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Solutions for an automated production of WPT-Systems

CERV 2023
Maximilian Kneidl M.Sc.

Test tracks all over the world prove that the technology of wireless charging is feasable. The challenge for scaling up the technology is the automation of manufacturing processes.

FAPS

ORNL (2016), Knoxville
10 m, 20 kW, $\eta = 90\%$

IPT Tech. (2015), Mannheim
80 m, 200 kW

duraBast (2022)
Cologne, 100 m

KAIST OLEV (2010), Seoul
370 m, 100 kW, $\eta = 74\%$

FABRIC (2017), Versailles
100 m, 20 kW, $\eta = 70\%$

Electreon (2019)
Gotland, 1600 m; 70 kW

ASPIRE (2022)
Logan, 50 m

EnBW (2019)
Karlsruhe, 100 m

E|MPOWER (2024)
Bavaria, 1 km

Auckland (2013)
10 m, 30 kW, $\eta = 85\%$

The fully automated production and deployment of inductive power transfer systems is characterized by process-spanning challenges.


Winding

- Mechanical behaviour of litze-wires influences the winding process
- Mechanical stresses on primary insulation
- Lack of automated flat winding kinematics and tools
- Termination and bridging of litz-wire is depending on coil topology
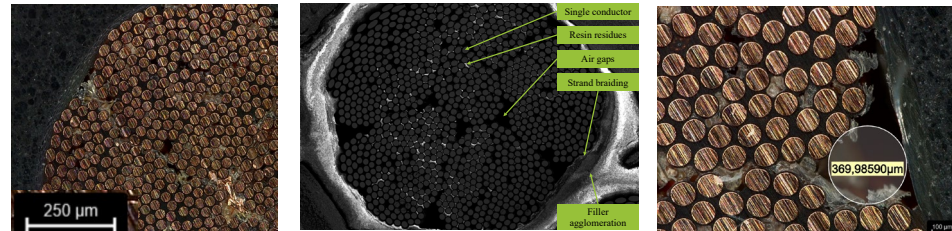
Contacting

- Primary insulation influences the stripping process significantly
- Defects in the electrical joints influence the quality factor of the coil
- Mechanical connection must be ensured over the entire lifetime
- Combined stripping and contacting processes reduce manufacturing efforts
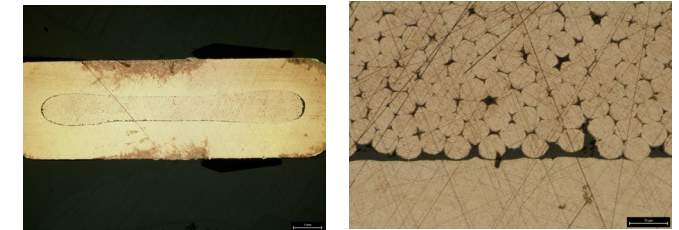
Potting

- Homogenious filler distribution is essential for heat transfer
- Dielectric properties ensure operation over lifetime
- Air traps and delamination increase the risk of partial discharges
- Compatibility to road construction technologies and materials
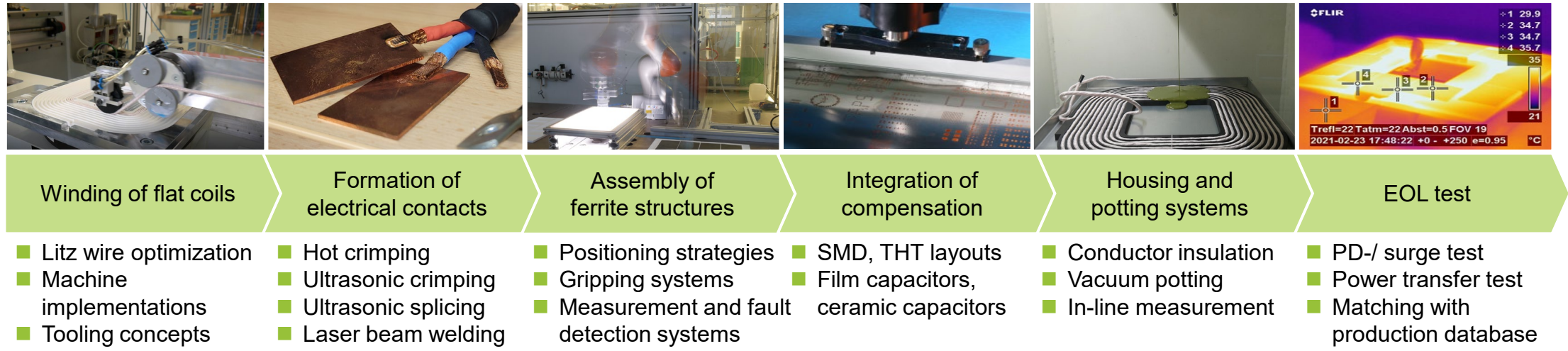
Deployment

- Mechanical stiffness of construction elements must be ensured
- Automatic deployment in accordance to modern road construction technologies
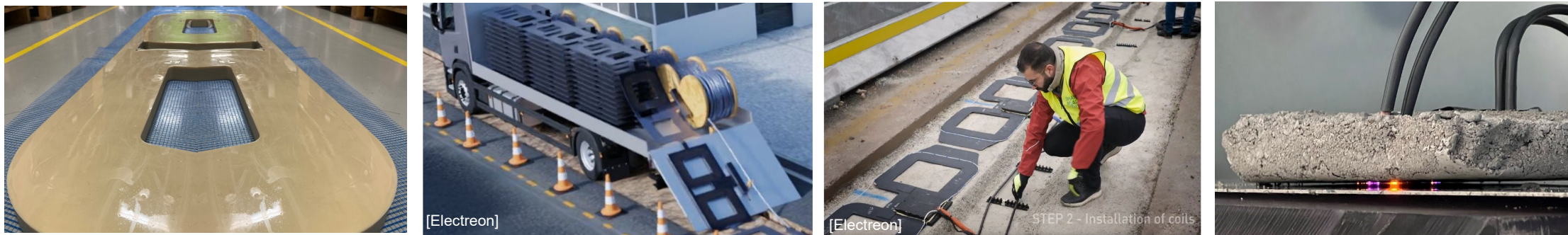- Mobile contacting technologies
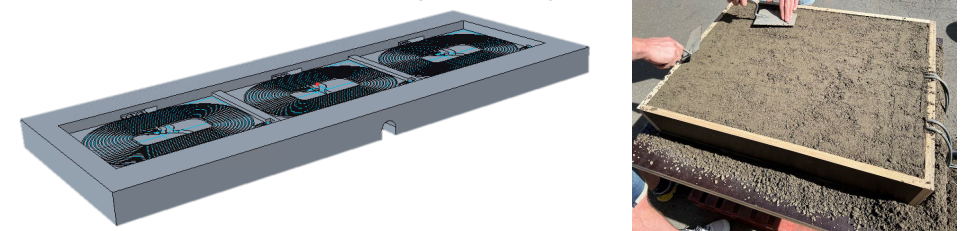
With data driven methods, flexible processes and improved quality control, FAPS investigates further advances manufacturing wireless power transfer systems.

FAPS

Process chain of coil module manufacturing

Winding of flat coils	Formation of electrical contacts	Assembly of ferrite structures	Integration of compensation	Housing and potting systems	EOL test
■ Litz wire optimization ■ Machine implementations ■ Tooling concepts	■ Hot crimping ■ Ultrasonic crimping ■ Ultrasonic splicing ■ Laser beam welding	■ Positioning strategies ■ Gripping systems ■ Measurement and fault detection systems	■ SMD, THT layouts ■ Film capacitors, ceramic capacitors	■ Conductor insulation ■ Vacuum potting ■ In-line measurement	■ PD-/ surge test ■ Power transfer test ■ Matching with production database

Scalable integration of coil modules in infrastructure

[Electreon]

[Electreon]

STEP 2 - Installation of coils

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FAU

Friedrich-Alexander-Universität
Technische Fakultät

Seamless energy

THANK YOU