

# REDUCED PROCESSING COSTS

Toray Cetex® TC1225 Engineered PAEK

WHITE PAPER

# Cetex®

## INTRODUCTION

Over the last decade, there has been a lot of attention for thermoplastic composites with matrices from the PAEK (Polyaryletherketone) group. PEEK and PEKK based composites, also in Toray's Cetex® thermoplastic product range, are among the best materials on the market in mechanical performance, chemical, and heat resistance. Toray has now developed Toray Cetex® TC1225, engineered PAEK composites in its portfolio, combining the high service temperature and outstanding mechanical and chemical properties of other PAEK family materials with a lower processing temperature, and exceptionally good processing characteristics. Toray Cetex® TC1225 is available in an excellent quality UD tape, fabric reinforced prepregs, and fabric reinforced thermoplastic laminates.

## TAPE QUALITY IS AN IMPORTANT CONSIDERATION

The growing use of thermoplastic composites in large parts and demanding industries such as primary and secondary aircraft structures causes a demand for materials that are suited for large-scale production and process automation. For these ends, it is critical that the basic needs are met in the UD materials that are used; uniform fiber and resin distribution and an extremely low void content. Toray's production processes achieve a high-quality tape that is the best on the market in these aspects and guarantee reproducible results.

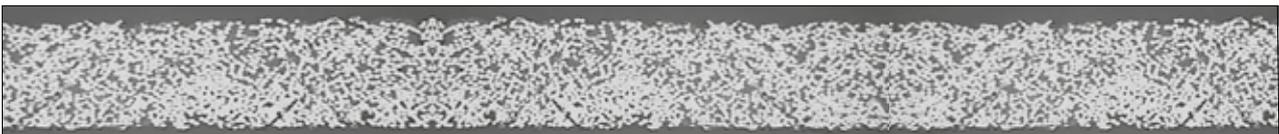


Figure 1. A cross section photo showing a Toray Cetex® UD tape

# TORAY

Toray Advanced Composites

## TORAY CETEX® UD TAPES:

- ▶ Uniform fiber distribution
- ▶ Even resin distribution around the fibers
- ▶ Low void content
- ▶ Low tension in tape
- ▶ Constant quality

## PROCESSING OF TORAY CETEX® TC1225 UD TAPE

Toray now offers a material that also distinguishes itself in the flow properties of the resin and is also consistent with the above stated process automation operations: Toray Cetex® TC1225 UD tape, based on an engineered resin system from the PAEK family. The low melt viscosity of the resin system guarantees a good bond between the different layers of a laminate, while the mechanical properties of the product stay on par with other PAEK family-based composites such as PEEK and PEKK. Combined with the relatively low processing temperature of the UD tape, this aids in speeding up the production process.

While composite parts from UD tapes are often press consolidated, or autoclave consolidated, TC1225 achieves excellent results in vacuum aided oven consolidation. Out-of-autoclave processing is viewed as a next generation process and has great potential to bring down the processing time, costs, and energy usage considerably.

When a product needs to be formed in a secondary operation, Toray Cetex® TC1225 does provide the possibility of shortening processing times even further because of its lower processing temperature. This is very similar to the savings made with the same resin system in reinforced thermoplastic laminates.



*Figure 2. Press consolidation provides a robust and proven baseline process*



*Figure 3. State of art. Toray Cetex® TC1225 looks good—results in a fast vacuum-aided oven consolidation process*



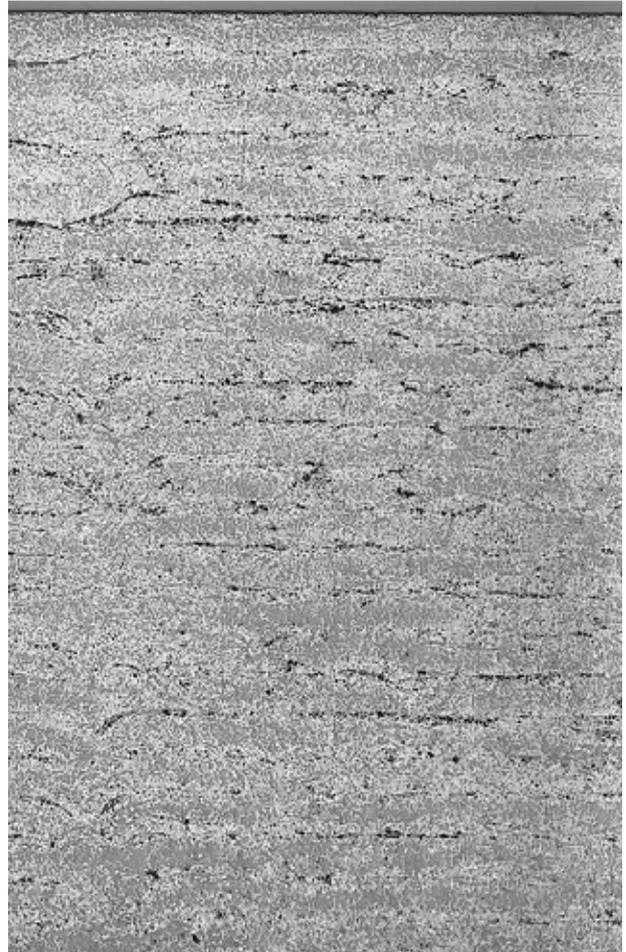
*Figure 4. Nearing the ultimate goal: Toray Cetex® TC1225 looks promising—results for full in situ tape placement*

## PROCESSING TORAY CETEX® TC1225 REINFORCED THERMOPLASTIC LAMINATES

Toray's fabric reinforced Cetex® TC1225, based on the same engineered PAEK matrix material, offers a solution to those companies seeking to combine the optimum in material properties with a reduced processing temperature. TC1225 facilitates processing with 50–75°C (122–167°F) lower temperatures compared to PEEK, but with comparable mechanical and chemical properties and even a similar glass transition temperature. The service temperature of a part is dominated by glass transition temperature, whereas the processing temperature is dominated by crystallization temperature.



*Figure 5. Micrograph after tape placement and oven consolidation*



*Figure 6. Micrograph after in situ tape placement at deposition rates >200mm/s*

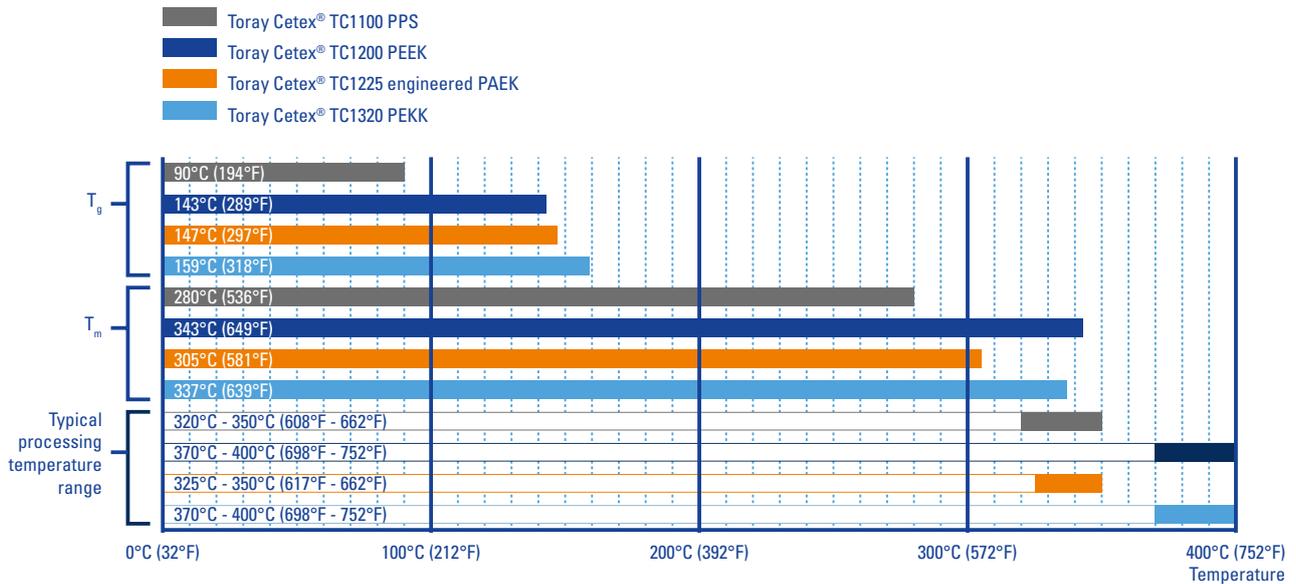


Figure 7. TC1225 offers benefits in with a lower processing temperature range while maintaining a high  $T_g$

The common denominator in most PAEK family materials is that they require to be processed in high-temperature equipment, and may require high capital investment in machinery and tools. This requirement can even appear daunting to companies already equipped to process other high-heat thermoplastic composites such as PEI and PPS. The lower processing temperature of TC1225 reduces the heating and cooling cycle, saving time and energy costs. Where semi-impregnated preregs are used in place of consolidated laminates, Toray Cetex® TC1225 low melt viscosity resin system will consolidate faster and shorten the cycle time compared to PEEK or PEKK materials.

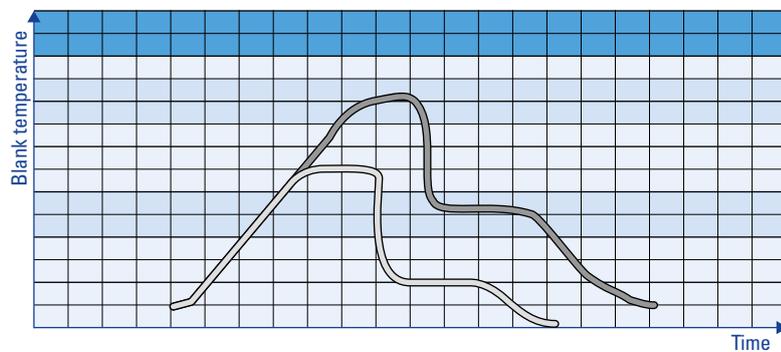


Figure 8. A lower processing temperature results in a shorter production cycle

## OVERMOLDING TORAY CETEX® TC1225

Toray Cetex® TC1225 also gained considerable attention over the last year at tradeshows and online as an ideal material for overmolding purposes. When a continuous fiber part made from Cetex® TC1225 is overmolded with either a filled or non-filled PEEK resin, the difference between the melt temperature in the two materials does establish a superior bond. A grid stiffened panel demonstrator made within the framework of the COMPeTE project that Toray supported shows the possibilities of combining the design freedom of an injection molded product with the superior mechanical properties of a continuous fiber reinforced laminate.

To read more on the project and the grid stiffened panel, please visit the TPRC website <https://tprc.nl/tprc-successfully-finalizes-overmolding-project-aerospace-automotive-partners/>

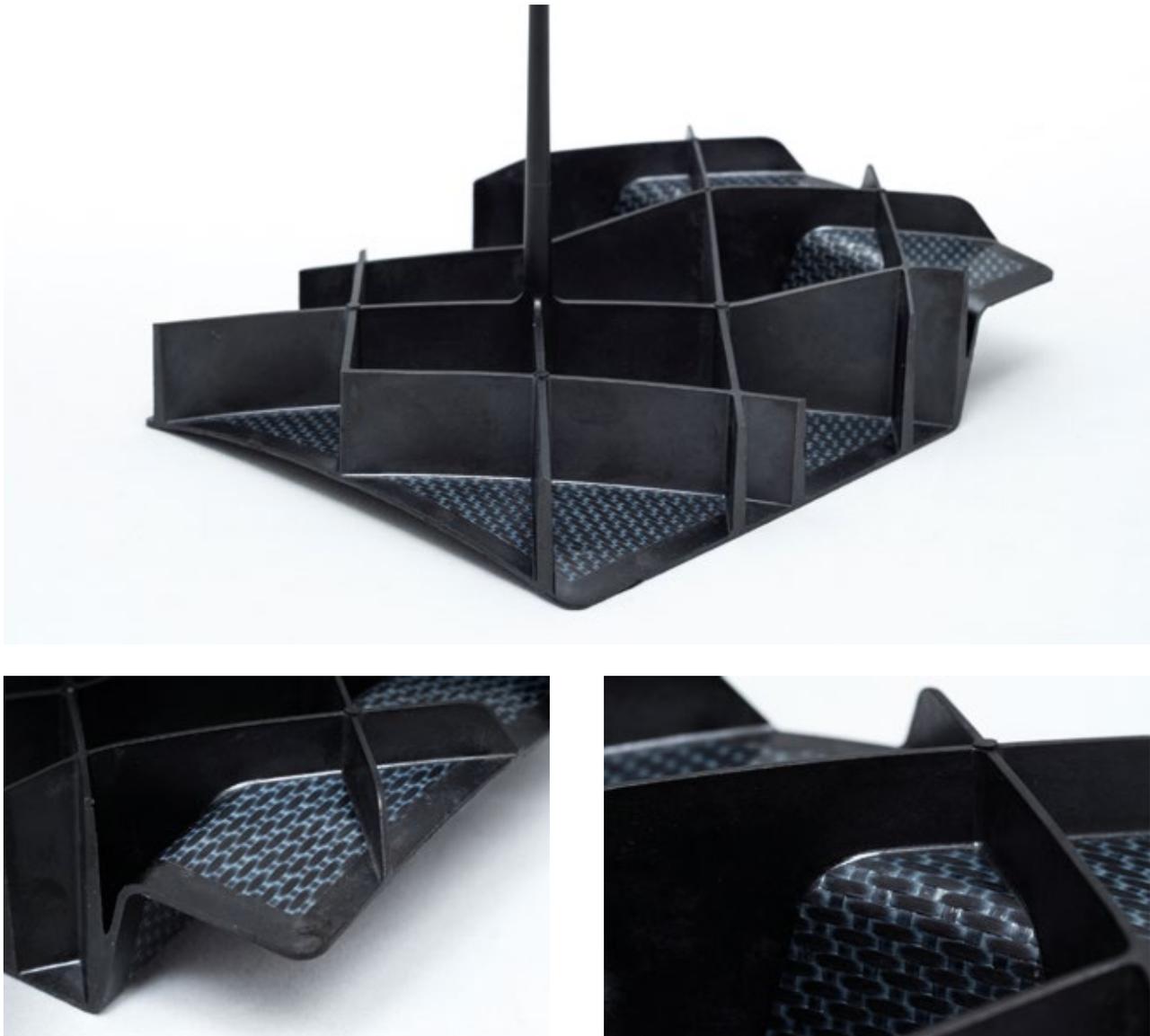


Figure 9. Grid stiffened panel

# LOCATIONS AND CAPABILITIES

## SOLUTIONS

- Thermoplastic composites
- Thermoplastic laminates

- Thermoset composites
- Carbon-free manufacturing

- Parts manufacture
- Sales office

## CERTIFICATIONS

- ISO 9001:2015
- AS9100D

Fairfield - California, United States

- ● ● ● ● ■ ■

Morgan Hill - California, United States

- ● ● ● ● ■ ■

Camarillo - California, United States

- ● ● ● ● ■ ■

Nottingham, United Kingdom

- ● ● ● ● ■ ■

Nijverdal, The Netherlands

- ● ● ● ● ■ ■

Toulouse, France

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Beijing, China

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Guangzhou, China

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Taichung, Taiwan

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