TPAC Newsletter

Edition July 2020

TPAC in your Mailbox!

Dear reader,

A lot has changed since our last newsletter: Covid-19 has an unprecedented impact everywhere. We hope you and your family are safe and healthy and hope both your personal and professional life are minimally affected by the current crisis.

After some weeks of complete closure, we at TPAC are now in the fortunate situation, to have been granted conditional access (respecting Covid-19 health and safety regulations) to our office and lab space. Although this will undoubtedly affect our activities, we are very pleased that we are back at work and can continue running our projects!

This newsletter gives an overview of our latest activities, ranging from project progress and novelties to other relevant TPAC-related news items. As usual, in addition, you can always follow the latest of TPAC on:

- thermoplasticcomposites.nl
- linkedin.com/company/thermoplasticcomposites
- twitter.com/TPACNL

We wish you all the best in the coming summer weeks and stay healthy!

Kind regards,

Ferrie van Hattum

Newsflashes

World's first flying fully recycled thermoplastic composite application in aerospace.

In our TPC-Cycle project a rotorcraft access panel from recycled carbon PPS was designed and flight tested. Read more about it here: https://thermoplasticcomposites.nl/rotocraft-access-panel-from-recycled-carbon-pps/

Recycling thermoplastic composites with partners GKN Aerospace, TPRC, Cato Composites, DTC, Toray Advanced Composites, NRT, SIA and Saxion.

Practical Injection molding at TPAC

First year mechanical engineering students from Saxion were introduced to injection molding at the TPAC laboratory.

For more information, and a video, go to: https://thermoplasticcomposites.nl/practical-injection-molding/

Composites NL board

TPAC's technical director Ferrie van Hattum joined as new board member of the Dutch Composites Association (Composites NL). He will be focussing on streamlining education with Dutch SME's needs.

Cleantech Center

Cleantech Center wins the Pro-motor award 2020! Together we worked on the riverplastics project to clean the Ijsel and produce clothing made from the plastic waste material.

Rotorcraft access panel from recycled carbon PPS

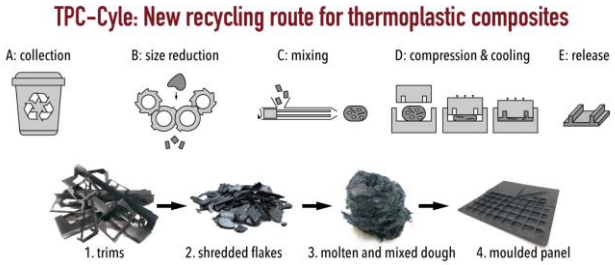
World's first flying fully recycled thermoplastic composite application in aerospace.

Within TPAC's TPCCycle-project, a rotorcraft access panel has been developed and succesfully flight tested. Utilizing a novel recycling route, the panel is lighter, more cost-effective and of recycled thermoplastic composites.

To demonstrate a novel recycling route for thermoplastic composites, an integrally-stiffened access panel door for a rotorcraft was selected for detail design, testing and actual flight tested (for more information, see here).

The design, development and validation followed the traditional 'Building Block approach'. The used material is carbon fibre reinforced PPS from post-industrial waste. The material originates from off-cuts generated in the production of components for the same rotorcraft as the access panel doors will be mounted on. This scenario helps to control the traceability of the recycled access panel door/scrap material. The development of such an application improves the logistics as well as the supply and demand for recycled TPC. Material data was gathered from mechanical tests and used to predict the panel's strength and stiffness. The stringer design was optimised with regard to part stiffness and internal stress distribution, using FEM simulations. A critical design detail was selected and tested for validation, i.e. flexural tests on bolted joints.

This section was included in a preliminary manufacturing demonstrator, along with other integrated design features, such as thickness transitions and various types of stiffeners. The manufacturing demonstrator enabled testing of the manufacturing limits regarding design and processability. The final panel door design was successfully produced and tested on component level. The proprietary re-manufacturing process includes the following steps: 1. Shredding of waste to centimetre-long flakes; 2. Simultaneous heating and low-shear mixing; 3. Compression moulding in an isothermal mould.



This offers the opportunity of retaining long fibres and therefore reaching high mechanical properties at the characteristic short cycle times of isothermal compression moulding. In comparison to the current carbon/epoxy hand lay-up solution, the new product is lighter, significantly more cost-effective and made of recycled material (fibre and matrix). The recycled thermoplastic access panels have been successfully flight tested.

For the complete article about the rotorcraft access panel, see here.

If you would like to know more about the TPC-Cycle project this, see here.

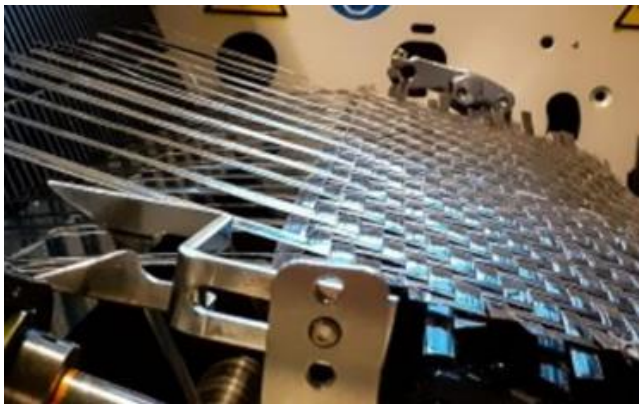
This research is co-financed by Regieorgaan SIA, part of the Dutch organization of scientific research (NWO).

CTCP – Circular Thermoplastic Composite Production

This research project subsidised by RAAK started at the end of 2019. The project is the result of a collaboration between two HBO's: NHL Stenden (GreenPAC) in Emmen and Saxion (TPAC) in Enschede. The focus in CTCP is on the circularity of thermoplastic composites, and we want to achieve this by using renewable raw materials or recyclable concepts such as single-polymer composites. The research of both the research groups from Emmen and Enschede complement each other well on this theme.

The participating SMEs come from various branches, such as the tape manufacturer CompTape, makers of non-wovens (BNP Brinkmann and Q-Nonwovens), the furniture manufacturer VEPA and thermoforming company Plastica. And of course branch organisation CompositesNL is represented.

Various fibres and matrix materials have now been purchased and the first tapes have been made.



These tapes can be used in various production technologies, such as barrel wrapping and tape-laying. But in this project we will also process the tapes into semi-finished products by weaving them. The weaving of tapes is unfortunately not possible on standard machines and we are now developing an adapted weaving machine of which a wooden prototype has now been built in the TPAC lab.

This research is co-financed by Regieorgaan SIA, part of the Dutch organization of scientific research (NWO).

Rik Brouwer

FIXAR – Future Improvements For Composite Sustainable Automated Repair

Project FIXAR officially started in November 2019, is aimed to develop knowledge and techniques in sustainable composite repair solutions. The applied research project will cater towards the Dutch wind and aviation sector.

Partnering with the Dutch wind and aviation companies, the research is aiming to answer the following key questions :

- Identifying repair solutions suitable for automation
- Repair methodologies for thermoplastics including validation
- Innovative NDT inspection techniques
- Automation of test results

In the coming months experimental research will be conducted using induction welding techniques to study the behaviour of thermoplastic welded joints followed by mechanical testing to validate the welded joints

This research is co-financed by Regieorgaan SIA, part of the Dutch organization of scientific research (NWO).

Esha Mohindru

B-hout Behoud (Wood Preservation)

In October, *TPAC* started the project *B – Hout Behoud*, in collaboration with *Rouwmaat* and *Innodeen*: it develops from the idea of preserving the recycled wood from incineration and so, recovery of the waste materials coming from constructions, by manufacturing wood fibre reinforced composites from it.

Most of the waste streams from demolition is B-wood: this category contains coatings, adhesive, paintings and

fixing materials, but for the most part consists of wood with still good properties.

Thus, the aim of the project is to investigate the possibility to make wood-fibre composite not only from the virgin wood without other organic materials (called "*A-wood*" as well), but also from *B-wood*. This could lead to a much higher quality application of this waste stream, having moreover a favourable cost price as a raw material.

Currently, some important steps have been done already: it has been shown that shredding leads to the production of fibres that can be used in the processing. Besides, compression moulding of composites with wood fibre and polypropylene have been produced.

Furthermore, the possible harmful materials inside the B-wood have been investigated and a threshold degradation temperature for the processing has been established.

Next important steps are the extrusion process and the mechanical tests.

This research is co-financed by Regieorgaan SIA, part of the Dutch organization of scientific research (NWO).

FibreRec

Within FIbreRec the focus goes to the application of recyclates in TPC: the use of continuous (glass) fibres in recycled products. Hereby focus goes to material properties, processability for tape production, rotation moulding and injection moulding, and some demonstrator products.

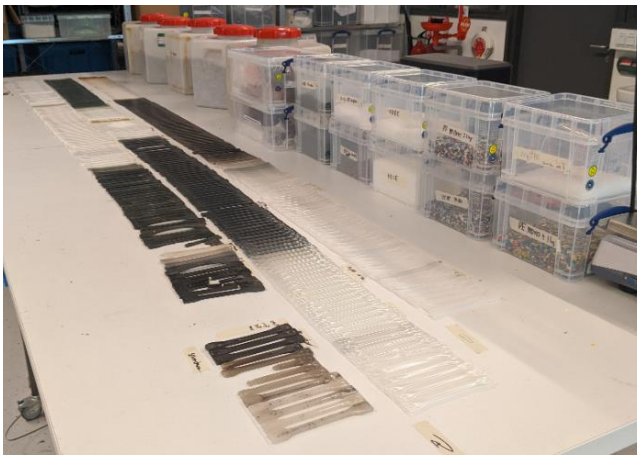
A new tape production was held, hereby glass fibre tapes where made with recyclates from PE, PP, polluted PE/PP, PEPP 20-80, PET and textile PET.

Tetrapak LDPE material was recently added to the research project. Apart from the processability and material research, a student team is working on concept designs. They are researching the possibilities of this material and looking for the best concepts. In this team six students with different backgrounds work on this assignment for half a school year.

A master student has started with his internship looking at the possibility to redesign a man hole cover, reinforced with composite material. He is approaching his assignment via finite element analysis. First starting with simulating the current design, and slowly moving to different composite designs, some combined with fibre inserts.

Furthermore a large dogbone production session was held, with all considered materials. This was done for two reasons:

- To check if the recyclates can be used for injection moulding;
- And to do tensile tests and gather mechanical behaviour of the different materials.



For the coming period more mechanical testing is planned, but on tape level. Apart from that the demonstrator cases are selected and the option to look more into rotation moulding is reviewed.

This research is co-financed by Regieorgaan SIA, part of the Dutch organization of scientific research (NWO).

Ilse ten Bruggencate

Compression moulding recyclates

Currently, we are running multiple projects one-on- one with a partner. In these projects we are examining the possibilities to compression mould recyclate or virgin material with long fibres, by means of low shear mixing the material.

Because we notice that the question regarding low shear mixing becomes bigger, we are also looking into finding a more industrial solution than our current lab set-up.

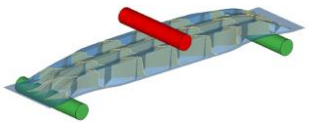
Ilse ten Bruggencate

This research is co-financed by Tech For Future.

MERGEurope - 3DFaim

TPAC is part of the MERGEurope network, where project partners of the Czech Republic, Spain, Italy, the Netherlands, Poland and Germany are working together, including both industrial as well as academic partners. The MERGEurope network originates from Chemnitz, as part of the MERGE cluster, consisting of more than 400 European partners in economy and industry. This cooperation intends to develop a competitive network of the strongest lightweight regions in Europe, of which TPAC is part.

Within MERGEurope, TPAC is main partner in the 3DFaim-project, where a thermoplastic composite automotive side impact bar is studied. Continuous fibre reinforced thermoplastic composite inserts, 3D printed using the technology developed at TPAC, are used to be integrated in the overmoulded impact bar. FEM-simulations show a significant improvement of the overall impact energy absorption of the part.



Manufacturing of the parts on the fully automated overmoulding facilities at TUChemnitz is foreseen this fall. Beside our colleagues at TUChemnitz, and some of the MERGEurope partners, the project involves the Dutch company CompTape, as supplier of the composites tapes used. TPAC's activities in the project are made possible by financial support of the Province of Overijssel.

Ferrie van Hattum

Rightweight

Where Aerospace meets Automotive

Recently the TPAC acquired a new three year project in which the thermoplastic composite knowledge of aerospace industry is exchanged with the automation knowledge of the automotive sector. The Interreg project, called 'Righweight' will focus on knowledge transfer to companies who want to develop TPC technology in their production organisation.

Typically, automotive is interested in weight reduction and high volume/low cost solutions. TPC materials are potential candidates for automotive, as long as material and processing costs are low. The application of e.g. glass-PP composites could meet this need, where manufacturing knowledge from aerospace (e.g. product consolidation, continuous fibre manipulation and welding) could unlock the potential of TPC applications in automotive.

Vice versa, TPC manufacturing requires repetitive and reproducible processing. The automation knowledge from automotive can be of high value for the aerospace industry technology, which is confronted with increasing production volumes. Potential examples are robot technology, vision and other quality control technologies.

Knowledge is shared by the participants in open workshops. Interested companies can obtain a voucher to finance applied research on their products with one of the research institutes involved.

The project is a collaboration of clusters like TPAC in the European Lightweight Clusters Alliance (ELCA). Participants are: Karlsruher Institut für Technologie

(IPEK) (De), Flanders Make (Be), Plastipolis - pôle de compétitivité Plasturgie & Composites (Fr), Cluster NanoMikroWerkstoffePhotonik NMWP Management GmbH (De), AutmotiveNL (NL), and distretto sull'Ingegnerio die Materiali polimerici e compositi e STruttue scarl (IMAST) (IT).

Rik Voerman

This research is co-financed by INTERREG NWE from the EU.

SBB accreditation

Since 2019 TPAC is SBB accredited (Erkend leerbedrijf). This means students from vocational education (MBO) can do their traineeship in our lab. Last year a number of MBO students have been busy improving and modernizing existing machines.

New control panels have been designed and built for the machines, extra safety precautions have been taken and thorough maintenance has been carried out.

Remi Hoefman

At the moment one of the students is busy converting the already purchased conventional milling machine to CNC controlled machine.

New emoplyee

In May Sotiris Koussios joined our TPAC team. He has a background in Mechanical and Aerospace Engineering. You can generally describe Sotiris as a results orientated and hands-on professional. He has an extensive track record in industry and academia. Broad experience in fund raising, project management and set-up of spin-off companies with emphasis on no-nonsense, pragmatic approach without sacrificing scientific rigor. Solid background in scientific dissemination through teaching, supervising, presenting at conferences and workshops, advising, publishing, reviewing and acting as a board member for various committees and programs at national and international level. Author of more than 150 publications.

Sotiris will focus his attention within TPAC on kinematic and dynamic simulation of a generic 6-axes robot. But also on the simulation and process optimization of multi-axes, robotic filament winding, FEM analysis and structural optimization of thermoplastic composite products.

Sotiris Kousious

We welcome Sotiris to our team, and wish him the best of luck!

Colofon

If you might have any questions after reading this newsletter, please contact TPAC directly:

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