

Electric motor innovation through digital materials testing

We collaborated with Victrex and IBM through the Hartree National Centre for Digital Innovation (HNCDI) to develop a computational workflow for understanding material behaviour at the molecular level, enabling rapid screening of high-potential candidate materials for electric motor applications.

Challenge

Electric motors are critical to cleaner transport. An important component in these motors is the insulation coating the wires inside them. These coatings must withstand extreme temperatures, chemical exposure and significant mechanical stress during manufacturing and use. Victrex, an organisation specialising in high-performance coating polymers, found that during electric motor manufacturing, wire-bending processes were causing these coatings to crack, which can compromise motor reliability and lifespan. Traditional testing of new materials is slow and expensive, so Victrex needed a new way to deepen their understanding of how molecular composition influences material failure to design better-performing coatings with greater confidence and speed.

Approach

To address this challenge our team developed a computational workflow using molecular modelling. This allows digital representations of polymer structures to be built at a molecular level, varying characteristics such as molecular size, branching patterns and chain compositions. These virtual materials are then subjected to simulated mechanical stress conditions mirroring real-world wire-bending processes. This gives Victrex a tailored virtual laboratory for testing coating resilience, generating clear evidence about which material designs will work best in electric motors before investing in expensive physical prototypes.

“Building on previous Victrex-HNCDI collaborations, this project demonstrated how using state-of-the-art computational modelling of high polymers can provide deep, rapid insights into complex application-related challenges and the materials science underlying them.”

Professor John Grasmeder

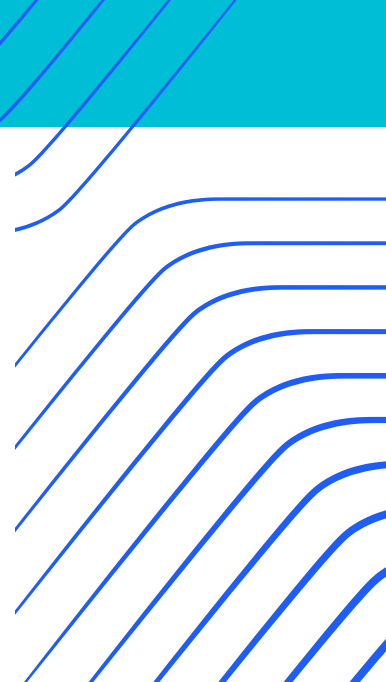
Victrex



Credit: Canva

Benefits

Virtual testing dramatically cuts the time, cost, and resources needed to develop new materials for electric motors. Instead of months of physical experiments, Victrex can simulate hundreds of options quickly, identifying the most promising candidates and focusing their R&D investment wisely. This means faster development of better-performing motor insulation, leading to more reliable electric vehicles with longer lifespans and reduced maintenance for drivers. By understanding exactly why materials fail, Victrex can engineer plastics designed for resilience, strengthening UK capabilities in critical clean technology supply chains.



At a glance

- Prediction of material performance under mechanical stress in electric motor applications
- Evidence-based material selection reducing R&D risk by identifying failure mechanisms before manufacturing
- Virtual testing replacing costly physical testing, enabling rapid exploration of material formulations
- Strengthening UK manufacturing with computational innovation in materials development for clean technology

The programme

The Hartree National Centre for Digital Innovation is a collaboration between the Hartree Centre and IBM which offers a safe and supportive environment for UK organisations to explore the latest digital technologies and skills, develop proofs-of-concept and apply them to industry and public sector challenges.

Who we are

The Hartree Centre was created by UK Government to help businesses and public sector organisations accelerate the adoption of high performance computing (HPC), big data analytics, artificial intelligence (AI) and quantum technologies. We play a key role in realising UK Government's Industrial Strategy by stimulating applied digital research and innovation, creating value for the organisations we work with and generating economic and societal impact for the UK. We are proud to be part of UK Research and Innovation.

What we do

- Boost productivity and innovation for industry
- Offer training and skills development
- Provide insights into future technologies
- Give tailored business development support

