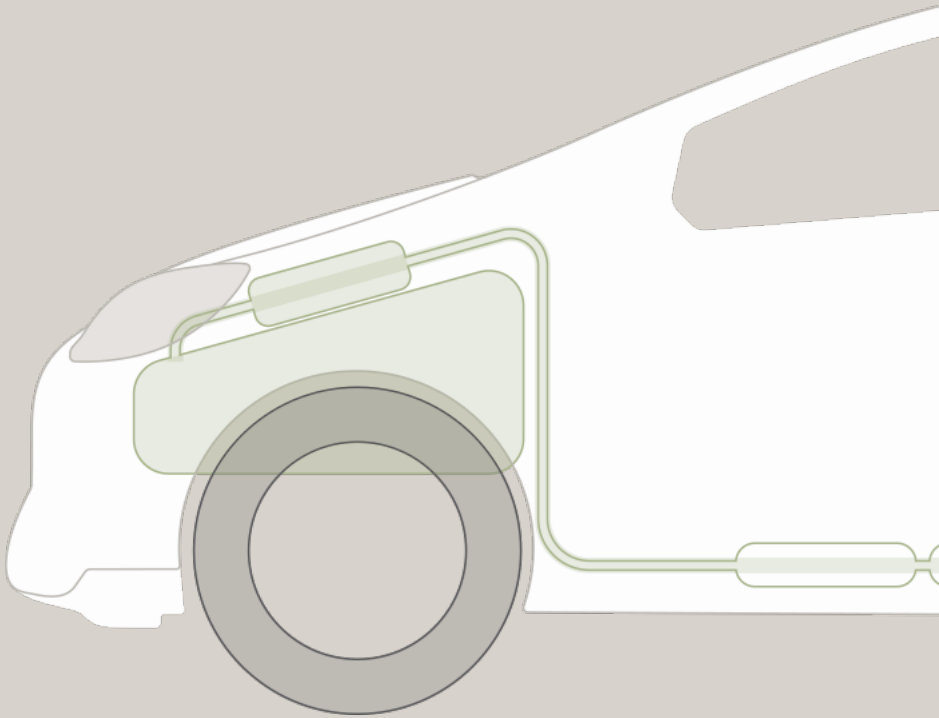
PEEK-insulated copper magnet wire for e-motor applications

Ampact™, wired-up to power high-voltage mobility!



Ampact™

Wire Düsseldorf 2024

Bekaert

Wired to power-up high-voltage mobility

PEEK-insulated copper magnet wire for e-motor applications

EV Technology Trend → 800V

- ✓ Fast(er) charging
- ✓ Improved E-Drive efficiency
- ✓ Optimising benefit vs. cost

Ampact™

PEEK-coated copper magnet wire

Engineered to meet the most challenging customer specifications of high-voltage e-motors and beyond…

- Provide electrical resistance in-line with 800V requirements
- Thin coatings with high thermal conductivity
- A more sustainable solution (with lower CO_2 emissions)
- Higly flexible for smooth processing & challenging motor designs

Bekaert

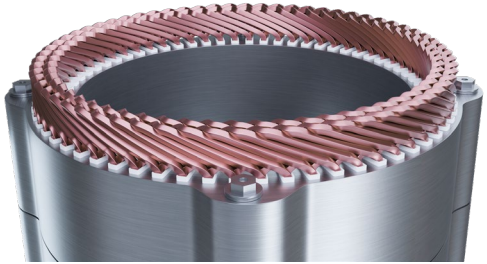
Copper magnet wires at the heart of the e-motor

Hairpin-based stators for 800V technology

Flat magnet wires as the new standard used for stators in traction motors

- Rectangular copper shapes have a better **fill-factor** than round (45% → 70-80%)
- Large wire surface (of a rectangular shape) requires **less cooling**
- Faster & better **automated assembly** (vs. random round wire 'knitting')
- Typical flat cross-sections of 5-10mm² (e.g. 3.5x2.0mm) in 4-8 layers
- Coated with **thin layers** for insulation protection, able to dissipate excess heat

Hairpin wires + 800V → State-of-the-art for high performing e-motor technology



Drivers for selecting suitable magnet wire products

- High quality conductors (↘ oxygen content): oxygen-free or ETP-1 Cu
- High electrical insulation capability → breakdown voltage > 10kV (PDIV > 1500V)
- Survive stator production process (bending of 1x wire thickness)
- Thermal resistance to temperatures above 180°C during peak motor loading
- Lasting performance in e-motor applications with lifetimes > 20.000 hours

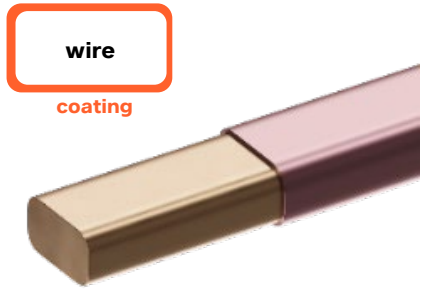
PEEK coating as an enabler for new EV technologies

PEEK coated magnet wires supports state-of-the-art E-motor trends

- SiC/GaN inverter technology with high switching frequencies
- Higher motor power density
- More efficient cooling (e.g. Direct oil cooling)
- Compact stator designs (with stringent hairpin bending)
- Continuous/Wave-winding of flat magnet wires
- High peak thermal stress resistance

- ✓ 400V BEV's use enamel PAI as standard solution (typically 40-80 µm thickness)
- ✓ 800V drive-trains need better insulation resistance → PEEK coatings are the preferred solution (bringing additional efficiency gains)
- ✓ PEEK is available as single layer (superior) or dual layer coating solution (> 100µm)

Bekaert Ampact™



Ampact™ = Single layer PEEK

800V coating assessment	Enamel PAI	PEEK
High performing motors with high Cu density	=	+
Optimised winding processes (manufacturing)	=	+
Thermal endurance & chemical resistance	=	+
Smaller and lighter stator	=	+
Sustainability & Regulation	=	+
Lifetime	=	+

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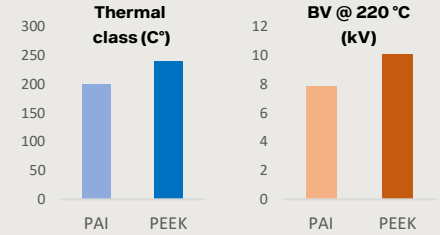
Bekaert Ampact™ as optimal solution for your next e-motor!

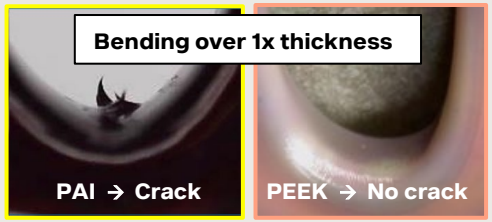
A superior product with a high TCO value

The ideal solution for e-motor applications

- ✓ Keep strong insulation performance after high thermal endurance



- ✓ Excellent flexibility enables tight hairpin bends and stator design benefits



Delivering high system TCO to electric drivetrains

E-motor/E-Axle **Battery pack**

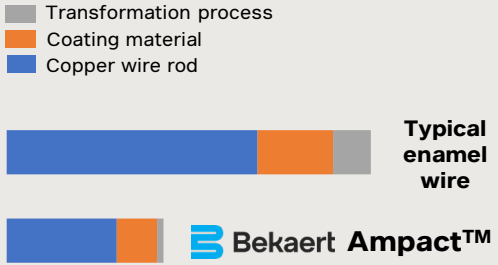
Full system benefits of using PEEK

- ✓ **Save on battery** size or extend the driving range
- ✓ Enable more **cost-efficient production methods** like continuous winding (wave-winding)
- ✓ Reduce overall material consumption by supporting compacter motors (↘ **BOM**)
- ✓ Lowered carbon **emissions** (on material level or during driving stage)

Bekaert as preferred supplier

- ✓ Global manufacturing footprint
- ✓ Global R&D & Engineering capabilities
- ✓ Technology development
- ✓ Established business partner for automotive sector
- ✓ IP-secure solutions
- ✓ High focus on **sustainability**

CO_2eq. Comparison



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