



Additive  
manufacturing

Sustainable  
manufacturing

Advanced  
polymer  
products

Innovation

Nano  
manufacturing

Collaboration

Industry  
focus

# Project Summary

June 2022

**NW****CAM**

North West Centre for Advanced Manufacturing

# Denroy

# denroy<sup>®</sup>

## Company overview

Denroy, an SME located in Bangor, is a leading innovator in the design and manufacture of engineered polymer components and solutions. With state-of-the-art manufacturing facilities, Denroy caters for customers in a range of sectors, including aerospace, automotive, medical, defence and haircare (with the proprietary hairbrush brand Denman<sup>®</sup> being exported to 60 different countries around the world). Research and innovation are central to Denroy's success. The company currently focuses on research and technology in areas such as hybrid moulding/composite overmoulding, thermoplastic composites, thermoplastic welding and joining, and advanced 3D printing.

## The projects

- Development of high performance PEEK composite
- Assessment of recyclability of multifunctional PEEK composites

## Industry focus

The key objective of the research was to investigate how polyetheretherketone (PEEK) polymer could be used as an injection moulding material for biomedical applications such as spine and knee arthroscopy, joint reconstruction, and dental implants.

With the aim of increasing the biocompatibility of implants, the project investigated ways of improving the electrical conductivity of the company's PEEK products. The research team explored the impact on electrical conductivity of using conductive particles and cellular structures found in bone to produce foam PEEK.

In line with Denroy's organisational value of innovation (specifically reducing waste and promoting continuous improvement), work was also undertaken to explore the functionality of recycled PEEK composites. Greater use of such composites has the potential to reduce consumption of raw materials and strengthen the circular economy within manufacturing practices and processes.

## Research partnership

Denroy was partnered with Ulster University's Advanced Future Materials & Manufacturing group in the School of Engineering at Jordanstown. The extensive polymers research and expertise within Ulster University provided the appropriate partnering arrangement to meet the research challenges set by Denroy. The research team included two co-investigators, one research assistant, and one PhD researcher.

## Project outputs

The projects enabled Denroy to experiment with its current manufacturing process (using polymers) in order to enhance its understanding of how the material's properties changed when placed under different conditions. The analysis considered the density of material in varying temperatures and the effect of particles on the hardness of materials. Modelling techniques were employed to provide a deeper insight into the effect of varying conditions on the properties of polymers. The projects provided Denroy with a deeper knowledge of condition-dependent polymer performance and the optimum processing environment. As a result, Denroy is now well-placed to expand its product offerings, explore new applications of its polymers, develop smarter advanced-manufacturing processes, and increase productivity and efficiency.



The research has led to the generation of an invention disclosure which has been submitted to Ulster University's Innovation Office for consideration of protectable work.

## Project benefits

- Access to academic R&D expertise
- Commencement of invention disclosure process
- Cross-border collaboration between Ulster University, Trinity College Dublin, NUI Galway and the University of Manchester to deepen the understanding of high-performance PEEK material
- Development of two-way knowledge exchange between Denroy and Ulster University
- Establishment of a strong research-led relationship between Denroy and Ulster University, resulting in collaboration on non-NWCAM projects (e.g. a project focusing on the recyclability of PPE and transformation of PPE waste into manufacturing grade plastics)
- Increased competitiveness of the life and health sciences sector through innovation
- Industry-related skills development of academic researchers
- Knowledge dissemination to the wider life and health sciences sector through academic publications and conference presentations

- Technology transfer from Ulster University to Denroy
- Upskilling of Denroy staff with regards to advanced manufacturing processes that can be applied to new product development innovations

## Project legacy

NWCAM's project with Denroy was supported by several researchers, including PhD student Sean Duffy. Commenting on the expertise developed through his NWCAM journey Sean noted: "The research has been exciting and NWCAM provided a lot of opportunities [...] to network with project partners and industry. The project aimed to expand the skills and knowledge of PhD students. I benefitted greatly from training on specialist techniques which I used during my PhD and will continue to use throughout my career."

John Irwin, MD of Denroy, stated: "Time and again, collaboration with our colleagues in academia produces value for Denroy, advancing our knowledge and providing a platform for researchers such as Sean to integrate into industry; making the whole R&D ecosystem so much richer."