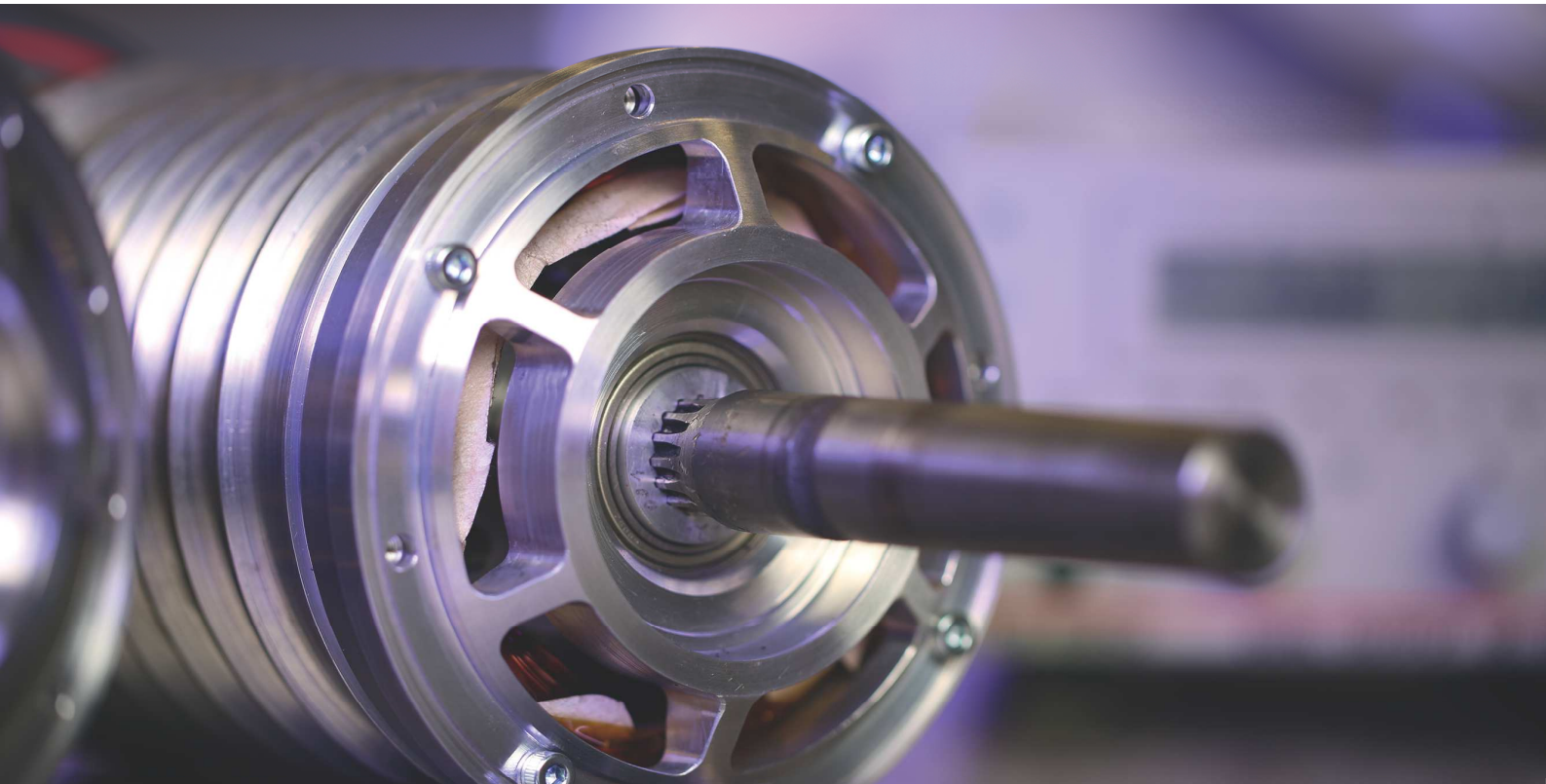




PROFILREGION

MOBILITÄTSSYSTEME
KARLSRUHE



ELECTRIC AND HYBRID ELECTRIC MOBILITY OPTIMIZATION OF THERMAL SYSTEMS

High immission levels in urban areas and rising fuel costs have created a need for new drive concepts as an alternative to conventional vehicles with internal combustion engines.

Electric and hybrid-electric vehicles offer the possibility of local emission-free driving. At the same time, hybrid electric vehicles have a long range, as sufficient energy is stored on board. Individual mobility can thus be achieved economically in urban and rural areas.

The holistic view of the electric and conventional drive train shows optimization potential with regard to energy demand and emissions, which have not been considered so far.

Optimization of thermal systems

Hybrid drive systems need a more complex thermal management system than conventional vehicles, as the heat requirement of the interior cannot be covered under all operating conditions by the intermittent waste heat from the hybrid drive train. The thermal operating range of the traction battery must also be taken into account.



Characterization

At Fraunhofer ICT, battery cells used in electric or hybrid vehicles are measured during various charging and discharging cycles. The data include electrical and thermal parameters such as temperature distribution on the cell surface and heat flow distribution.

Modeling

Using these measurement data, the battery cell is modelled with regard to thermal and electrical properties by the Institute of Product Engineering (KIT-IPEK). The Electrotechnical Institute (KIT-ETI) models the heat flows from power electronics and electrical machines, which can be used for thermal recuperation or must be dissipated through the cooling system. Fraunhofer ICT uses data from the previous initialization project and current data collection to model the internal combustion engine.

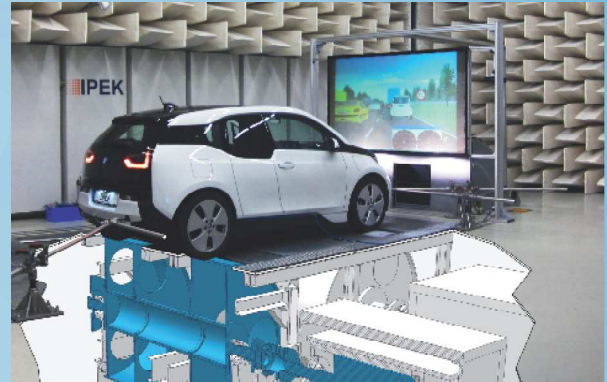
Based on these findings, the detailed modelling of a thermal recovery system for residual heat utilization in the exhaust tract is carried out. The overall efficiency of a hybrid electric drive train can be further increased by using the dissipative waste heat flows from the combustion engine with the aid of suitable post-processes.

Optimization

Using the extended model, Fraunhofer ICT is developing an operation strategy for optimal control of the complete drive train in terms of electrical range and CO₂ emissions. This requires in particular a balance between the use of existing waste heat and the energy-efficient use of additional heating components.

Validation

Validation can take place by comparing fuel consumption and the resulting vehicle range with and without optimized thermal management. This allows us to compare and quantify the advantages of the thermal management system with the effort involved.



BMW i3 on the acoustic roller test bench (ARP) of the Institute of Product Engineering (KIT-IPEK)

Contact:

Andreas Dollinger

Fraunhofer Institute for Chemical Technology
 New Drive Systems

Rintheimer Querallee 2, 76131 Karlsruhe

phone: +49 721 915038-19

Andreas.Dollinger@ict.fraunhofer.de