Critical Magnetic Characterization for EV & Battery Manufacturing

MAGTrans Systems Pvt Ltd, in partnership with **Dexin Mag,** delivers advanced magnetic measurement solutions that enable EV OEM's, battery pack integrators, and Tier-1 suppliers to control magnetic effects, improve production consistency and build safer, more reliable electric vehicles.

End-to-End Magnetic Solutions for EV & Battery Manufacturing

- **Current Sensor Validation & Stray Field Measurement Solution for checking EV**

- **Magnetic Flux Analysis & Busbar Characterization Solution for AC-DC Converters**

- **BMS Current Sensor Calibration & Magnetic Field Mapping Solution for detecting Magnetic Interference in EV Battery**

- **Magnetic Material Characterisation & Core Performance Validation Solution for evaluating magnetic motors**

- **Traction Motor & Magnet Performance for EV power electronics**

- **Production-Grade Magnetic Quality Control & Coercivity Testing Solution for EV components**

- **Influencing Pulsed Magnetic field in fast Magnetization of EV**

- **Evaluating Magnetization under Constant Magnetic Field for EV motors**

   Investigation of Magnetization using Halbach Array Magnets for high power density EV

- **Development of Magnetization under adjustable Magnetic Field for wide range speed of EV**

- **Synthesis of NdFeB by Magnetic field Press for EV**

Why do we need Magnetic Characterization in EV & Battery Manufacturing

Electric vehicles operate with **high currents, fast-switching power electronics, and compact battery systems**, magnetic behavior directly impacts **BMS accuracy, EMI/EMC compliance, safety, and reliability**. From **battery pack current sensor validation** to **magnetic material characterization in motors and power electronics**, magnetic characterization is **essential to ensure accurate sensing, controlled interference, and dependable EV performance**. To address these critical requirements, we present below a selection of our standard magnetic measurement solutions for EV applications.

Experiment 1 Current Sensor Validation & Stray Field Measurement Solution for checking EV

Gauss Meter Measure AC/DC magnetic field strength using high-sensitivity Hall-effect probes.

Key Features & Specifications:
- Range: ±0.1mT to ±3T(probe-dependent)
- Accuracy: up to ±0.5% of reading
- Resolution: as fine as 0.01 mT / 0.1 G
- Frequency (AC): DC to several kHz
- Probe options: axial, transverse, flexible probes
- Interfaces: USB / RS-232 (model dependent)

EV Applications:

Calibration of Hall-based BMS current sensors, stray field measurement around battery packs, EMI/EMC pre-checks, inverter and motor leakage analysis.

Modular expansion with additional instruments is available.
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Experiment 2 Magnetic Flux Analysis & Busbar Characterization Solution for AC-DC Converters

Flux Meter Measures total magnetic flux by integrating induced voltage from sensing coils.

Key Features & Specifications:

- Flux range: ±0.01 Wb to ±100 Wb (coil dependent)
- Accuracy: ±0.2% to ±0.5%
- Resolution: micro-Weber level
- Integration stability: low drift for long-duration tests
- Input support: search coils, Helmholtz coils
- Data output: digital display, PC connectivity

EV Applications:
Busbar magnetic evaluation, shielding effectiveness verification, inductor characterisation for AC-DC converters.

Experiment 3 BMS Current Sensor Calibration & Magnetic Field Mapping Solution for detecting magnetic interference in EV Batteries

Magnetic Field Mapper Measure 2D/3D magnetic field distribution using calibrated Hall probes and positioning systems.

Key Features & Specifications:

- Field range: up to ±2 T
- Spatial resolution: sub-millimetre (positioning dependent)
- Field accuracy: ±1% or better
- Vector measurement: X, Y, Z components
- Automation: motorised scanning & software mapping
- Customisation: adaptable to customer sensor fixtures

EV Applications:

BMS current sensor calibration, sensor placement optimisation, detection of magnetic interference inside battery packs.

Experiment 4 Magnetic Material Characterization & Core Performance Validation Solution for evaluating magnetic motors

BH Curve & Core Performance Validation System Characterize magnetic materials by measuring B-H curves, hysteresis, coercivity and permeability.

Key Features & Specifications:

- Field strength (H): up to ±2000 kA/m
- Flux density (B): up to ±2.5 T
- Measurement accuracy: ±1%
- Sample types: soft magnetic cores, permanent magnets
- Test modes: static & dynamic hysteresis loops
- Standards support: IEC / ASTM compatible methods.

EV Applications:

Testing magnetic cores for inductors and transformers, evaluation of motor magnets, incoming material inspection.

Experiment 5 Traction Motor & Magnet Performance for EV power electronics

Vibrating Sample Magnetometer Measures magnetic moment by detecting induced voltage from a vibrating magnetized sample.

Key Features & Specifications:

- Magnetic moment sensitivity: down to 10^{-6} emu
- Field range: up to ±3 T
- Temperature range: ambient to 800°C (options available)
- Measurement modes: hysteresis, temperature sweep
- Stability: high signal-to-noise ratio
- Software: advanced data analysis & automation

EV Applications:

Validation of next-generation motor magnets, high-temperature magnetic materials, EV power electronics R&D.

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Experiment 6 Production-Grade Magnetic Quality Control & Coercivity Testing Solution for EV components

Coercivity & Soft Magnetic Property Testers: Quick, non-destructive measurement of coercive force and soft magnetic response.

Key Features & Specifications:

- Coercivity range: 1 A/m to >100 kA/m
- Accuracy: ±2% or better
- Measurement time: seconds per sample
- Test method: non-destructive, surface-based
- Operation: minimal operator skill required
- Suitability: inline or near-line QC.

EV Applications:
Quality control of magnetic cores, post-annealing verification, end-of-line inspection for EV components.

Experiment 7 Influencing Pulsed Magnetic field in fast Magnetization of EV

Pulse magnetic Test develops Permanent magnetic materials (Sm-Co-Pr, Nd-Fe-B, Sr-Ba), magnetic tape & Al-Ni-Co are magnetized with short duration using Pulsed magnetizer.

Key Features & Specifications:

- Input power: AC220±20V, 50-60Hz, 30A
- Max.Output: 15,000 A- 30,000 A
- Capacitance: 1000 µF- 6000 µF
- Charge Time: 5 s – 16 s
- Max. Energy: 5000 J- 18,000 J
- Magnetizing time: 1.0-3.0 sec
- Magnetic field: 0-8 Tesla
- Performance: long time with stable lines

EV Applications: products to be magnetizing permanent magnets for EV products, with low energy consumption, high efficiency and fast magnetization.

Experiment 8 Evaluating Magnetization under Constant Magnetic Field for EV motors

Fixed Magnetization Test: Materials are magnetized permanently under constant magnetic field with fixed air gap. It performes good rigidity and stable magnetic field.

Key Features & Specifications:

- Power Need: Zero
- Airgap can be fixed: 10-110 mm
- Pole diameter: 50-200 mm
- Magnetic field: 0.4- 0.5 Tesla
- Heat dissipation: Zero
- Operation: Long time
- Suitability: light weight, low cost.

EV Applications: simple way to magnetize materials for EV products.

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Experiment 9 Investigation of Magnetization using Halbach Array Magnets for high power density EV

Arrangement of Magnets Test: Halbach Array Magnets are arranged to one side of concentrate magnetic field strength through precise rotation of magnetic orientation which produces higher field strength without increasing magnet size and Improves efficiency in devices that need directed magnetic force.

Key Features & Specifications:

- Power requirements: No need
- 1-sided flux concentration with many field strength
- Compact size compare to electromagnets
- Dimensions: precise tunable
- Cylindrical type: (L: 4mm, W: 8mm, Center hole: 1mm)
- Passive &electrical: Non-conductive

EV Applications: They allow High-speed operation, Reduced rotor heating, better field weakening performance, better efficiency, Power density, Compactness, Range.

Experiment 10 Development of Magnetization under adjustable Magnetic Field for wide range speed of EV

Adjustable Magnetization Test: Permanent magnets are produced by varying magnetic field through adjusting airgap distance between two poles of magnets. The magnetic field is weakened when distance between two poles are increased.

Key Features & Specifications:

- Airgap adjustable: 10-100 mm
- Pole diameter: 100 mm
- Magnetic field: 0.2- 0.8 Tesla
- Double magnetic axis adjustable PM: yes
- Single-poles adjustable magnetic field PM: yes
- Power supply: Required.

EV Applications: High Torque at low speed, high speed efficiency, wide range of speed, advanced control complexity.

Experiment 11 Synthesis of NdFeB by Magnetic field Press for EV

Magnetic field Press Test: Simultaneous controlled compaction and magnetization using hydrulic press and electromagents. REPM powder materials are pressed and molded under the orientation of magnetic field. It is designed for the production of green compact NdFeB permanent magnetic powders.

Key Features:

- Hydraulic press load: 40 Ton
- Magnet Size:(L:60mm,W:60mm,H:30mm)
- Green Density of magnet: 4-4.2 g/cm^3
- Magnetic field: ≥2 Tesla in 60 mm airgap
- Oxygen control: ≤100 ppm
- Spray system for releasing agent: Yes
- Automatic powder weighing machine: Yes
- Water cooling system: Yes
- Power supply required: 150 KW

EV Applications: Very high magnetic energy density, Strong torque output, Better power-to-weight ratio, High efficiency (important for battery range), Supports compact motor designs, Position sensors, Speed sensors, electronic control actuators.

MAGTrans would be extremely glad to discuss your requirements, resolve your queries and guide you in choosing the right solutions for your laboratory. Your journey of academic research is important to us and we will be more than happy to assist you every step of the way. Please reach out to us at:

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