▶ 6 Series Standard Product
- ▶ Customized Product

首钢用户技术服务 | Early Vendor Involvement

- ▶ 材料数据库
- ▶ 选材方案
- ▶ 有限元仿真
- ▶ 制造技术研究
- ▶ 电机测试

- ▶ Material Database
- ▶ Material Selection
- ▶ FEM Simulation
- ▶ Manufacturing Technology Research
- ▶ Motor Test

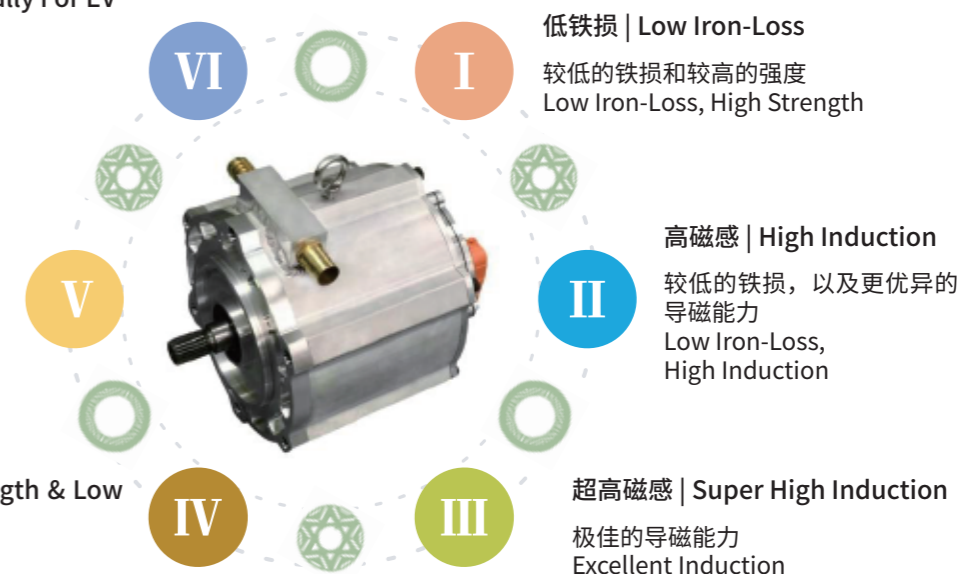
首钢新能源汽车用电工钢产品系列 | Product Series of Shougang NOES for EV

EV 专用 (ESW) | Especially For EV

提高路况效率
Improve the Efficiency of Working Cycle

高强度 | High Strength
极高的强度
Extremely High Strength

高强低铁损 | High Strength & Low Iron-Loss
综合性能最优的产品
Best Products with Comprehensive Performance



新能源汽车驱动电机用无取向电工钢产品性能 | Properties of NOES for EV

系列 Series	牌号 Grade	铁损 P _{1.0/400} (W/kg)		磁极化强度 J ₅₀₀₀ (T)		屈服强度 Yield strength (MPa)	
		保证值 Guarantee value	典型值 Typical value	保证值 Guarantee value	典型值 Typical value	保证值 Guarantee value	典型值 Typical value
Low Iron Loss (SW)	20SW1200	12.0	11.0	1.61	1.63	420	440
	25SW1250	12.5	12.2	1.63	1.65	420	440
	25SW1300	13.0	12.4	1.63	1.64	420	440
	27SW1400	14.0	12.8	1.64	1.65	420	440
	30SW1500	15.0	13.8	1.64	1.66	420	440
	35SW1700	17.0	16.0	1.64	1.66	420	440
	35SW1900	19.0	16.8	1.66	1.68	390	410
High Induction (SWH)	27SWH1400	14.0	13.3	1.64	1.66	390	410
	30SWH1500	15.0	14.3	1.65	1.67	390	410
	35SWH1900	19.0	17.5	1.67	1.69	340	360
Super High Induction (SWG)	27SWG1400	14.0	12.8	1.67	1.69	420	440
	30SWG1500	15.0	13.8	1.67	1.69	420	440
	35SWG1700	17.0	15.8	1.68	1.70	420	440
High Strength & Low Iron Loss (SW-H)	20SW1200H	12.0	11.0	1.61	1.63	470	490
	25SW1250H	12.5	11.6	1.65	1.67	430	460
	27SW1400H	14.0	12.1	1.65	1.67	430	460
	30SW1500H	15.0	13.0	1.65	1.67	430	460
	35SW1700H	17.0	15.5	1.63	1.65	430	460
High Strength (SWYS)	25SWYS480N	20.0	18.0	1.63	1.65	480	510
	35SWYS500	27.0	24.5	1.65	1.67	500	520
	35SWYS900	65.0	57.0	1.51	1.54	900	950
Especially For EV (ESW)	ESW1230	12.0	11.5	1.61	1.64	430	460
	ESW1333	12.5	12.0	1.62	1.64	430	460

涂层特性 | Coating Properties

涂层代码 Coating Type	M1	M4
组分 Composition	半有机 (无 Cr) Semi-organic (Cr Free)	半有机 Semi-organic
ASTM 分类 ASTM Code	C-5	C-5
涂膜厚度 Coating Thickness	0.4-1.0 μm	0.4-1.0 μm
层间电阻 Interlamination Resistance	≥ 3Ω·cm ² /lam	≥ 3Ω·cm ² /lam
耐热性 Heat Resistance	180°C	180°C
	210°C × 2500h 600°C × 30min	210°C × 2500h 600°C × 30min
耐油性 Oil Resistance	150°C × 1000h	150°C × 1000h
附着性 Adhesiveness	很好 Excellent	很好 Excellent
冲片性 Punching Ability	很好 Excellent	很好 Excellent
耐蚀性 Corrosion Resistance	很好 Excellent	很好 Excellent
耐溶剂性 Solvent Resistance	对冲压油、清漆、制冷剂具有高耐受性 High resistance to stamping oil, varnish, and refrigerant	

注：首钢可以根据用户使用要求开发特殊涂层

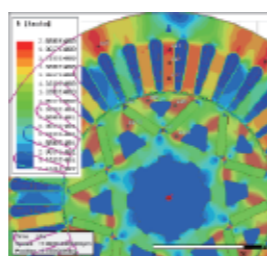
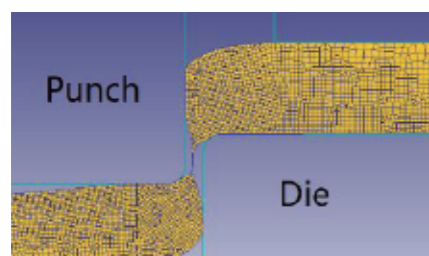
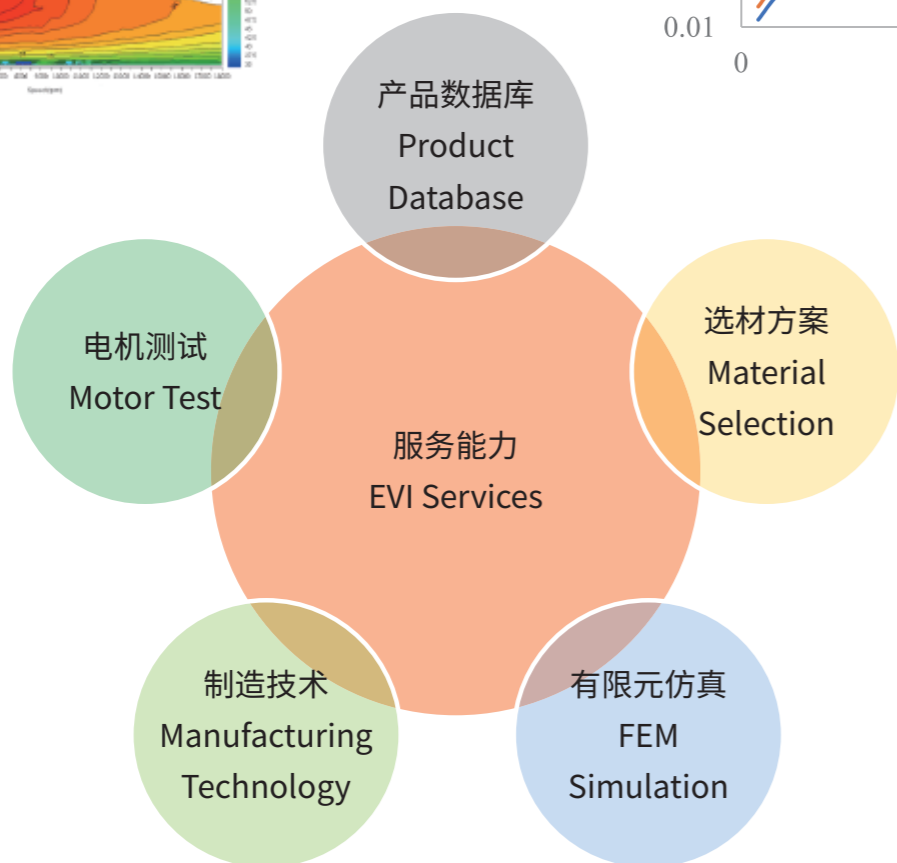
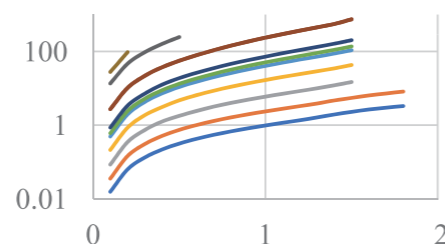
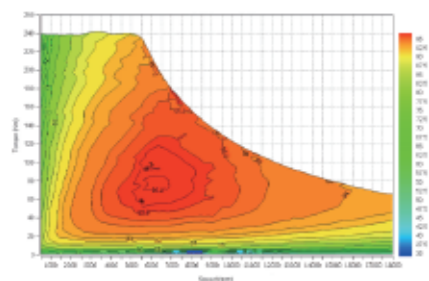
Note: Shougang can develop special coating according to user's requirements



Chapter 3 Early Vendor Involvement

第三章 用户技术服务

用户技术服务 | Early Vendor Involvement



产品数据库 | Product Database

电磁性能 | Electromagnetic properties

- ▶ 交流 / 直流磁化曲线
- ▶ 不同频率下铁损曲线
- ▶ AC/DC JH curve
- ▶ Iron-Loss curve at different frequency

机械性能 | Mechanical properties

- ▶ 应力 - 应变曲线
- ▶ 屈服强度 / 抗拉强度 / 延伸率
- ▶ 维氏硬度
- ▶ 疲劳强度
- ▶ Stress-Strain curve
- ▶ Ys/Ts/Elongation
- ▶ Vickers-hardness
- ▶ Fatigue strength

涂层特性 | Coating Properties

- ▶ 涂层厚度
- ▶ 层间电阻系数
- ▶ 附着性
- ▶ 耐油性
- ▶ Coating thickness
- ▶ Interlamination resistance
- ▶ Adhesiveness
- ▶ Oil resistance

其它物理性能 | Other physical properties

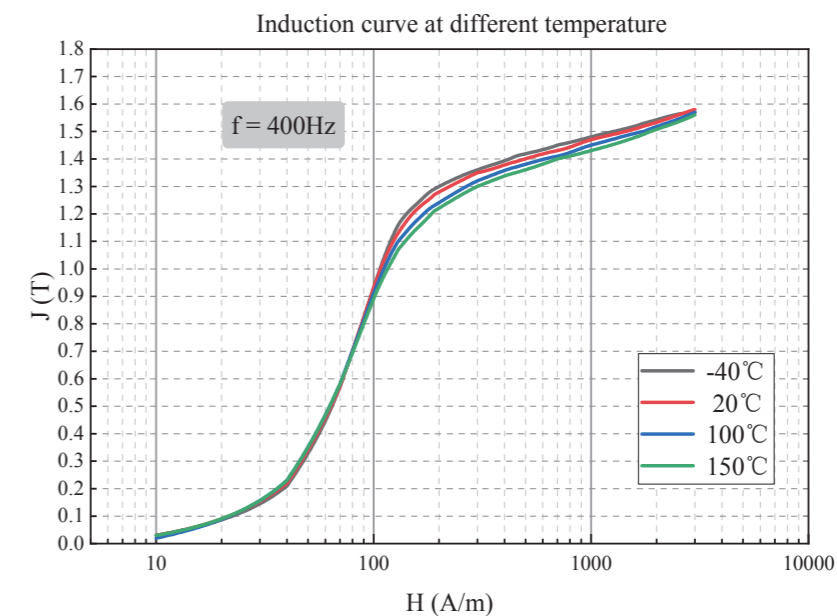
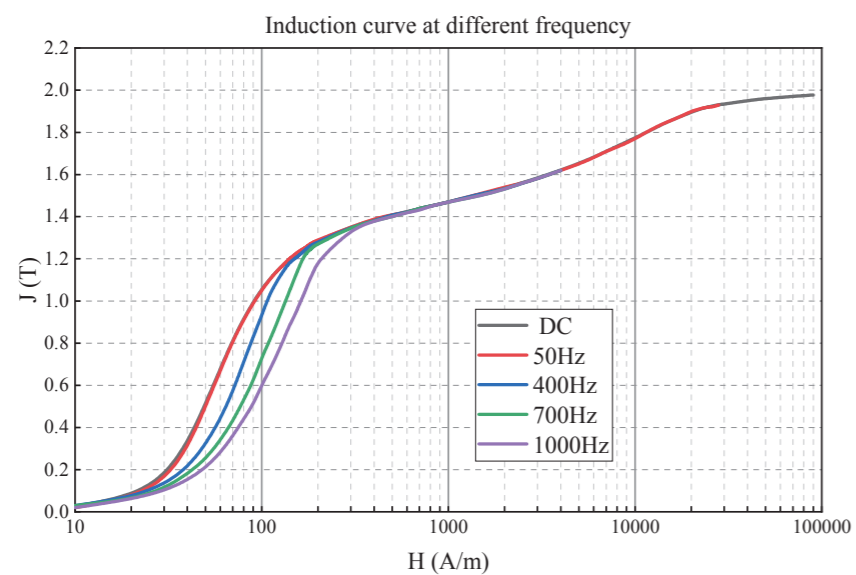
- ▶ 导热系数
- ▶ 线膨胀系数
- ▶ 比热容
- ▶ 电阻率
- ▶ Heat coefficient
- ▶ Expansion coefficient
- ▶ Specific heat capacity
- ▶ Electrical resistivity

典型产品电磁性能 | Electromagnetic Properties of Typical Product

典型产品电磁性能 | Electromagnetic Properties of Typical Product

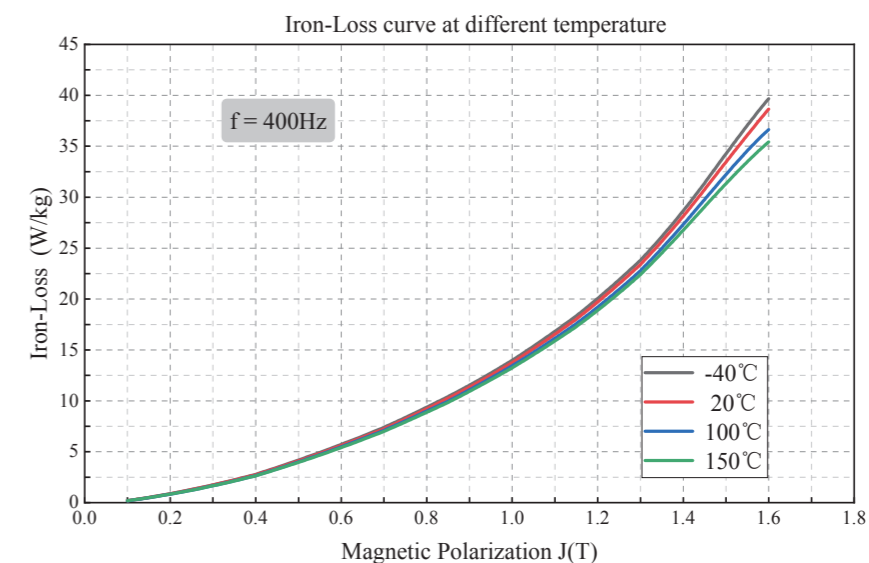
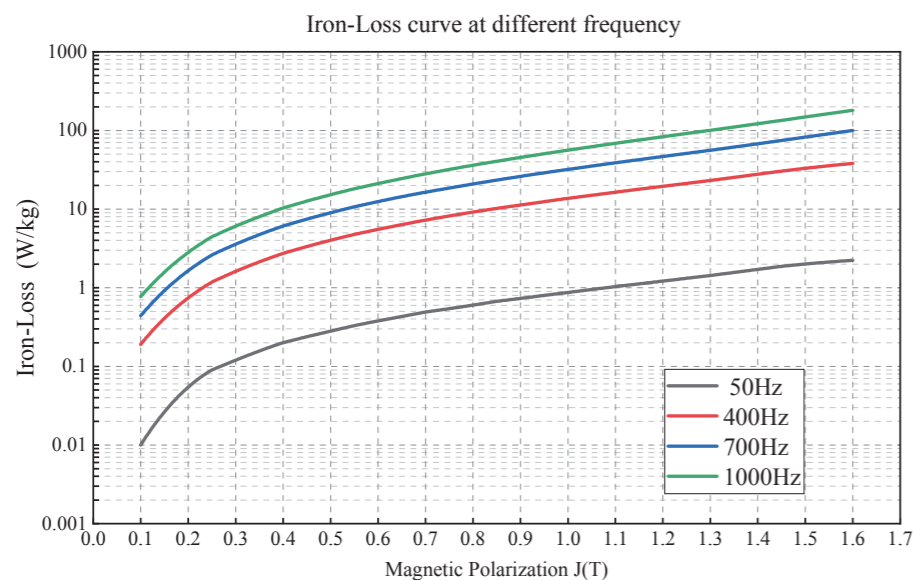
▶ 不同频率下磁化曲线 (以 30SW1500 为例) | Induction curve at different frequency (Exp. 30SW1500)

▶ 不同温度下磁化曲线 (以 30SW1500 为例)
Induction curve at different temperature (Exp. 30SW1500)



▶ 不同频率下铁损曲线 (以 30SW1500 为例) | Iron-Loss curve at different frequency (Exp. 30SW1500)

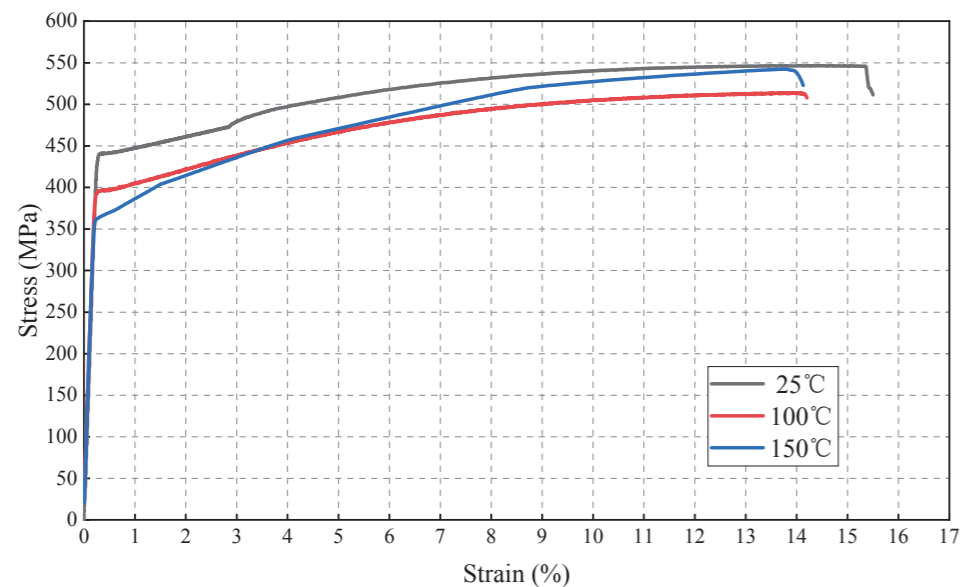
▶ 不同温度下铁损曲线 (以 30SW1500 为例)
Iron-Loss curve at different temperature (Exp. 30SW1500)



典型产品机械性能 | Mechanical Properties of Typical Product

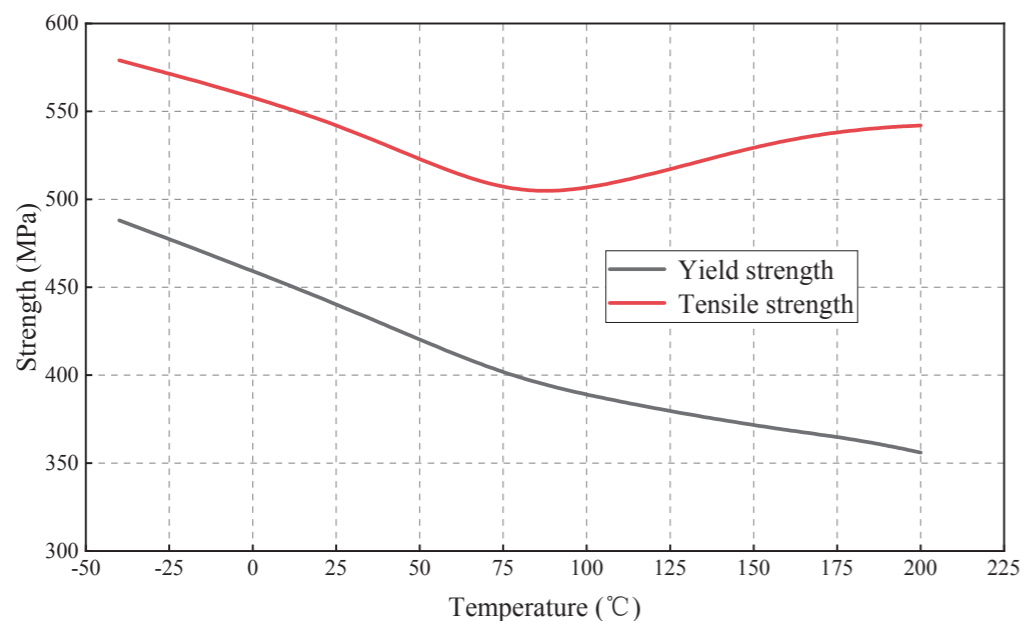
► 不同温度下应力 - 应变曲线 (以 30SW1500 为例)

Stress-Strain curve at different temperature (Exp. 30SW1500)



► 不同温度下屈服和抗拉强度 (以 30SW1500 为例)

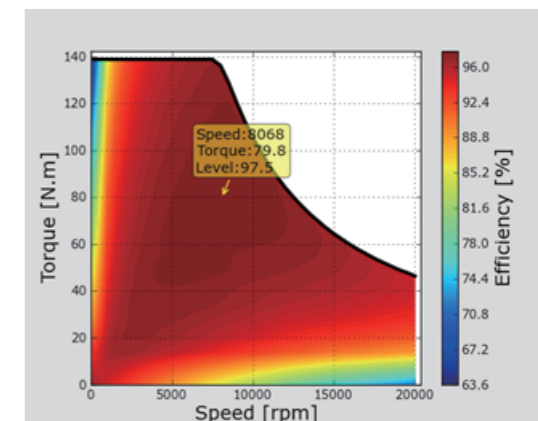
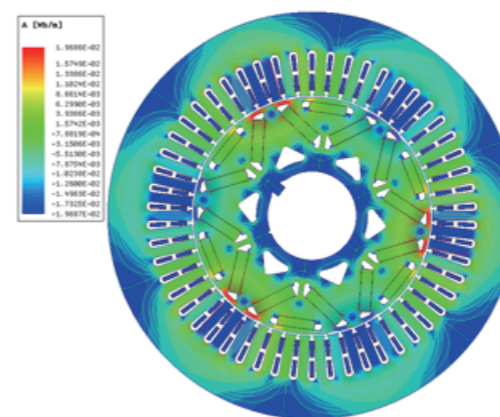
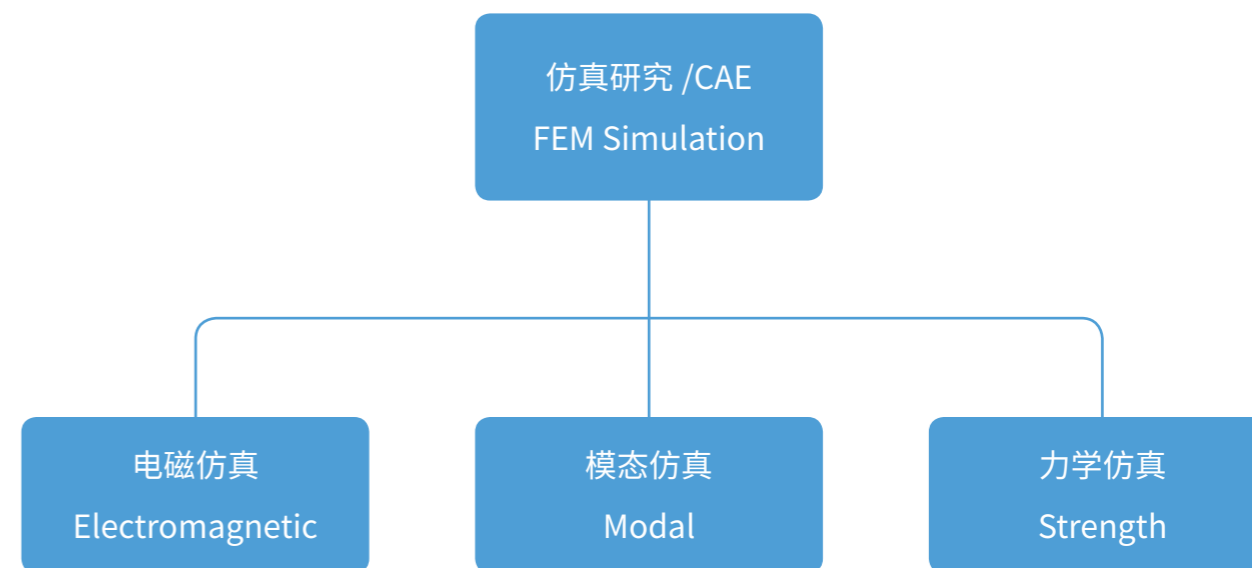
Ys and Ts at different temperature (Exp. 30SW1500)



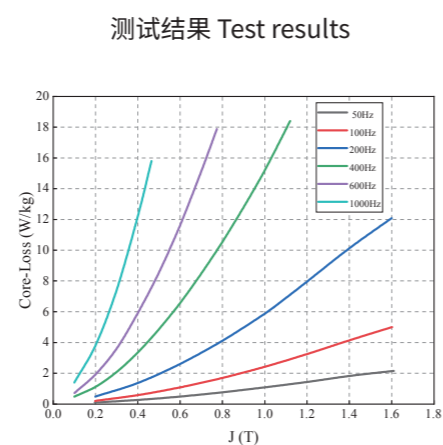
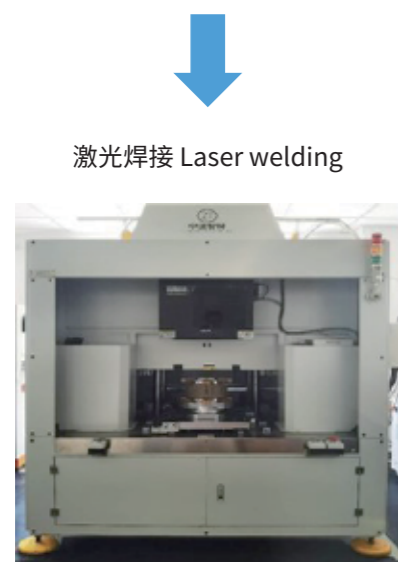
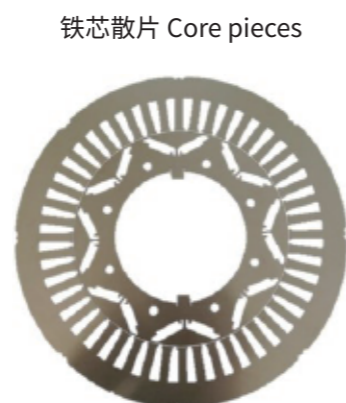
有限元仿真 | FEM Simulation

基于有限元仿真平台, 首钢可以开展电磁、模态、力学等仿真, 帮助客户选择合适的电工钢材料。

Shougang provides electromagnetic, modal, strength simulation services based on FEM platform, to help customers choose the appropriate electrical steel.

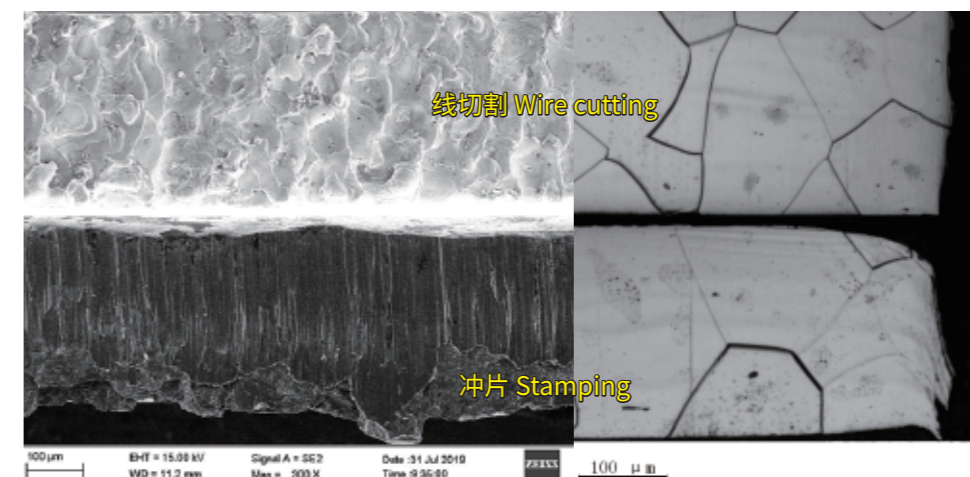


定转子加工制造 | Manufacture of Stator and Rotor

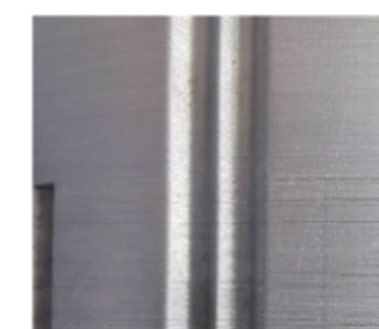
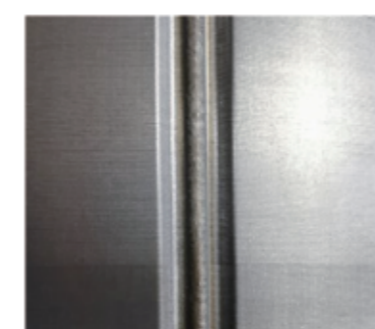


铁芯加工技术研究 | Iron Core Manufacturing Technology Research

► 冲压导致磁性能恶化
Stamping causes deterioration of magnetic properties



► 叠装方式
Stacking modes



焊接 Welding

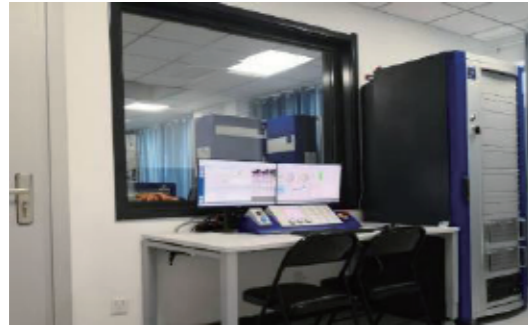
扣点 Interlock

粘接 Gluing

车用电机测试台架 | Test Bench For Vehicle Motor

▶ 台架测试能力参数

Bench test capacity parameters

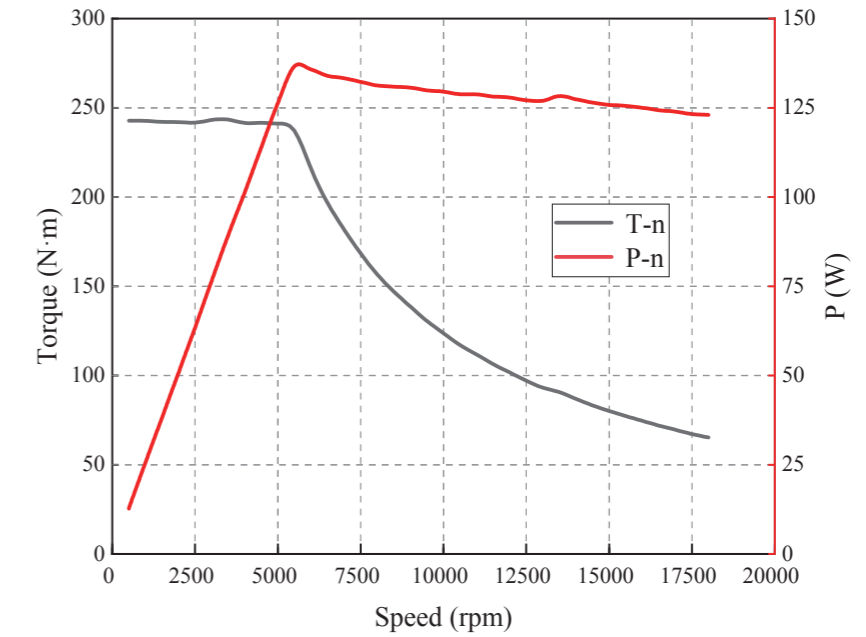


额定功率 Rated power	250 kw
最大转速 Maximum speed	20000 rpm
额定扭矩 Rated torque	500N·m
高低温环境仓 Environment chamber	-40 ~ +150°C

电机测试能力 | Motor Test Capability

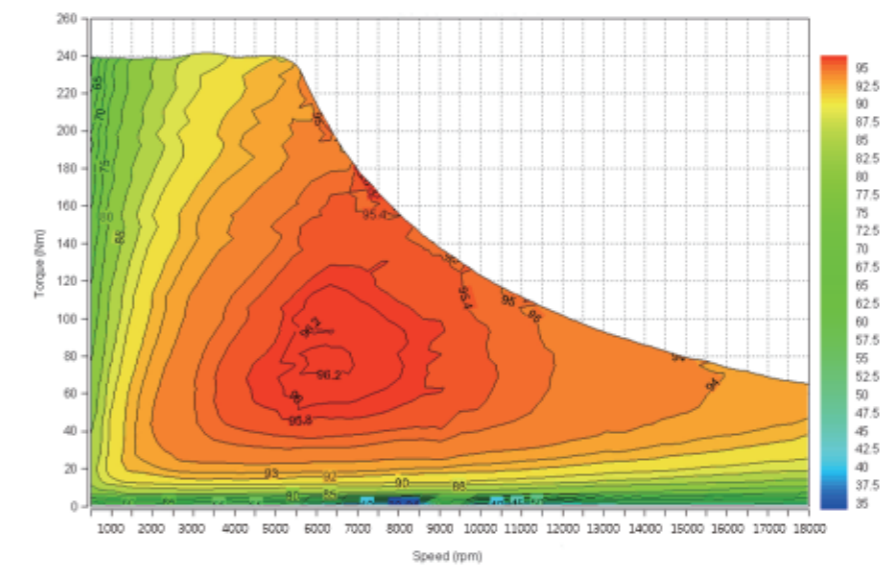
▶ 外特性曲线

External characteristic curve



▶ 电机效率 Map

Motor efficiency Map



Chapter 4 Conversion Table

第四章 单位换算表

单位换算表 | Conversion Table

单位 Unit	初值 Multiply	倍数 by	结果 to obtain
磁场强度 Magnetizing force	奥斯特	Oersted (Oe)	7.985×10 安培 / 米 Ampere per meter (A/m)
	奥斯特	Oersted (Oe)	2.021 安培 / 英寸 Ampere per inch (A/in)
	安培 / 米	Ampere per meter (A/m)	1.257×10 ⁻² 奥斯特 Oersted (Oe)
	安培 / 米	Ampere per meter (A/m)	2.540×10 ⁻² 安培 / 英寸 Ampere per inch (A/in)
	安培 / 英寸	Ampere per inch (A/in)	4.947×10 ⁻¹ 奥斯特 Oersted (Oe)
	安培 / 英寸	Ampere per inch (A/in)	3.937×10 安培 / 米 Ampere per meter (A/m)
	安培 / 厘米	Ampere per centimeter (A/cm)	10 ² 安培 / 米 Ampere per meter (A/m)
磁感 Magnetic Induction	特斯拉	Tesla (T)	10 ⁴ 高斯 Gauss (Gs)
	特斯拉	Tesla (T)	1 韦伯 / 平方米 Weber per square meter (Wb/m ²)
	高斯	Gauss (Gs)	10 ⁻⁴ 韦伯 / 平方米 Weber per square meter (Wb/m ²)
	高斯	Gauss (Gs)	6.452 磁通量 / 平方英寸 Lines per square inch (Line/in ²)
	韦伯 / 平方米	Weber per square meter (Wb/m ²)	10 ⁴ 高斯 Gauss (Gs)
	韦伯 / 平方米	Weber per square meter (Wb/m ²)	1 特斯拉 Tesla (T)
	韦伯 / 平方米	Weber per square meter (Wb/m ²)	6.452×10 ⁴ 磁通量 / 平方英寸 Lines per square inch (Line/in ²)
	磁通量 / 平方英寸	Lines per square inch (Line/in ²)	1.550×10 ⁻¹ 高斯 Gauss (Gs)
	磁通量 / 平方英寸	Lines per square inch (Line/in ²)	1.550×10 ⁻⁵ 韦伯 / 平方米 Weber per square meter (Wb/m ²)
铁损 Core loss	瓦特 / 千克	Watt per kilogram (W/kg)	4.536×10 ⁻¹ 瓦特 / 磅 Watt per pound (W/lb)
	瓦特 / 磅	Watt per pound (W/lb)	2.204 瓦特 / 千克 Watt per kilogram (W/kg)
长度 Length	米	Meter (m)	3.937×10 英寸 Inch (in)
	英寸	Inch (in)	2.540×10 ⁻² 米 Meter (m)
	米	Meter (m)	3.281 英尺 Feet (ft)
	英尺	Inch (in)	3.048×10 ⁻¹ 米 Meter (m)
重量 Weight	千克	Kilogram (kg)	2.204 磅 Pound (lb)
	磅	Pound (lb)	4.536×10 ⁻¹ 千克 Kilogram (kg)

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