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香港城市大學
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Next-Generation High-Power Nanocrystalline Smart Wireless EV Charger

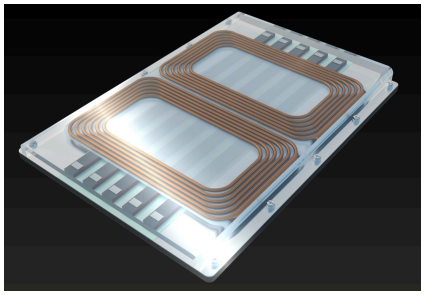
Energy & Environment

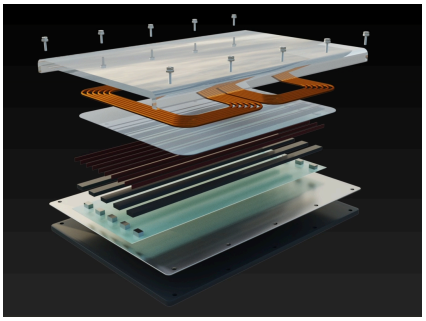
Manufacturing

Electricity and Power Electronics

Nanotechnology and New Materials

Smart Mobility and Electric Vehicle





Remarks

1. International Exhibition of Inventions of Geneva (IEIG) 2024 - Gold Medals with Congratulations of the Jury
2. Silicon Valley International Invention Festival (SVIIF) 2024 - Gold Medal

IP Status

Patent filed

Technology Readiness Level (TRL) ? 6

Opportunity

The applications of inductive power transfer are encountering challenges in electric vehicles (EV) industries in power density and efficiency when compared to traditional cable charging methods. To overcome the challenges, we have developed a solution by incorporating a cutting-edge nanocrystalline ribbon soft magnetic material into wireless charging technology. Through the implementation of a hybrid configuration and a comprehensive analysis of core loss characteristics, our invention has successfully achieved enhanced efficiency and a higher power density in comparison to conventional ferrite systems. With an impressive efficiency rating exceeding 97%, our invention can be integrated into existing (EV) models, enabling the practical implementation of wireless charging technology.

Technology

By incorporating the new laminated Nanocrystalline ribbon (FeCuNbSiB) for the magnetic core design and the quadrilateral current mode (QCM) switching scheme for the parallel connected SiC MOSFETs, significant advancements can be achieved in the wireless charging system. These advancements include further reduction in losses such as the iron loss of the magnetic core and the switching loss of the transistors. Consequently, the system can benefit from higher efficiency, increased magnetic saturation, lower core losses, enhanced power density, superior stability across a wide temperature range, and improved controllability. These improvements pave the way for more efficient and reliable wireless charging systems, offering greater convenience and flexibility for users.

Inventor(s)

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Advantages

- Using high permeability nanocrystalline ribbons as the main magnetic core. Coupling and quality factors are increased
- Thin design of the core structure, achieving high power density
- Using nanocrystalline flake ribbon as shielding material for the main coupler, reducing edge loss and improving thermal behavior
- Using the quadrilateral current mode (QCM) switching scheme for parallel connected SiC MOSFETs in the wireless charging system reduces switching losses, improves current control, enhances system efficiency, and minimizes electromagnetic interference

Applications

- Static wireless charging for electric vehicles
- Dynamic wireless charging roads
- Wireless charging for AGVs
- Smart charging for industrial equipment and vehicles
- Wireless charging for AUVs