Universität Stuttgart
Institut für Elektrische
Energiewandlung

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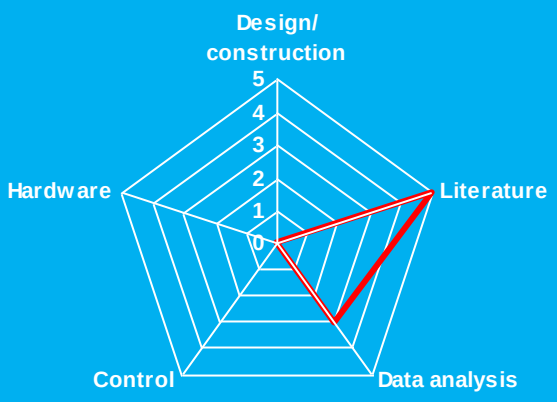

Literature review on modern soft magnetic materials used in electric machines and wireless power transfer

Soft magnetic materials are crucial for the efficiency and power density of modern electric drives and systems for contactless energy transfer. Recent innovations in materials science are opening up new possibilities for performance enhancement and loss reduction. Particularly noteworthy are:

Nanocrystalline and amorphous materials: Low-loss materials with high permeability for high-frequency applications.

Soft Magnetic Composites (SMC): Isotropic, powder-based materials for 3D magnetic flux guidance in compact electric machines.

Cobalt-iron and nickel-iron alloys: High-saturation materials for powerful, thermally stable machines.

Advanced electrical steels: Thin, loss-optimized, grain-oriented laminations for efficient electrical machines.

Multimaterial designs & hybrid cores: Combinations of different materials for targeted tuning of magnetic properties.

Sustainability & resource efficiency: Focus on cobalt-free, recyclable, and environmentally friendly materials.

Thermally robust soft magnetic materials: Materials with stable magnetic properties at high operating temperatures.

Additive manufacturing / 3D printing: New production and design methods for functionally optimized magnetic cores.

As part of a systematic literature research, current soft magnetic materials are to be identified and analyzed with regard to their properties, applications and challenges. The focus is on their use in electrical machines and systems for contactless, inductive energy transmission.

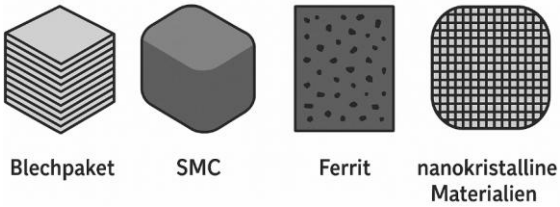

Figure 1: Schematic representation of various soft magnetic materials [This image was created with the help of Dall-E].

Student-Profile:

- Basic knowledge in the field of electrical engineering and in particular electrodynamics
- Interest in electrical machines, contactless energy transfer and electromagnetic field theory.
- Knowledge of Citavi and LaTeX desirable
- Structured, independent and thorough way of working

Work packages:

- Topic delimitation and target definition
- Selection of suitable databases and search sources
- Development of the search strategy
- Carrying out the literature search
- Literature selection and evaluation
- Thematic structuring of the literature
- Knowledge preparation and documentation

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