HEXAGON

Case study

ICME for post-industrial and post-consumer recycled engineering polymers

Accurately predicting mechanically recycled engineering polymers

Digimat for sustainable materials

RadiciGroup High Performance Polymers is providing mechanically recycled engineering polymers. As developing recycled polymers for high-end applications is a challenge in and of itself, RadiciGroup High Performance Polymers turned to Hexagon's Digimat and Marc to create an advanced predictive approach to provide customers the confidence these sustainable materials will meet their application requirements.

RadiciGroup High Performance Polymers has validated three recycled products. One Post-Industrial Recycled (PIR) grade and two Post-Consumer Recycled (PCR) grades originating from airbag waste and from wheel cover waste. The impact of recycled engineering materials based on a Life Cycle Assessment is a CO2 reduction of an astonishing 84% to 88% compared to similar virgin materials.

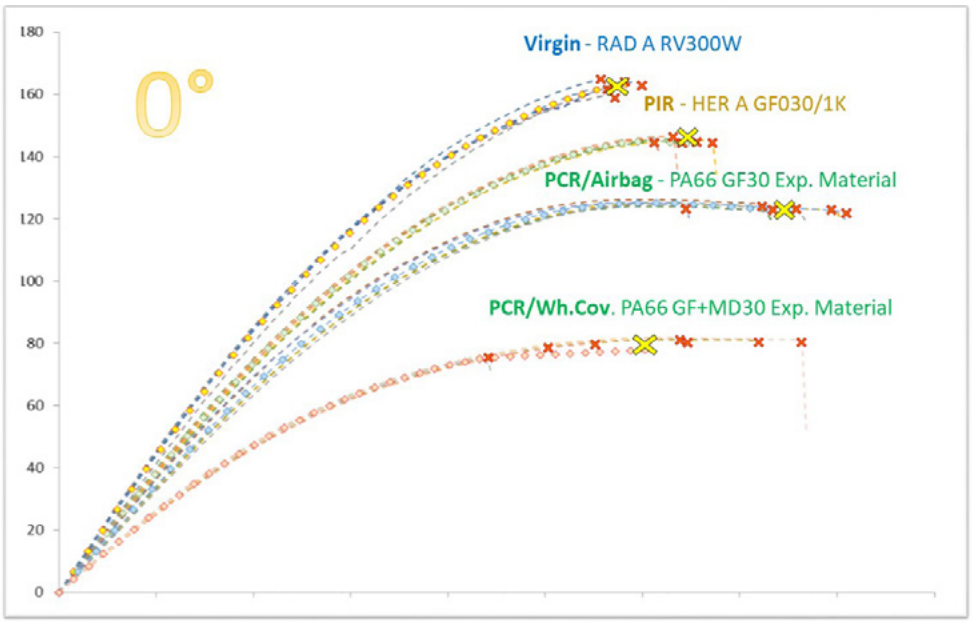

Figure 1: Tensile test data of a virgin material reference and three recycled grades

Challenge

The tensile test data in Figure 1 is an initial indication of the challenge for material development and commercialization of recycled polyamides 6.6. Three recycled compounds have been compared to a virgin reference, the PIR GF030/1K, the PCRPA6.6-GF30 with end-of-life airbags content, and the PCR PA6.6-GFMD3015 with recovered wheel covers percentage.

Variation in material performance among the three grades and a virgin material reference shows the performance dependence on the sourced materials. An advanced predictive approach is required to convince customers these sustainable products will meet their application requirements.

Solution

RadiciGroup High Performance Polymers has used Digimat and Marc to reverse-engineer material cards based on the microstructure, tensile test data and micro-mechanical modelling. Additional processing steps in the recycling

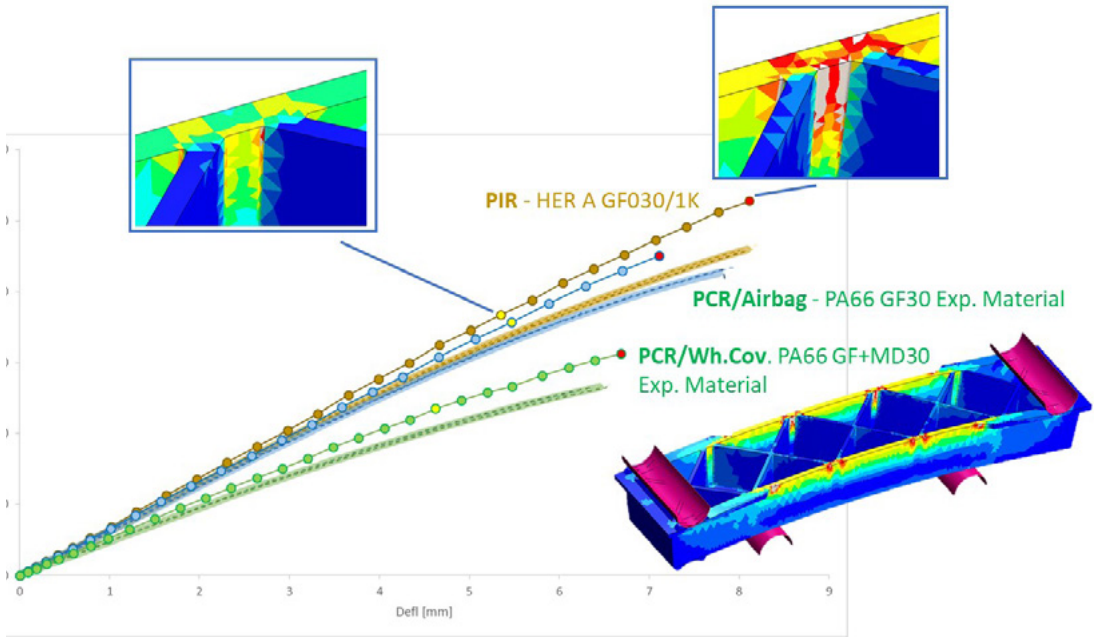

Figure 2: Validation of the Digimat reverse-engineered material cards for three recycled grades

process make the microstructure a critical component in the material behaviour of recycled engineering polymers. Fibre length distributions, affected by grinding and compounding, are accurately captured in the Digimat material cards.

Results & benefits

With a convincing validation in Figure 2, RadiciGroup High Performance Polymers used the PCR grade and the predictive approach in a misuse test for an adjustable desk actuator housing. Comparing the PCR grade with a similar virgin material in a full predictive approach shows the strength of the recycled engineering polymer. In Figure 3, an overview of the predictive approach is depicted. Combining the adjustable desk actuator model with the fibre orientation distribution in Digimat yields two FEA models that are analysed in Marc. The misuse test for the actuator housing applies a maximum electric motor torque of 6Nm on the housing. The predictive approach shows that the PCR grade is able to handle that level of misuse.

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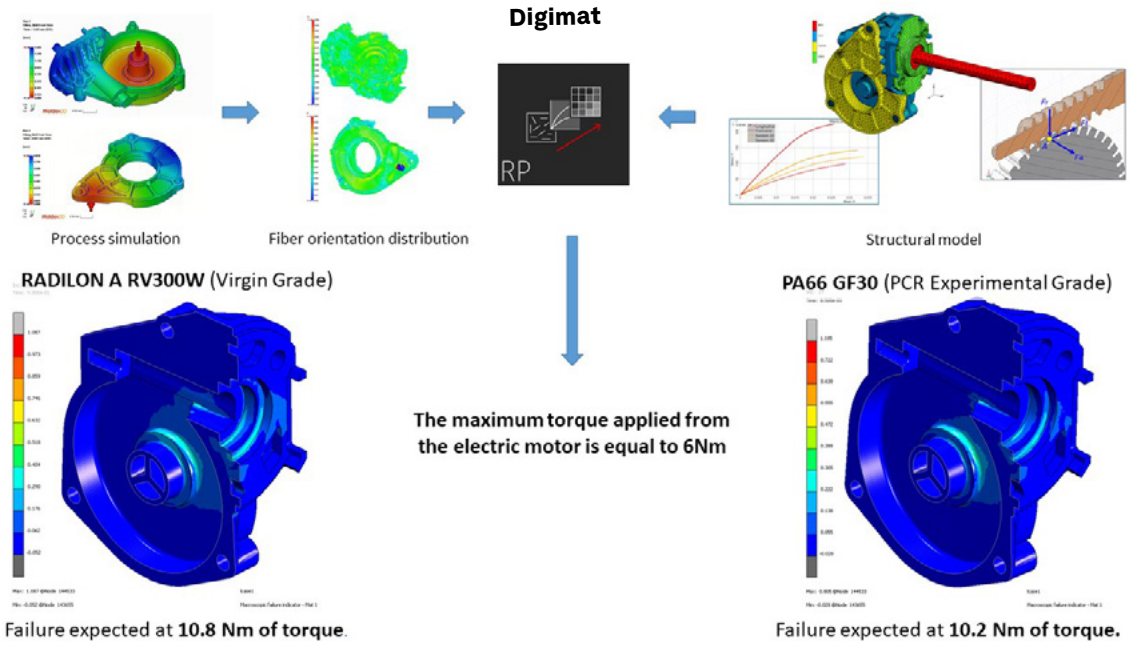

Figure 3: Predictive approach comparing a virgin grade (left) and a post-consumer recycled grade (right)

> **"RadiciGroup High Performance Polymers has used Digimat and Marc to reverse-engineer material cards based on the microstructure, tensile test data and micro-mechanical modelling."**

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Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

Hexagon's Manufacturing Intelligence division provides solutions that use data from design and engineering, production and metrology to make manufacturing smarter. For more information, visit hexagonmi.com.

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