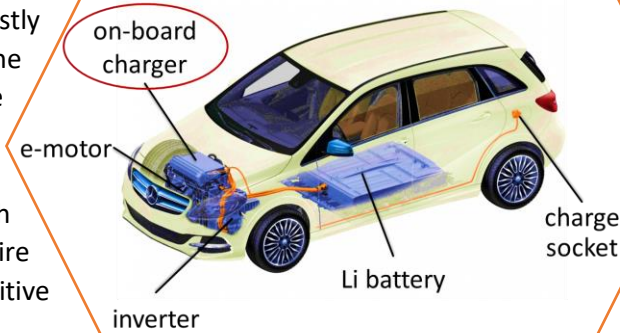


Low-voltage Battery Charger Powers Drive for Safer, More Efficient Electric Vehicles

Challenge & Solutions

Current battery electric vehicle (BEV) mobility systems based on 400V or higher drivetrains, which include high-end cars, can be lethal in accidents or mishaps during manufacturing or handling. Low voltage is both safer and more efficient, but costly state-of-the-art electric vehicle systems require high voltage to reduce the impact of resistances and conductor cross-sections or to balance resistive connections. Meanwhile, demand is growing for safe low-voltage drivetrains that provide the high performance that electric vehicles require, such as the Intelligent Stator Cage Drive (ISCAD). This extra-low voltage drive delivers high performance at safe battery voltages. Those 48V batteries, in turn, require onboard low-voltage charging devices, which will make ISCAD systems competitive with state-of-the-art high-voltage drivetrains.

To accelerate the transition to these low-voltage drivetrains, the ISCAD Charger project developed a 48V on-board charger with a high-voltage input for a 48V high-power drivetrain system. The team used Power Factor Correction (PFC) technology to develop an onboard AC/DC converter charger for this system, which is essential for adoption of low-voltage drivetrains. PFC adjusts the ratio between active and reactive power of energy during charging. Active power charges the battery, while reactive power in this case is just waste, which produces losses and therefore decreases charging-system efficiency. Connected to the vehicle battery, the PFC-adjusted charger converts AC voltage to DC voltage so the DC battery can be charged. In addition, the low-voltage ISCAD Charger allows stored energy to be transferred to the grid. The ISCAD Charger provides high currents with parallel semiconductors and lower resistance. Various inexpensive MOSFETs were designed and used in a parallel arrangement, so that the current is distributed over all parallel paths, taking the load off the semiconductors.



EuroCPS Support

Finepower GmbH provided essential advice and instruction on advanced power electronics and power factor correction. Infineon's XMC microcontroller was used in the project.

Digital Skills

FEAAM GmbH: Power electronics, control theory, test benches up to 222 kW, 2,000 Nm or 140,000 min⁻¹.

Finepower: Power electronics, simulation, prototyping.

Company

FEAAM GmbH is a highly experienced research and development company focused on smart, efficient and effective power electronics, actuators and drives for energy and automotive applications and solutions (G) – www.feam.de



15 employees

Partners:
Finepower (G)

Since
2006

fine power

Impact/What's next

ISCAD drivetrains are projected to account for 10 percent of electric-vehicle sales by 2020, nearly 1 million vehicles. This project's low-voltage ISCAD charger could change those forecasts, because low-voltage onboard chargers make ISCAD systems competitive with state-of-the-art high-voltage drivetrains, while reducing risk of electrocution. The charger's vehicle-to-grid, electricity-transfer capability also supports smart cities and renewable-energy distribution.

FEAAM is working to complete a prototype DC/DC ISCAD charger in 2018. It also plans to add staff. The charger design is flexible so it can be adapted to the shape of the car, which saves money in vehicle design and development.