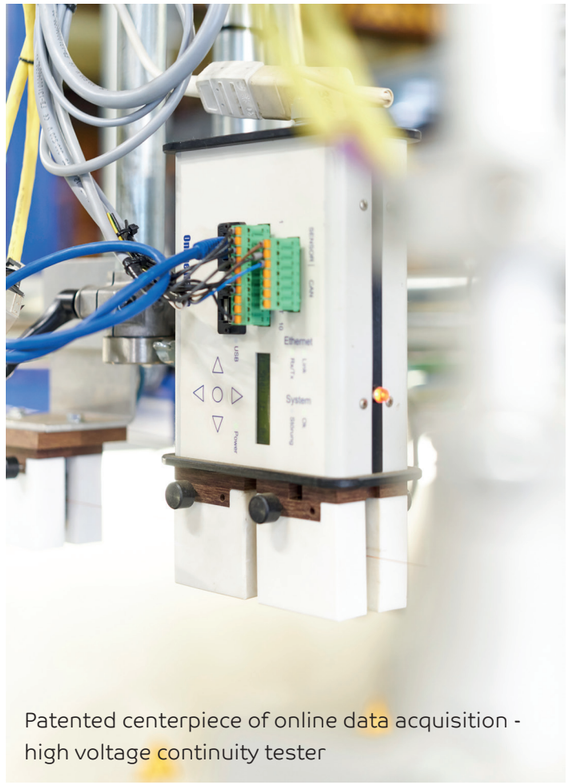
SHWire Industry 4.0+ process technology: Benchmark in quality assurance for enamelled wires

With the SHWire highly automated production process, we link machine, process and product quality data in real time with the support of Industry 4.0+ technologies. With our production monitoring platform “FIT”, all process parameters are monitored inline, deviations are recognized immediately and independent of the machine operator. Appropriate measures are initiated. The centerpiece of the online data acquisition system is an innovative high-voltage continuity tester specially developed by SHWire. It enables continuous monitoring and control along the entire production line so that every centimeter of wire produced is checked for insulation failings. With this innovative quality assurance system, we can guarantee our customers that the goods produced meet the specified requirements over the entire length thanks to a 100 % inspection.

- **Reliable real-time measurement results**
- **Traceable human-independent decisions**
- **Automatic system-controlled blocking**
- **Complete traceability**



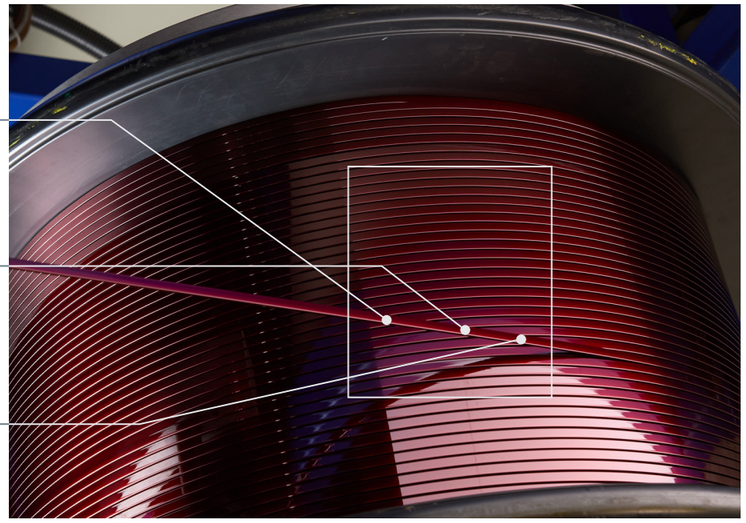
Patented centerpiece of online data acquisition - high voltage continuity tester

Real-time process monitoring platform - ‚FIT‘ (Production Information Technology)

Machine parameters
e.g. wire tension control, curing air flow / ventilation

Process parameters
e.g. monitoring of production speed, oven temperatures

Product quality parameters
e.g. high voltage continuity, blister detection, coupled with quality assurance system



SHWire
Magnet Wires

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Find out all about our new enamelled wire development SHXLife!

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SHWire
Magnet Wires

SH X Life

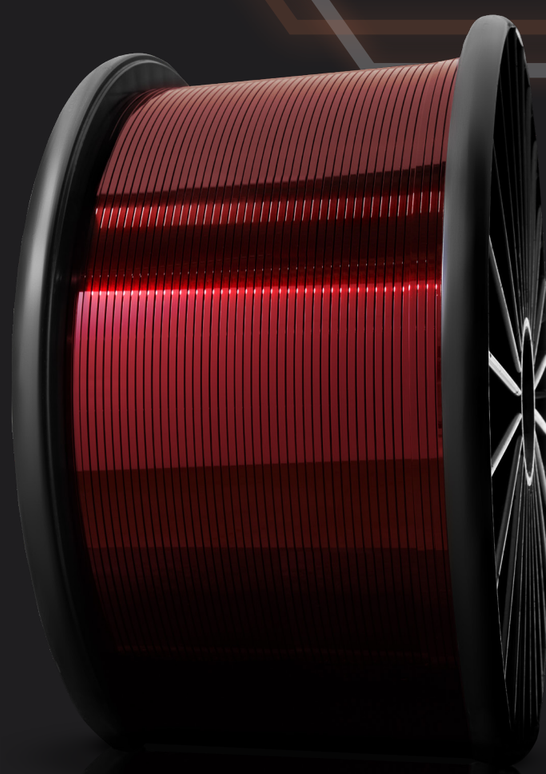
High-Performance Enamelled Copper Wire for 800V+ E-Mobility Solutions

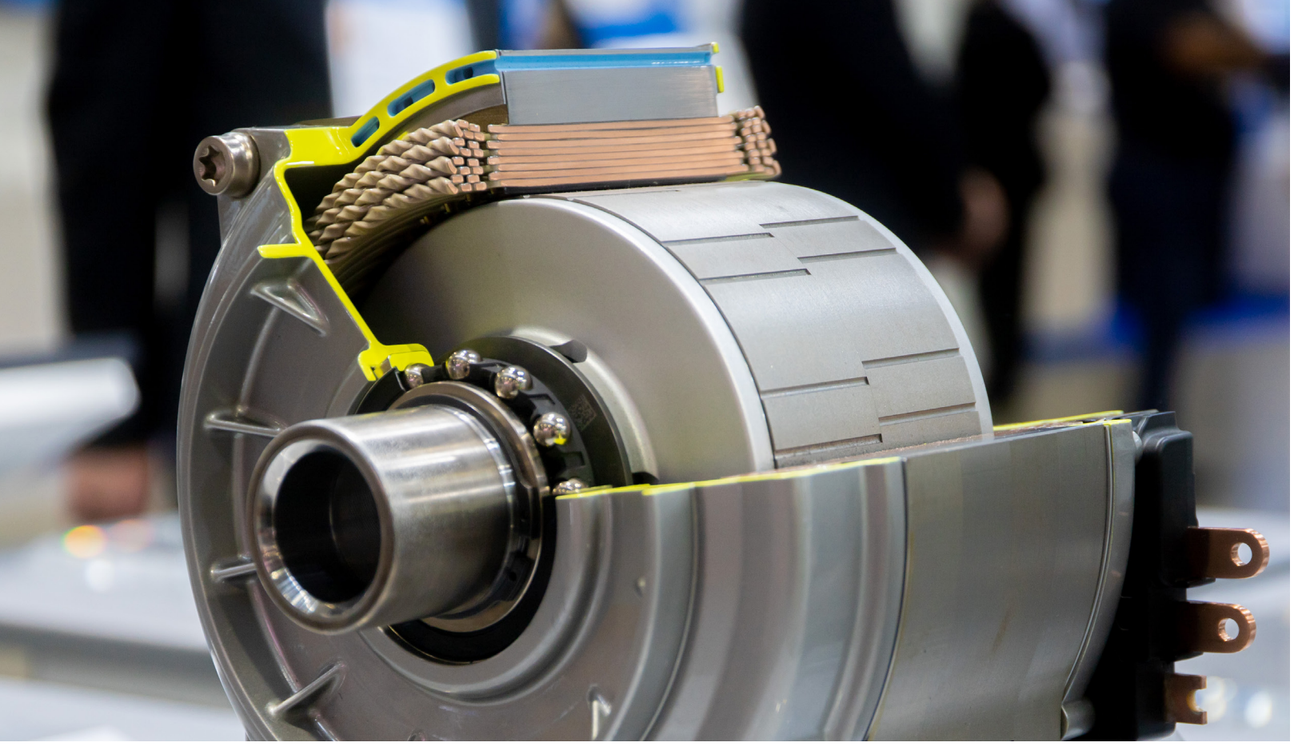
Durability:
500x extended life time* under partial discharge

Design flexibility:
Enables smaller safety margins

Increased efficiency:
Increased copper fill factor due to reduced layer thicknesses

Economy success:
Makes 800V+ solutions more cost-effective

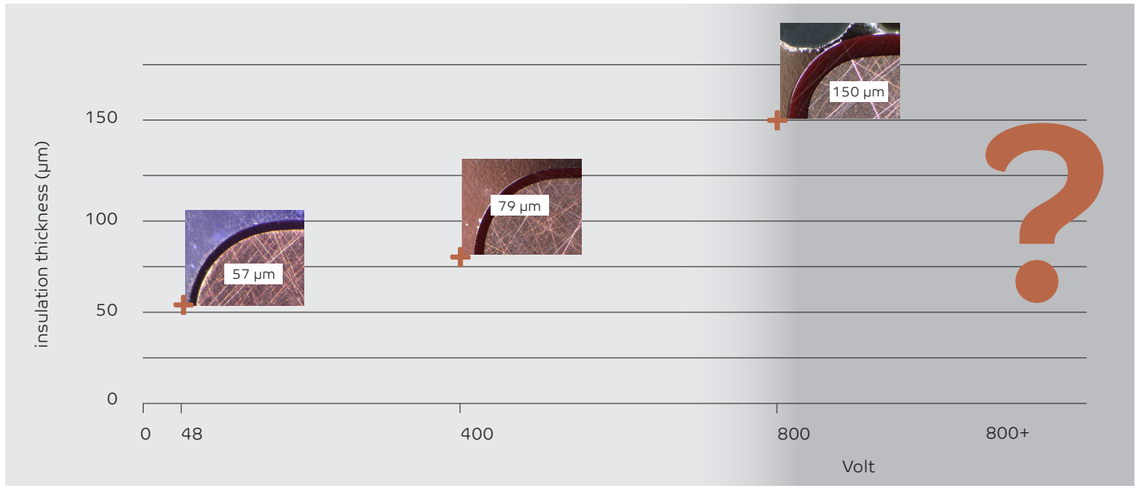




Electric vehicles with 800V+ systems - challenges for the electrical insulation system due to partial discharges

Future battery electric vehicles (BEV) will rely on voltage levels of 800V and more in order to be able to charge faster with higher power. Modern circuit breakers with silicon carbide technology place very high demands on the entire electrical insulation system of electric motors. Partial discharge that occurs in the extreme ranges has so far led to unavoidable damage to the electric motor‘s electrical insulation system that could end in a total breakdown with the destruction of the insulation system.

For good reason, this has so far been countered by increasing the layer thickness of the enamelled wire in order to compensate for the increasing voltage load on the insulation system and prevent the occurrence of partial discharges. However, this approach reaches its limits, as very high layer thicknesses (>150µm) are required that reduce the utilization of the winding space, resulting in the limitation of design freedom, efficiency and cost-effectiveness.

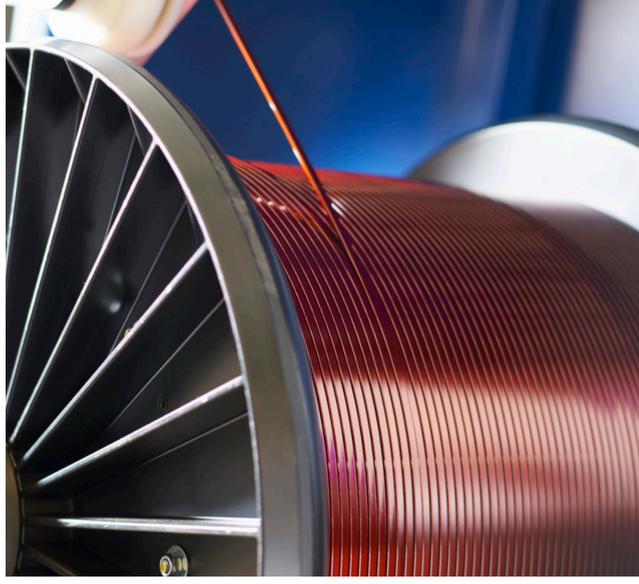


High insulation thickness was required to prevent the destructive effect of partial discharge.

The SHWire alternative: Enables unrivalled 500x the life time under partial discharge

- 500x longer life time compared to conventional wires under partial discharge
- Based on established process technology
- Low layer thicknesses provide new freedom
- Commercially immense advantage over extruded solutions

SHXLife enamelled copper wire has been specifically developed for use in electric motors that are exposed to very high voltage peaks, such as those that occur in frequency converter applications. The enamelled copper wire, which is manufactured using established processes, is able to withstand the damage mechanism of the partial discharge inception voltage significantly longer thanks to a smart modification of the enamel system, including an optimization of the relative permittivity of the individual enamel layers.



The new SHXLife enamelled wire achieves a life time that is over 500 times longer than that of conventional wires with comparable standard polymers.

Allowing a certain amount of partial discharge leads to new freedoms that can be used to reduce the layer thicknesses and, conversely, increase the copper fill factor. The result is higher performance and efficiency for the demanding applications of electric mobility.