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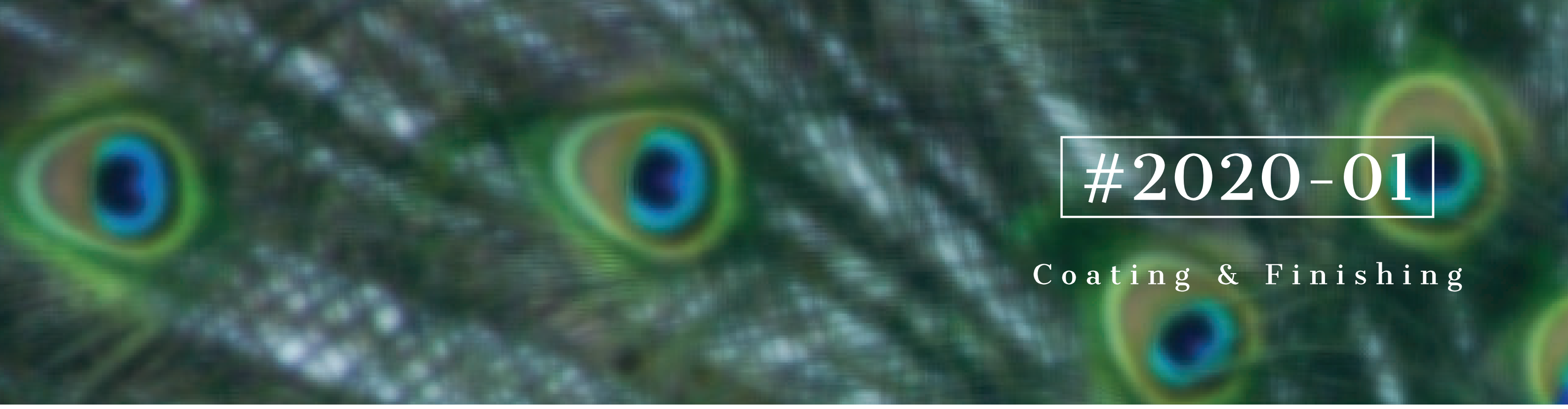

Changes and Challenges

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2020 will be a challenging year for many of us, with a few hurdles that are still unclear. A number of changes are imminent within our research. Although changes are always difficult, they are never without opportunities.

This year the **COOCK**[1] projects (Collective Research, Development & Collective Knowledge Dissemination) will start, a new type of project initiated by VLAIO, Flanders Innovation & Entrepreneurship, aimed at sharing and transferring our knowledge with and to companies, through business cases in which the feasibility of materials and technologies are tested.

A first theme concerns bio-based/biodegradable coatings. In **BioCoat**[2] we fine-tune our previously acquired knowledge on PLA and bioPU coatings to various textile and plastic applications. In **MONET**[3] we demonstrate how and for which applications anhydrous coating technologies are suited, using hot melt, extrusion coating and co-extrusion. In the coming weeks we will organize an information session for both projects. You can register your interest via the dedicated project web pages.

In 2020, the **Moonshot** programme will also be launched, an innovation programme of the Flemish government with the aim of creating a CO_2-neutral industry in Flanders by 2025. Centexbel is in the driving seat for the Moonshot. We are involved in a first **PADDL**[4] initiative in which polymer additives derived from lignin are used to improve the properties (fire retardancy, UV stability, plasticizing effect) of plastics in injection moulding applications and textile coatings.

The expansion of our machine park in the course of last year allows us to broaden our research radius. Within **MONET**, we will deploy our **extrusion coater and co-extrusion equipment**. Within **Plasmasol**, a **Catalisti ICON project**, we use **atmospheric plasma** to laminate and coat materials in order to obtain fire retardancy and antimicrobial properties.

Our **2-component machine** will be used both in our research on bio-based polyurethanes and for the encapsulation of electronics and conductive coatings in smart textiles.

The global outlines of our research themes will be maintained, with a strong focus on bio-based and biodegradable materials, circular economy, smart materials, composites, and new technologies.

These themes are also being researched within the field of coating, finishing, dyeing and printing. We would like to share some of our recently obtained results, both in this first issue of the Centexbel INFO and at our **INFOhappening on June 11th**, our annual contact moment with the companies where we propose new possibilities for your applications through pitches and demonstrations. So, save the date.

Don't hesitate to contact us if you want more information, if you desire to discuss the applicability for your developments, or if you would like to test a feasibility.

The entire Centexbel-VKC team wishes you a prosperous and innovative 2020!

(1) https://www.vlaio.be/nl/andere-doelgroepen/coock-collectief-oo-en-collectieve-kennisverspreiding

(2) https://www.centexbel.be/en/projects/biocoat

(3) https://www.centexbel.be/en/projects/monet

(4) https://www.centexbel.be/en/projects/paddl

Biobased PU without isocyanates

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The production of biopolymers for commercial applications is in full expansion, and the synthetic rubber and textile industries are making a transition to biobased materials. In this respect, the textile sector intends to produce at least 20% of its products from organic material by 2030.

The biopolymers presently used in the production of textile coatings and synthetic rubbers (elastomers) such as polyurethanes can only be applied in a limited number of products and are not entirely biobased. Indeed, polyols and isocyanates are used to synthesize polyurethanes.

The **Bio NIPU**[1] project will therefore research alternative components to synthesize polyurethane. Fully renewable resources - including residual streams from sugar refineries and biofuel production as well as natural oils and fats - will be used in the development of biobased polyurethanes.

Research centres (Centexbel, Universiteit Maastricht, Thomas More Kempen) and chemical companies (Limburgse Urethaan Chemie and Stahl International) will join their expertise to develop high-quality bio NIPU with the desired properties.

The sustainability of the bio NIPU will be assessed by means of a life cycle analysis assement (LCA) to identify the most appropriate composition for large scale production.

Bio NIPU is an **Interreg Vlaanderen-Nederland** project and aims at developing 100% biobased and isocyanate-free polyurethans (bio NIPU) for final products in the textiles and synthetic rubber industries. It will allow research centres and companies in the cross-border region to reinforce their leadership in developing and applying biobased materials.

Project website: https://bionipu.eu/

(1) Bio NIPU is financed within the Interreg V programme Vlaanderen-Nederland, with financial support of the European Fund for Regional Development and cofinanced by the provinces of Oost-Vlaanderen and Antwerpen, the Dutch ministery of Enonomic Affaires and the Flemish Goverment: more info www.grensregio.eu

Smells Like Teen Spirit[1]

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Textiles preventing the development of nasty smells are beneficial to the wearer's comfort, the quality of the product, and the longevity of clothing and other textile products that are difficult to clean on a regular basis, including interior textiles such as curtains, cushions and mattress covers.

Unpleasant odors in textiles are caused by micro-organisms (bacteria) that metabolize human sweat or by the intake of environmental smells from cooking, smoking, etc. Textile odors are mostly controled by biocides, masking agents and cyclodextrins. Because these methods are often ineffective, expensive and/or eco-unfriendly, new alternatives need to be developed.

Biocides reduce the stentch of odor-producing bacteria on textiles, but because of their negative impact on the environment, they may no longer be used in non-medical products.

During the **TOM project (Textile Odor Management)** we have evaluated several eco-friendly and biocide-free formulas and technologies for odor management that comply with the European legislation. The evaluation was carried out by an odor panel test and a GC-MS analysis according to ISO 17299-3[2].

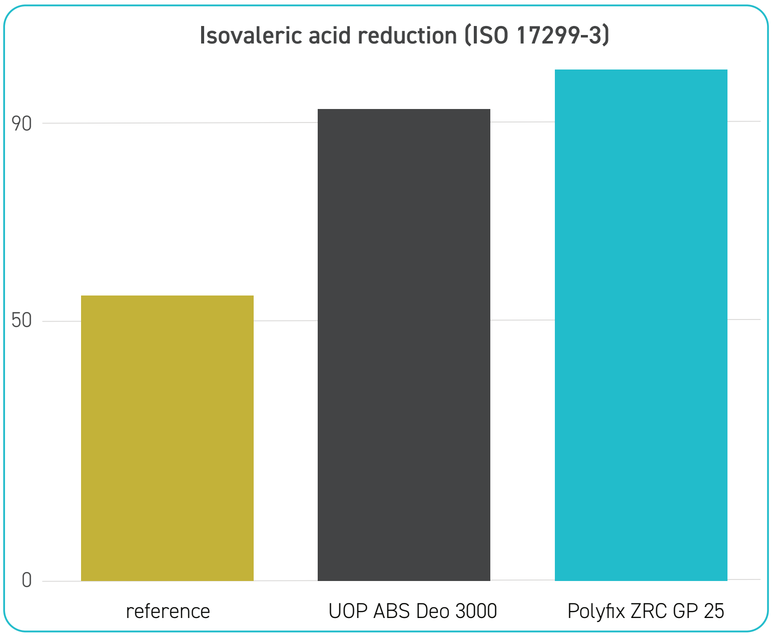
Several products, including activated carbon, cyclodextrins, zeolites and zinc cyclinoleate have been evaluated. All addtitives (except for the activated carbon) have been applied on textiles by padding.

The odor reduction capacity depends on the density, structure, chemistry, and treatment of the textile. Zeolite and zinc cyclinoleate yielded the best results.

The graph shows the reduction of the organic compound isovaleric acid[3] quantified according to ISO 17299-3.

Compared to the reference textile, the textile samples finished with a UOP ABS DEO 3000 and Polyfix ZRC GP 25 treatment show a much higher effectiveness to reduce isovaleric acids.

Both products are therefore suitable odor absorbants to reduce bad smells and improve the comfort of textiles.



(1) When Kurt Cobain (Nirvana) wrote the song 'Smells Like Teen Spirit', it wasn't a reference to the excitement of youth. It was about a deodorant, named Teen Spirit. Read more on: https://www.dictionary.com/e/slang/smells-like-teen-spirit/

(2) ISO 17299-3:2014 specifies a gas chromatography test method for the deodorant testing of all textile products. This method applies to the odour component chemicals, such as indole, isovaleric acid, nonenal, and acetic acid with added sodium chloride (NaCl).

(3) 3-Methylbutanoic acid, also known as ß-methylbutyric acid or more commonly isovaleric acid, is an organic compound with the formula $(CH_3)_2CHCH_2CO_2H$. Isovaleric acid has a strong pungent cheesy or sweaty smell, but its volatile esters have pleasing scents and are used widely in perfumery. It has been proposed that it is the anticonvulsant agent in valerian. It is a major component of the cause of unpleasant foot odor, as it is produced by skin bacteria metabolizing leucine.

The results are part of the CORNET research project TOM (2017-2019) funded by Flanders Innovation and Entrepreneurship (HBC.2016.0665) https://www.centexbel.be/en/projects/tom

Recyclability of multilayered products

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Linear "take, make, dispose" industrial processes, and the lifestyles dependent on them, use up finite reserves to create products with a finite lifespan, which end up in landfills or incinerators.

The technical (and economical) feasibility of recycling is often compromised by the complex structure of consumer goods. Many products are composed of different materials and are often coated or laminated to obtain certain functionalities including colour and barrier properties, making their recycling too complex and too expensive compared to incineration or convertion into RDF pellets and even compared to using virgin materials.

In order to enhance the recyclable fraction, all the different layers need to be separated. Ideally, this separation process is taken into account at the design phase of multilayered materials.

Eco-design or 'design for recycling' means that a product is designed to guarantee its optimal use and lifespan, while taking into account its end-of-life phase and recyclability. This will help to realize a shift from a linear to a circular economy. One of the best-known strategies is to manufacture an object from one single thermoplastic material that can be easily melted at its end-of-life and reused - with or without adding a fraction of virgin material.

Another strategy that Centexbel and partners are currently investigating can be called **"triggered recycling"**.

RECYCOAT

In this project, Centexbel researches different routes to recycle coated and laminated materials. The first strategy focuses on eco-design and includes a delamination process based on a heat trigger for which commercially available additives are incorporated into the adhesive layer. The second strategy consists of selectively dissolving one of the layers by means of "green" solvents.

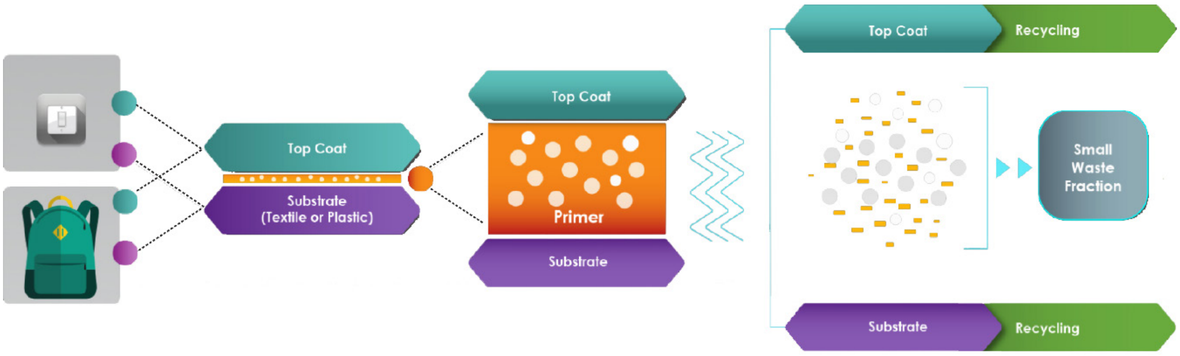
AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

CATALISTI
WE MEAN BUSINESS

Recycoat (2018-2020) has received funding from Flanders Innovation & Entrepreneurship as a Catalisti cluster project in transition priorities - Circular economy under number HBC.2017.0686. More information: https://www.centexbel.be/en/projects/recycoat

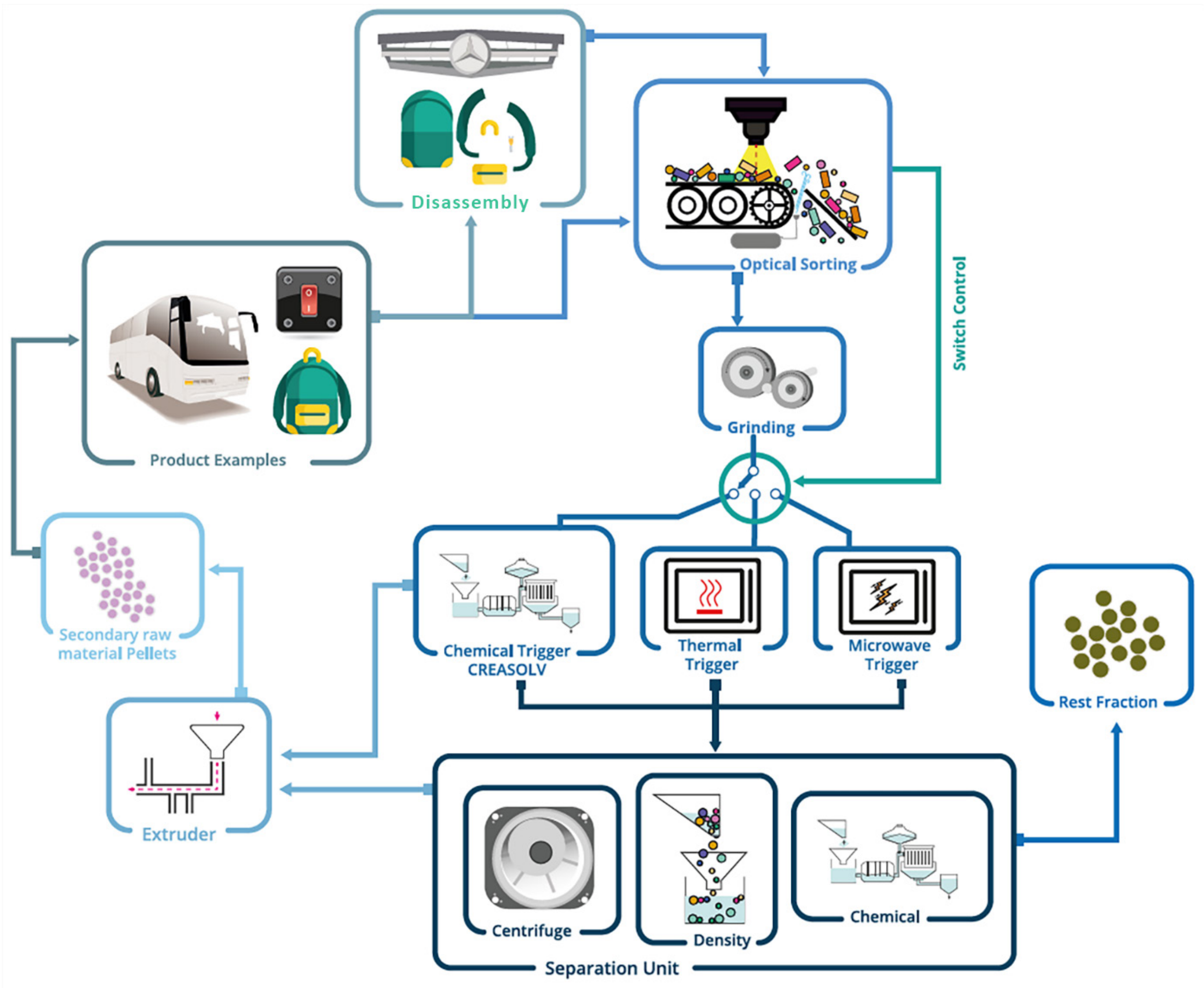
DECOAT

Centexbel is currently leading a European research project on the development and incorporation of additives in for example the adhesive layer in-between a coating layer and the plastic or textile substrate. These additives will react to an external trigger (heat, microwaves, etc.) that activates the separation process of the different layers.



Another strategy aims at dissolving coating layers by means of "green" solvents based on the **CreaSolv®** process, that has been developed by our German research partner Fraunhofer IVV. This process does not need the use of additives.

The recycling loop of **DECOAT** includes the disassembly of the different product parts followed by an optical sorting based on the selected trigger (chemical, heat, microwave) to the corresponding delamination process (CreaSolv® process, oven or microwave). During this step, the coating layers are removed from the substrate and then separated by physical or chemical processes. Once they have been separated, the material is conducted to an extruder to produce secundary raw materials in the shape of pellets that can be used to make new products similar to the original ones.



DECOAT is funded by the European Union's Horizon 2020 research and innovation program under Grant Agreement number 814505.
More information: https://www.centexbel.be/en/projects/decoat

CarPVB: Turning Windshields into Textile

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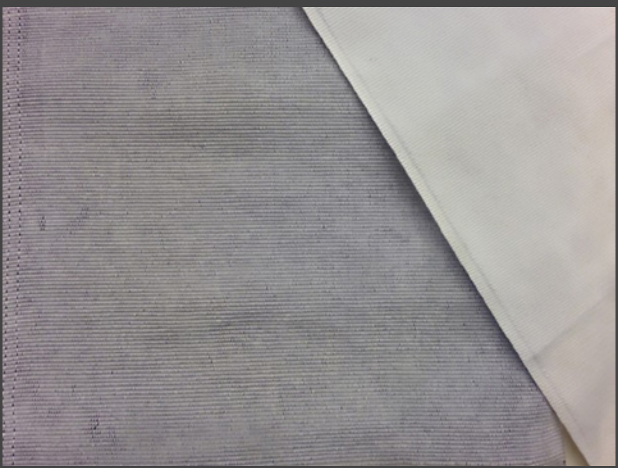
As we all know, the end of life use of many products is becoming more and more important, both to recuperate valuable raw materials, and to reduce the amount of waste produced. To support these goals, the European Union End of Life Vehicles Directive requires that 95% of a vehicle (by weight) must be available for reuse and recovery at the end of its lifespan. One of the streams of recovered material available from end of life vehicles is Polyvinylbutyral (PVB), which is often used as an interlayer in windshields, to keep windshields from shattering into many pieces during a collision.

In the CarPVB project, Centexbel worked together with Hochschule Niederrhein and (FILK) to develop and valorize applications for recycled PVB (rPVB) in the textile industry. In order to investigate the different possibilities for rPVB, each institute investigated a different application method.

Centexbel focused on coating via water-based dispersion of textiles, Hochschule Niederrhein investigated yarn coating, via both water-based dispersion and extrusion, and FILK looked at the possibility of extrusion coating onto textiles. Along with different application techniques, we also explored various options for functionalization. Each of the project partners developed a demonstrator to showcase their application technique.

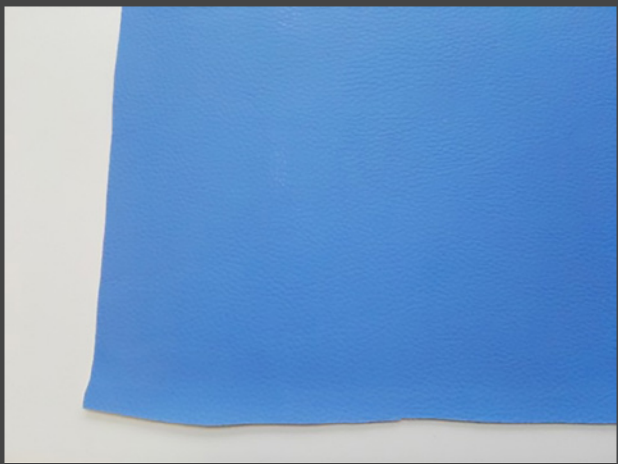


Hochschule Niederrhein focused on **yarn coating**, with the goal to develop a sunscreen based on rPVB coated glass fibers. This required the inclusion of UV blockers such as titanium dioxide and iron oxide.

Picture: a narrow woven fabric was produced with r-PVB coated PET multifilament yarn (with 25 % crosslinking agent) as weft material and a raw polyester as warp yarn

FILK's goal was to produce an **rPVB extruded artificial leather** similar to those currently based on PVC. This required the optimization of processing parameters, to avoid the development of unpleasant odors.

Picture: r-PVB coated artificial leather, homogenized and batched with foamer and a light blue pigment

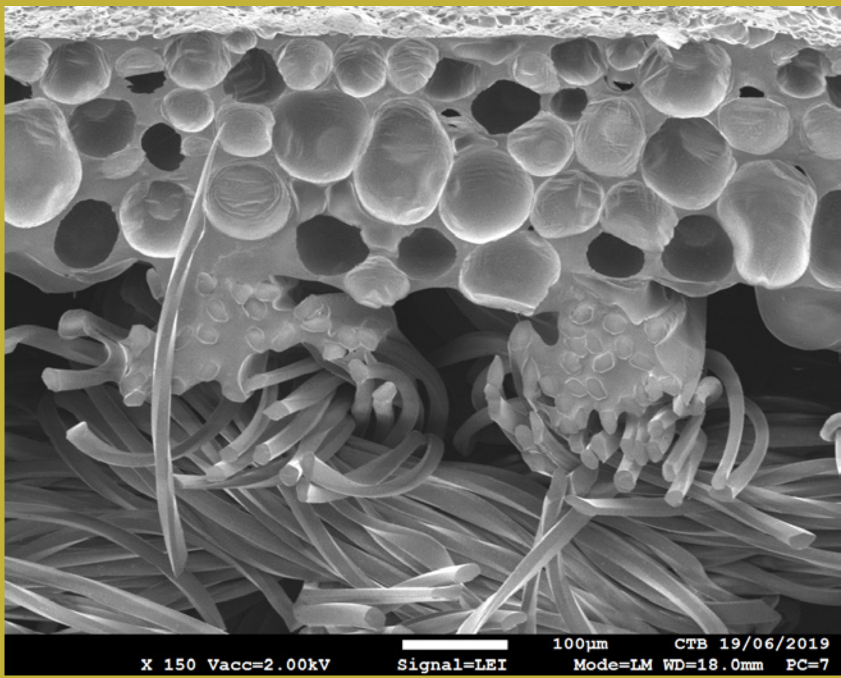


rPVB artificial leather & FR rPVB dispersions

Centexbel aimed to develop an **rPVB based artificial leather**, and to incorporate **flame retardants i**nto the **rPVB dispersion**. In order to produce the artificial leather, the incorporation of blowing agents and dyes was optimized.

We studied the incorporation of flame retardants for both transfer and direct coating applications, and achieved the best results with direct coating techniques – certain formulations perform very well on ISO 15025[1] tests.

Additionally, we explored the applicability of rPVB for carpet backings, which require high filling levels, combined with high foamability.



(1) ISO 15025:2016 -- Protective clothing — Protection against flame — Method of test for limited flame spread

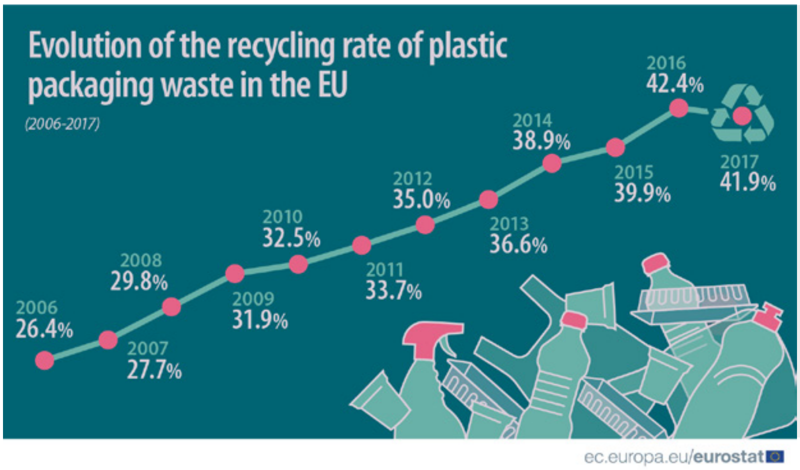
All told, the CarPVB project has shown that a wide range of applications for rPVB is possible in the textile industry. Using the fundamental knowledge built up in this project, that ended in 2019, the consortium hopes to further optimize rPVB for specific applications in future projects.

Coating applications for recycled PVB

Looking for

biodegradable packaging

biontop



In the EU[1], an estimated 42% of plastic packaging waste was recycled in 2017. In seven EU Member States, more than half of the plastic packaging waste generated was recycled in 2017. Compared with 2005, the recycling rate of plastic packaging waste increased by 18 percentage points (pp) in the EU (from 24% in 2005 to 42% in 2017). This increasing trend is observed at varied levels in all EU Member States, except Croatia.

(1) https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20191105-2

The quest for biodegradable packaging

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Many packaging materials are difficult to recycle because of their being contaminated by food rests or because of their multilayered structure (see the article on triggered recycling). To increase the recycling rate of plastic packaging waste, Centexbel and partners in the BiOnTOP project are looking to develop biobased packaging materials that are designed to be easily recycled, and if this is not possible, to be composted under domestic conditions.

PLA is one of the most promising biopolymers because of its availability and good pricing. However, its applications are limited because it can only be composted under industrial conditions. This means that below a temperature of 60°C - as is the case with domestic compost piles - PLA remains intact. In the **BiOnTOP** project we will look for new types of "home compostable" PLA, copolymers and compounds, that can be used in many more types of packaging materials.

The main challenge is to obtain packaging materials with suffient barrier properties against oxygen, moisture and aromas for food packaging purposes. At present, different polymer types (e.g. polyamid, polyethylene and ethylene vinyl alcohol) are combined in multilayer films to obtain the right properties.

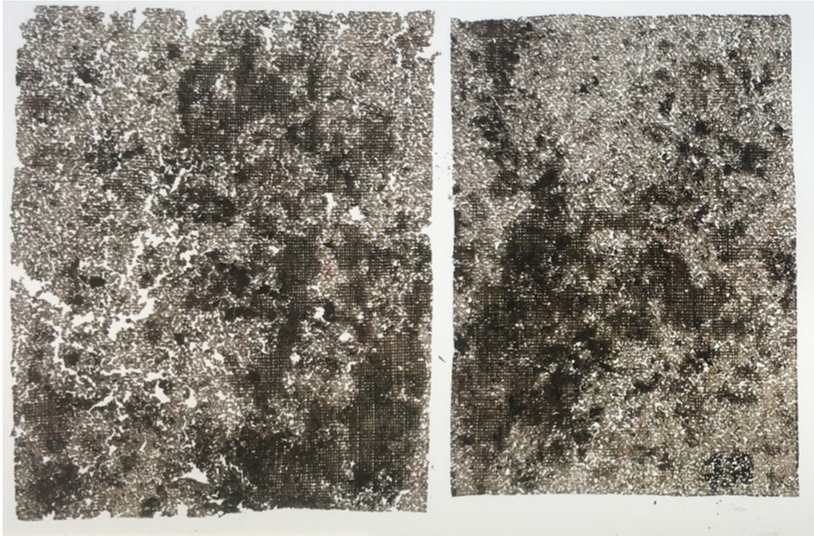
During this project we will research alternatives based on PLA, proteins, alginates and other biobased polymers to create new packaging materials as well as reusable grocery totes, food wraps and satchels.

BiOnTOP will cover a large domain of research topics and therefore requires a lot of expertise.

The project is coordinated by **Aimplas** (Spain). The Belgian partners are **Centexbel**, **Sioen** and **Organic Waste Systems (OWS)**, a world leader in the assement and certification of biodegradable products.

Centexbel will research the process of producing biodegradable filaments from PLA and help project with our expertise in coating with biodegradable polymers.

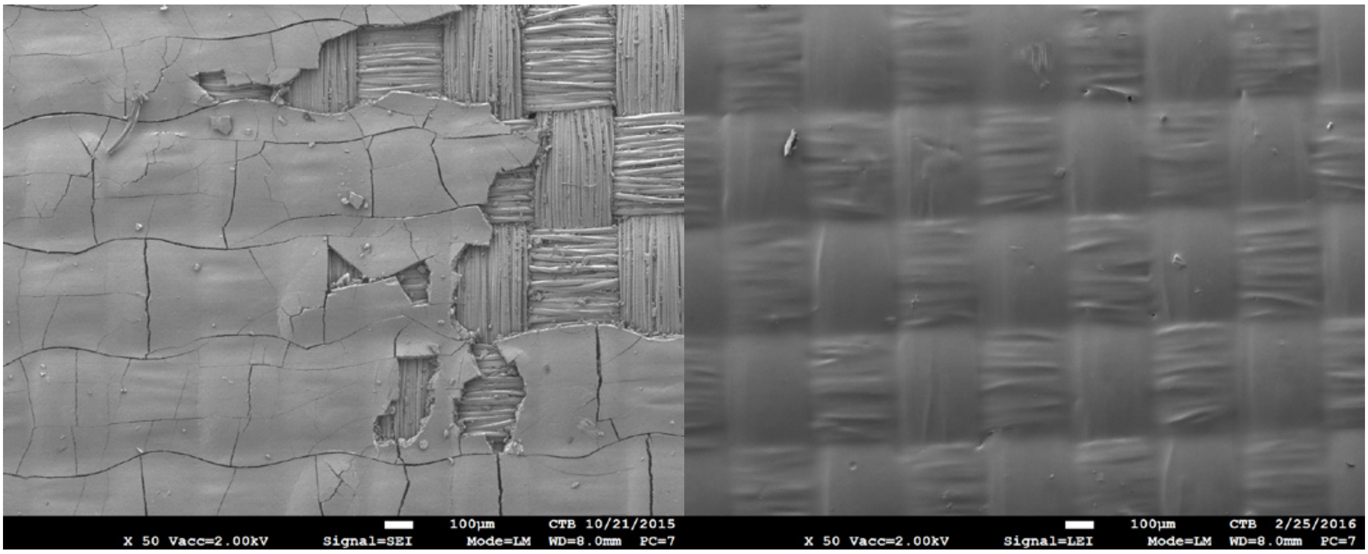
Soil burial test
PLA coatings are buried to assess their degradability



The degradability of PLA can be accelerated or slowed down by specific PLA compounds

The making of a flexible PLA coating

Because PLA is a brittle, glass-like material, we have to add plasticizers to produce a flexible coating. A real challenge, for plasticizers tend to migrate quickly out of the PLA, a feature that is totally unacceptable in packaging materials.



PLA coating without (left) and with (right) plasticizer applied on a woven fabric

Our research partners will investigate methods to anchor existing plasticizers in PLA or develop adequate plasticizers.

BiOnTOP is an ambitious project researching a solution to the waste problem of packaging.

More information:

https://www.centexbel.be/en/projects/biontop
https://biontop.eu/

BBI JU

Horizon 2020
European Union Funding
for Research & Innovation

Bio-based Industries
Consortium

This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No. 837761.

Evolution in flame-retardant products

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Recent headlines on fires include: Brussels hotel fire: 179 guests evacuated, one woman in intensive care (March 13, 2019); Tourists rushed to hospital after fire rips through popular Majorca hotel (July 2, 2019); Child dead, three others injured in apartment fire at 23rd and Dunlap avenues (Phoenix-USA) (December 15, 2019).

Because more and more inflammable materials, including textiles made from synthetic materials, are being used in houses, hotels, etc., fires are breaking out more quickly and flames are spreading with an incredible speed. Therefore, the use of flame-retardant products is life saving for it enhances our chances to escape a building on fire while limiting material damages.

Over the past ten years, flame retardants have been "under fire". The almost universally used, very efficient and all-round halogenated products (such as decabromodiphenyl oxide) proved persistent in the environment and are even detected in domestic dust. These findings caused a shift: many halogenated products have been replaced by non-halogenated alternatives. However, the alternatives rely on a different flame-retardant effect, which necessitated a lot of research before halogenated products could be effectively substituted. At present these alternatives with a different flame-retardant effect are familiar in many textile applications.

The European **LIFE-Flarex** project - in which Centexbel is involved - aims to examine not only the technical performances but also the risks linked with the use of alternatives.

In recent years we have seen an evolution in the use of bio-materials, including biobased flame retardants. The first commercially available biobased formulations are already being applied (in less demanding applications such as mattress ticking).

Centexbel investigates which biobased materials are suitable as alternative flame retardants. In this respect, the **KaRMA2020** project addresses the valorization of keratin (from feather wastes from poultry) as flame retardant, whereas the **Bio FR Letex** project examines a broader offer of potential biobased flame retardants.

In **LIFE-FLAREX** we assessed alternative flame retardants for applications in mattress ticking, bed linen, curtains and upholstery. The technical screening is carried out on natural (cotton) and synthetic (polyester) materials and blends, all having a different burning behaviour. Decabromodiphenyl ethane (drop-in for the oxide variant that is on the REACH list of restricted substances) and the Pyrovatex process resulting to a washable FR textile are screened as benchmark.

In response to the industrial interest in polymer bromated FRs, they have also been included in the study. These FRs are supposed not to migrate from the matrix and therefore be eco-friendlier. The non-halogenated alternatives that have been screened include graphite, sulphamate, phosphorous molecules, etc.

Technical screenings performed by Leitat and Centexbel showed that certain alternatives meet the requirements of the required burning behaviour tests. Some of these alternatives are also being evaluated on an industrial scale.

The project partners also evaluate the skin penetration of FRs, while performing LCA and LCC studies and conducting full risk analyses. The project will end by July 2020 and the results of the study will be published on the project website.

Home Fires

In just two minutes, a fire can become life-threatening. In five minutes, a residence can be engulfed in flames.

Fire is FAST! In less than 30 seconds a small flame can turn into a major fire. It only takes minutes for thick black smoke to fill a house or for it to be engulfed in flames.

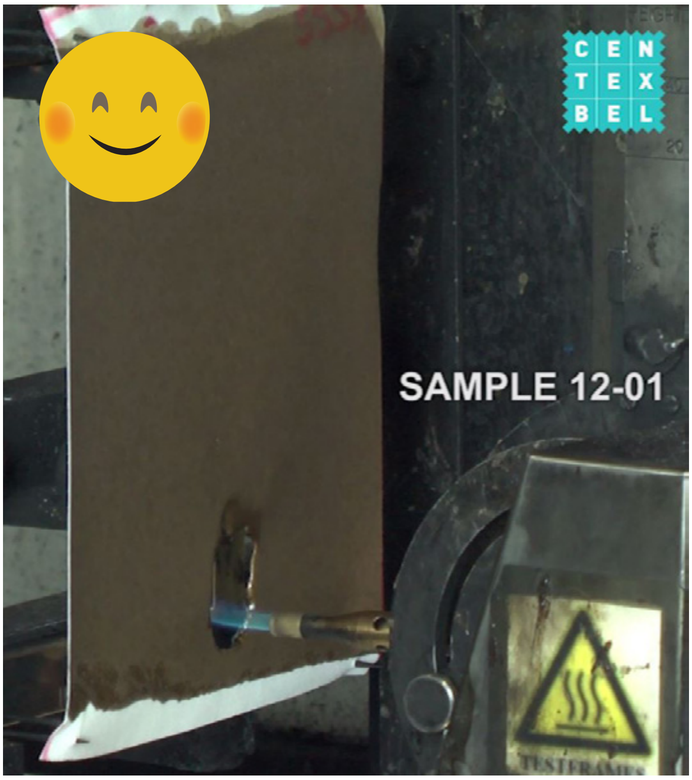
Fire is HOT! Heat is more threatening than flames. Room temperatures in a fire can be 100 degrees at floor level and rise to 600 degrees at eye level. Inhaling this super-hot air will scorch your lungs and melt clothes to your skin.

Fire is DARK! Fire starts bright, but quickly produces black smoke and complete darkness.

Fire is DEADLY! Smoke and toxic gases kill more people than flames do. Fire produces poisonous gases that make you disoriented and drowsy. Asphyxiation is the leading cause of fire deaths, exceeding burns by a three-to-one ratio.

KaRMA2020 evaluates the application of biobased materials. Chicken feathers contain 90% keratin, a nitrogen-containing protein, one of the elements with a flame-retardant effect. Feathers from slaughterhouses are collected, washed, sterilized and grinded to ~5µm in a multi-step process. The keratin powder was then added to polyurethane (PU) textile coatings but did not result in a flame-retardant effect due to the very low N-concentration in the keratin, i.e. a mere 14%.

Halogenated flame retardants are still necessary for technical and highly demanding items, such as mattress covers for hospital beds. During KaRMA2020 we are examining to replace them by a biobased flame retardant. One of the project partners, DarenLabs, has developed a novel flame retardant to be applied in mattress covers for hospital beds. In addition to keratin, this FR also contains lignosulfonate and other bio-based products such as polyols and amines.



First generations did not have the desired FR effect, but after constant adjustments to the FR, a flame-retardant PU coated PES was finally obtained. Moreover, it was perfectly waterproof, which was not the case with the first generations of FRs. During the last weeks of the project (December) an industrial run was carried out at Sioen Fabrics.

In March 2019, the CORNET project **Bio FR LeTex** was started. In this project we are screening the burning behaviour of all kinds of commercially available bio-based materials. FILK (Germany) is looking at the applicability on leather, while Centexbel is looking at textile applications. In this respect, the potential of bio-based acids, amines, polyols, proteins, phosphorus molecules, etc. will be looked at. Initially, the FRs are applied as a finish, before being integrated into coatings at a later stage. Although the project only started this year, we have already obtained good results on both natural and synthetic materials. Partner FILK will also modify proteins with e.g. phosphor groups to boost the performance, after which they will be tested for textile applications.

Centexbel-VKC is engaged in many initiatives in the field of flame retardancy. The above-mentioned projects mainly deal with flame retardancy, a property that is a key requirement in many textile and plastic applications and will therefore be the subject of many present and future research projects.

SPIRE
Sustainable Process Industry through Resource and Energy Efficiency

KARMA2020 is a project funded by the European Commission. This project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement n° 723268

http://www.karma2020.eu/

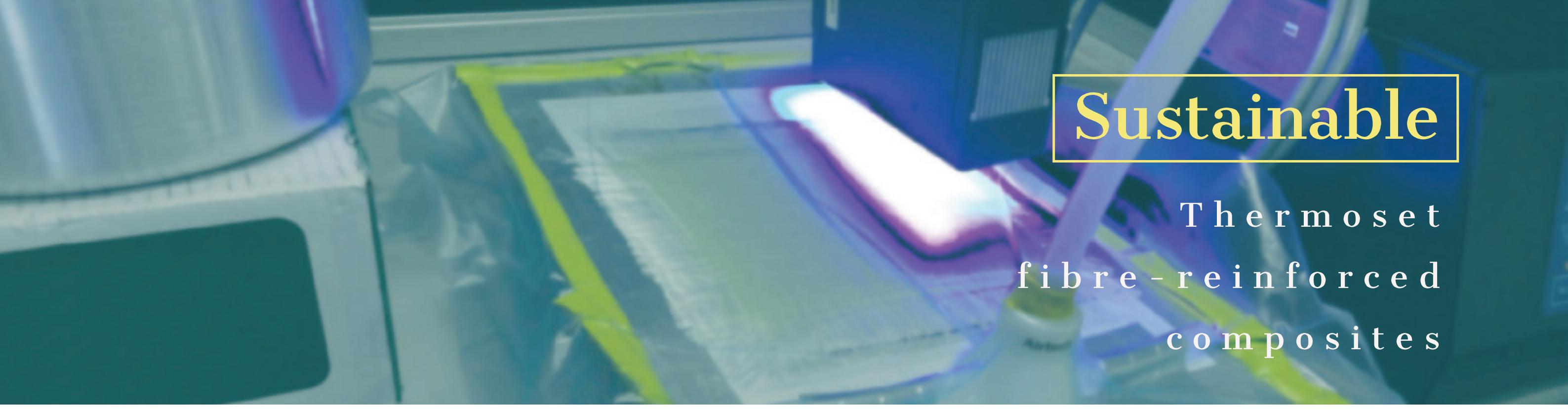
LIFE-FLAREX is a project co-funded by the European Union under the LIFE+ Financial Instrument within the axe Environment Policy and Governance and under the Grant Agreement n. LIFE16 ENV/ES/000374

https://www.life-flarex.eu/

cornet AGENTSCHAP INNOVEREN & ONDERNEMEN Vlaanderen is ondernemen

Bio FR LeTex is a Cornet project funded by Flanders Innovation and Entrepreneurship (HBC.2018.0266)

https://www.centexbel.be/en/projects/bio-fr-letex



Sustainable thermoset fibre-reinforced plastics

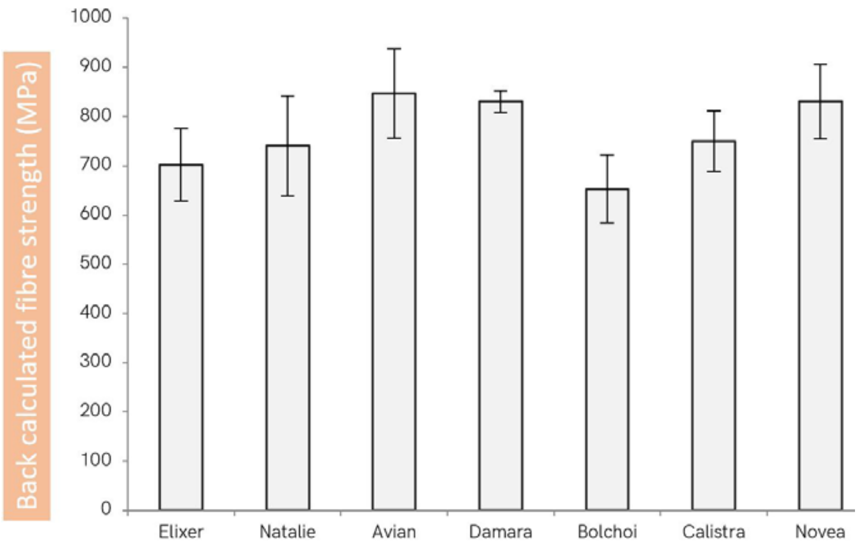
Frederik Goethals | frg@centexbel.be

Thermoset fibre-reinforced plastics are high-quality composite materials that, depending on the composition, can even replace aluminium and steel in structural applications. These materials are durable in themselves because they have a long service life and are lighter than metals. However, recycling these materials is not so easy because thermoset plastics cannot be remelted.

Recycling usually means thermal energy recuperation (incineration) or grinding and reuse as filler material. In addition, research is carried out in order to break down the matrix via solvolysis processes in order to obtain matrix monomers again. On the other hand, it is also possible to make the thermoset composites even more sustainable by:

- Using renewable raw materials
- Using less harmful resins
- Making the curing process more efficient

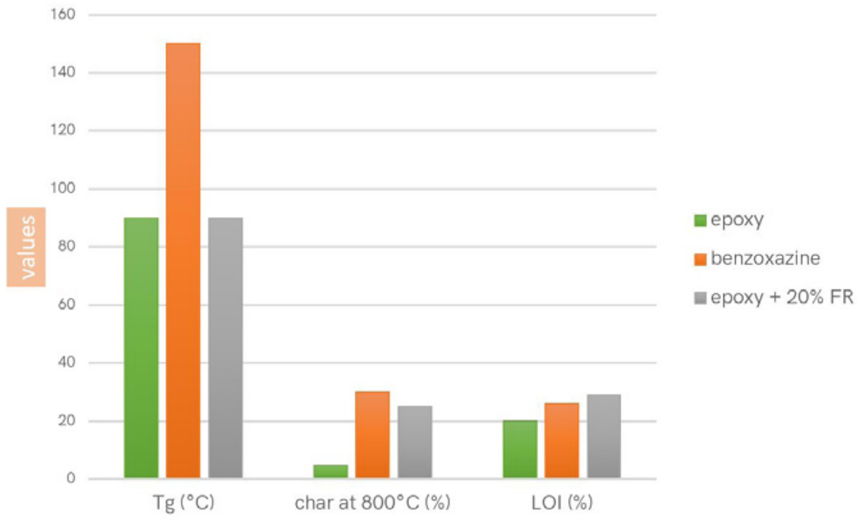
This article focuses on Centexbel's research on these 3 above-mentioned themes. Flax fibres are known for their good mechanical properties and also thrive in our regions, making them a more durable alternative to glass fibres. However, there are different types of flax fibres and in the Biocompal project we will find out which one is most suitable for composite applications. The strength of some flax varieties is shown below.



The graph clearly shows that there is a difference in strength between the fibres, and for composite applications, of course, the higher the strength, the better. This means that Avian, Damara and Novea are the most promising varieties. Research is still ongoing to see if these results are reproducible after different harvests, because flax remains a natural product whose quality also depends on climatic conditions (rain, drought, temperature, soil conditions, and so on).

By combining these fibres with a bio-based resin (e.g. bio-epoxy), high-quality composites with a high bio content are obtained.

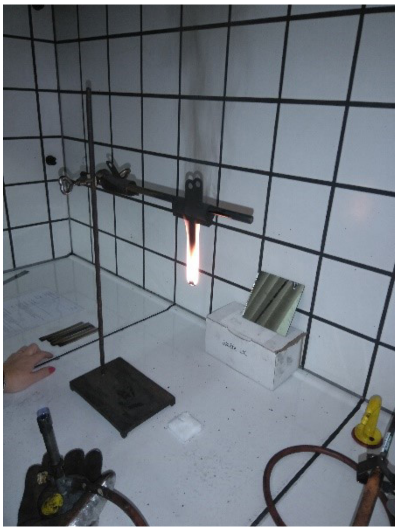
The SUSCOMTRAB project uses resins that are less harmful (CMR and solvent-free) to people who come into contact with them. For low viscosity processes (RTM, infusion) bio-epoxy is again used. For high viscosity processes (prepreg + thermopressing) polybenzoxazines are used as a resin. Benzoxazines are 1k thermoset plastics that harden through a ring opening polymerization reaction in which no side reactions occur. Benzoxazines have a high temperature resistance, good mechanical properties and are also fire retardant. Below a comparison is made in properties between the benzoxazine resin and a conventional epoxy.



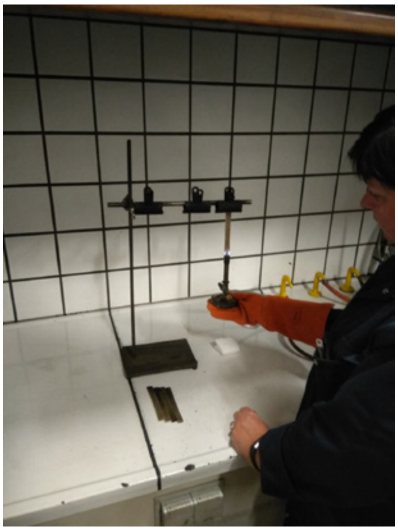
This graph clearly shows thermal (Tg: glass density temperature) and fire-retardant properties (char and LOI: limited oxygen index) in favour of the benzoxazine resin. By adding fire-retardant (FR) additives to the epoxy resin, the FR properties of the epoxy resin can be greatly improved. On the other hand, adding non-liquid flame retardants increases the viscosity of the matrix, making good fibre impregnation more difficult. However, the viscosity can be lowered again by adding additives and the mechanical properties can be increased again.

	FR (%)	Add 1 (%)	Add 3 (%)	Add 4 (%)	Add 5 (%)	Add 6 (%)	Viscosity RT (mPa.s)	Bending Strength (MPA)
suscomtrab10_01	20						2920	44
suscomtrab10_02	20	0,5					2350	80
suscomtrab10_03	20		1				2150	80
suscomtrab10_04	20			0,2			2130	58
suscomtrab10_05	20				2		1810	76
suscomtrab10_06	20					2	2090	70

The resins are combined with basalt fibres and FR-treated flax to produce durable high quality composites with good FR properties.

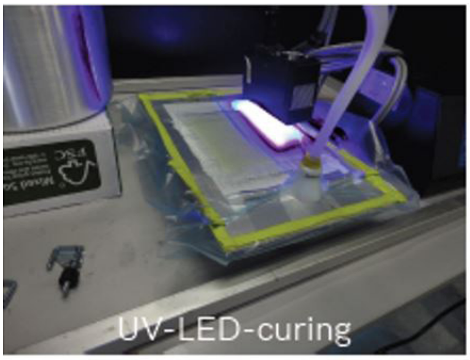


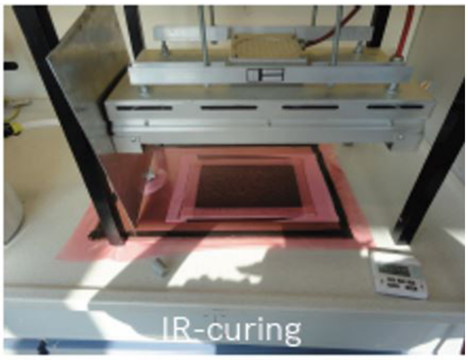
UL94 test:
composite without FR-additives

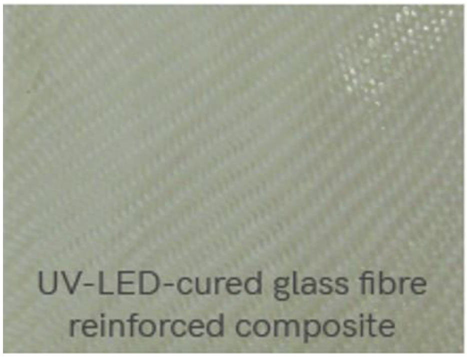


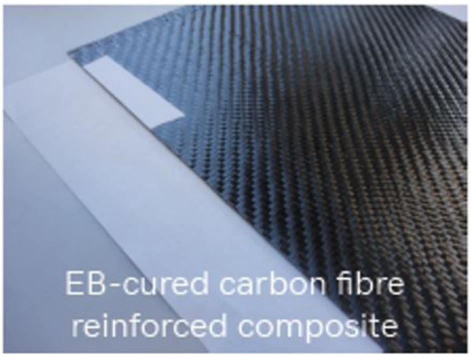
UL94 test:
composite with FR-additives

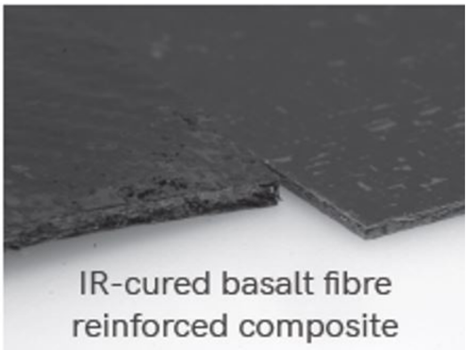
In addition to selecting the right raw materials, more sustainable composites can also be developed by optimising the curing process. In the Fenecom process 3 alternative curing processes to thermal curing were investigated. These techniques are UV-LED curing, E-beam curing and infrared (IR) curing.



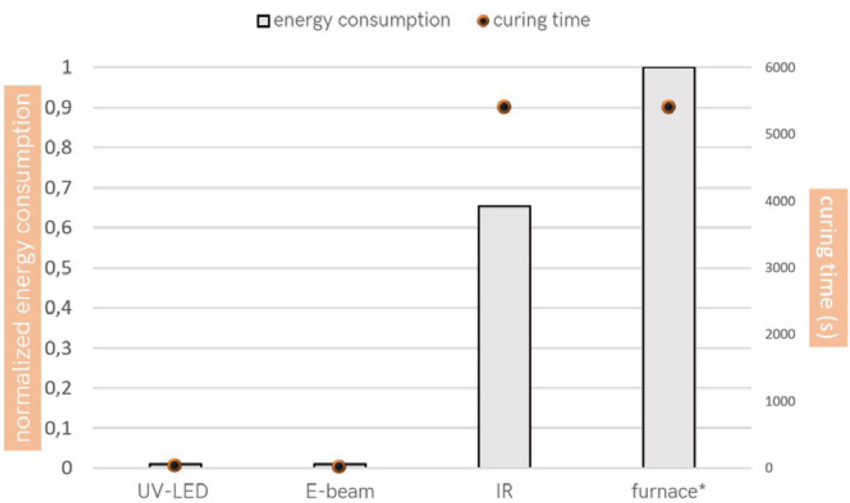








UV-LED, as the name suggests, uses UV radiation to cure the matrix. In order to use this technology, the resin must react to UV light and the fibers must allow the UV light to pass through. This means that this technology is very suitable for making glass fibre reinforced plastics as glass fibres allow UVA radiation to pass through. EB curing, uses electron beams to harden out the matrix. The matrix formulation is quite similar to that for UV curing, but the voltage of the E-beam and the density of the fibers determine the thickness of the composite plate. The lower the density of the fiber, the deeper the electrons can penetrate. Therefore, carbon reinforcements are more suitable than glass fibres as the density of carbon is about 1.8 g/cc while the density of glass fibres is about 2.5 g/cc. In IR curing, the IR radiation is absorbed by the resin and converted into heat. Since it is not necessary to heat a medium (e.g. air) first, this is a more efficient technique than curing with warm air. The graph below shows the potential in energy and time efficiency of the radiation curing technologies compared to thermal curing.

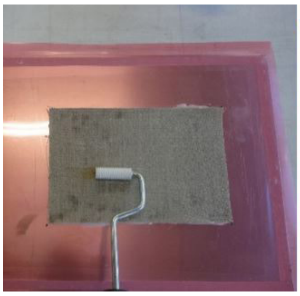
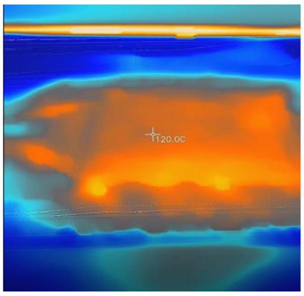
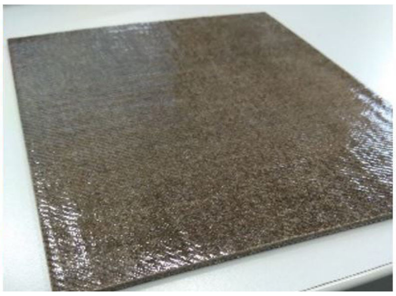
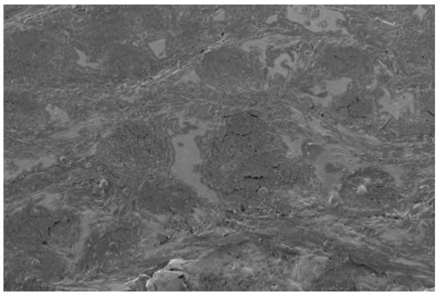


*electrical furnace heated at 120°C for 90 min to cure the epoxy

(= same epoxy resin as used for IR-curing)

This graph clearly shows that UV and electron beam can cure composites quickly and energetically and are therefore a good alternative to thermal curing for glass fibre reinforced composites (UV) and thin carbon laminates (EB). IR curing is less efficient than UV and E-beam curing, but is still more efficient than thermal curing. In addition, IR curing is less dependent on the type of fibre and thickness than UV and EB curing.

Finally, sustainable raw materials and sustainable curing processes can be combined so that the final product becomes even more ecological as is shown below by a flax-bio epoxy composite cured by IR radiation.

Theme-related projects

	website	supported by
Biocompal	http://www.biocompal.eu/	
Fenecom	https://www.centexbel.be/en/projects/fenecom	
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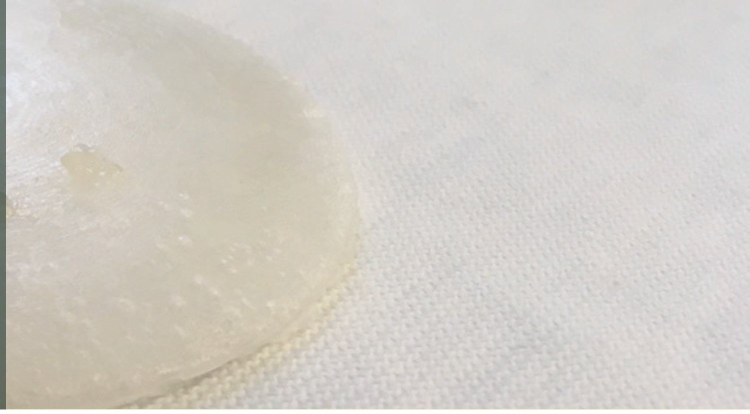
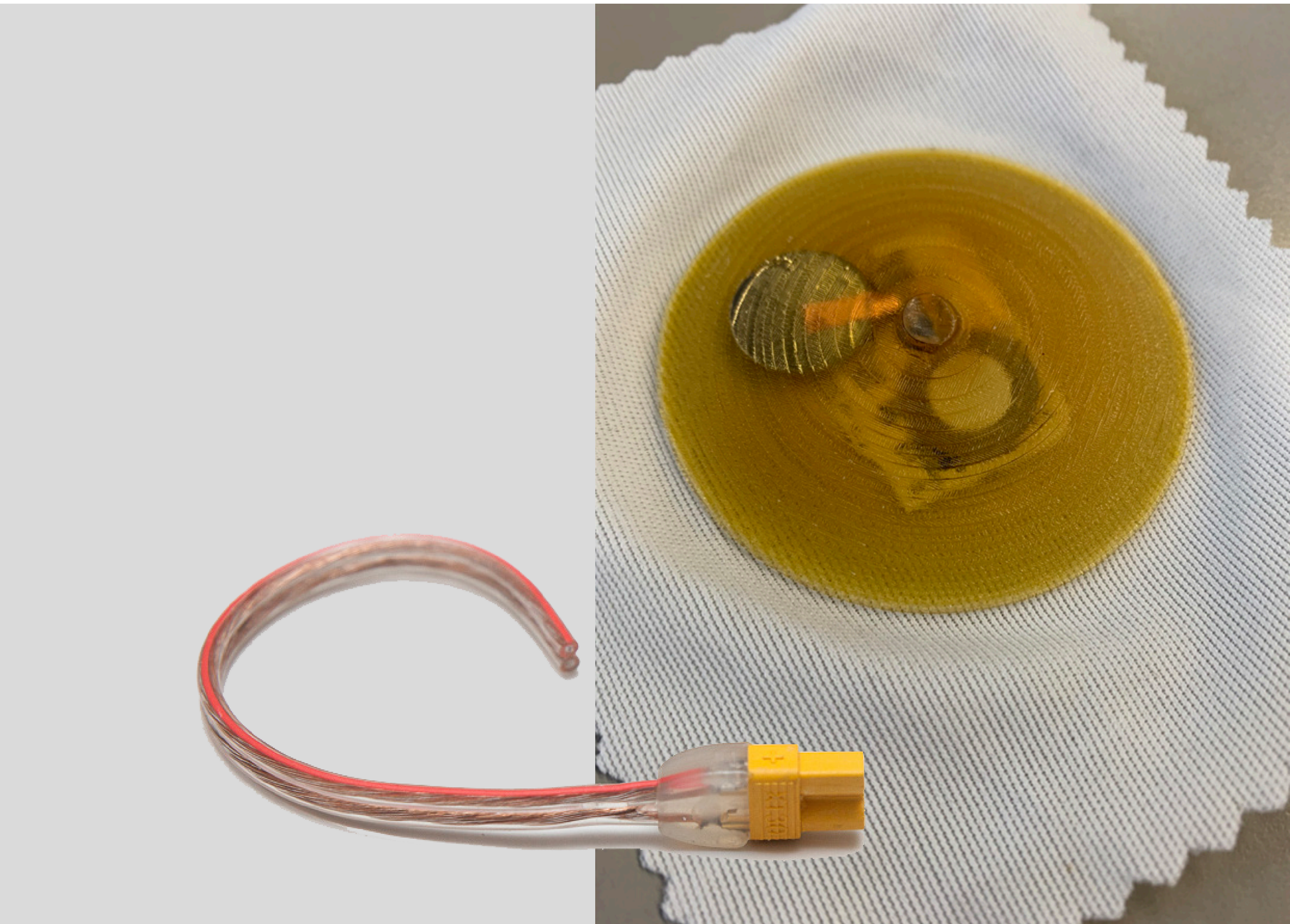


New methods to produce smart textiles

Brecht Demedts | bdm@centexbel.be • Pol Paelinck | ppa@centexbel.be • Myriam Vanneste | mv@centexbel.be

Integrating electronics in textiles calls for new methods. Indeed, the bonding of electronic components requires different methods than conventional ready-to-wear techniques. Moreover, all components must be sealed off from moisture and have to withstand cyclic loading. Last year, Centexbel strengthened its efforts in this field by applying "low pressure molding" and "potting".

LOW PRESSURE MOLDING is used to inject resins in a liquid phase under low pressure into a mould and is a well-developed technique for thermoplastic polyamides applied to neatly finish the outlets of cables and plugs, where an electrical wire with a brittle connection is attached to the head, and is then surrounded by a sturdy plastic sheath. The technique can be implemented with minimal investment. Centexbel modified the technique to suit textiles. Therefore, we meticulously fit the textile in-between the moulds and apply resins with an excellent textile compatibility. The results are remarkable: we succeeded in functionally encapsulating electronic components on textiles. Moreover, the electronic textiles produced by this method are perfectly washable.



However, the technique has its disadvantages. The polyamides for the cable connectors are applied at high temperatures that are not suited for all electronic components or textile substrates.

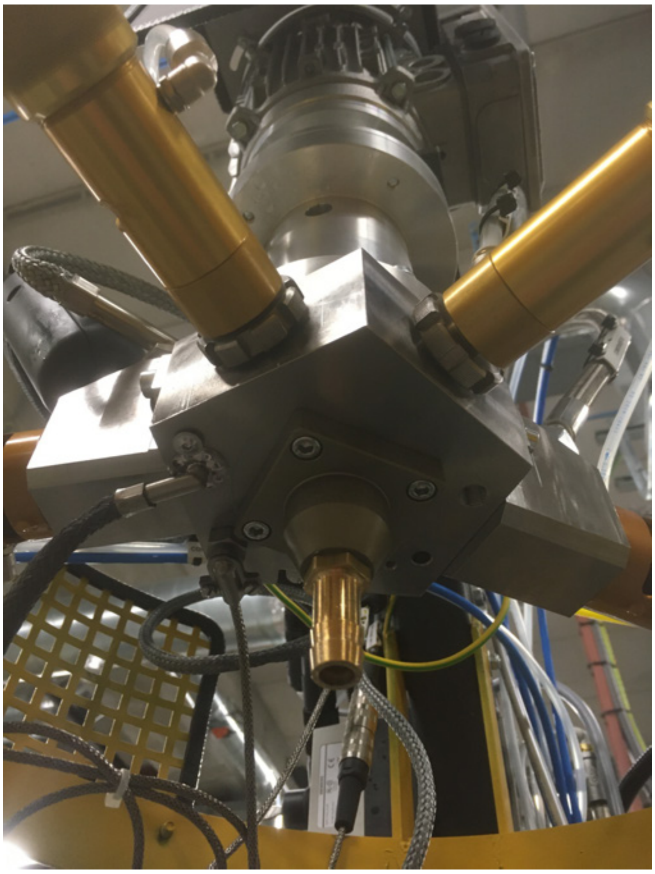
Because, rechargeable batteries cannot withstand these high temperatures, Centexbel invested in a 2K mixing system to work with "cold" chemicals.

2K polyurethanes provide a perfect seal against water, harden at low temperatures and are attractively priced. Moreover, we obtained a much higher flexibility and since we are mixing the components ourselves, we can add all kinds of additives. For example, we can protect the electronics by encapsulating them in a heat-conducting resin, but we can also add EMI shielding or antistatic additives.

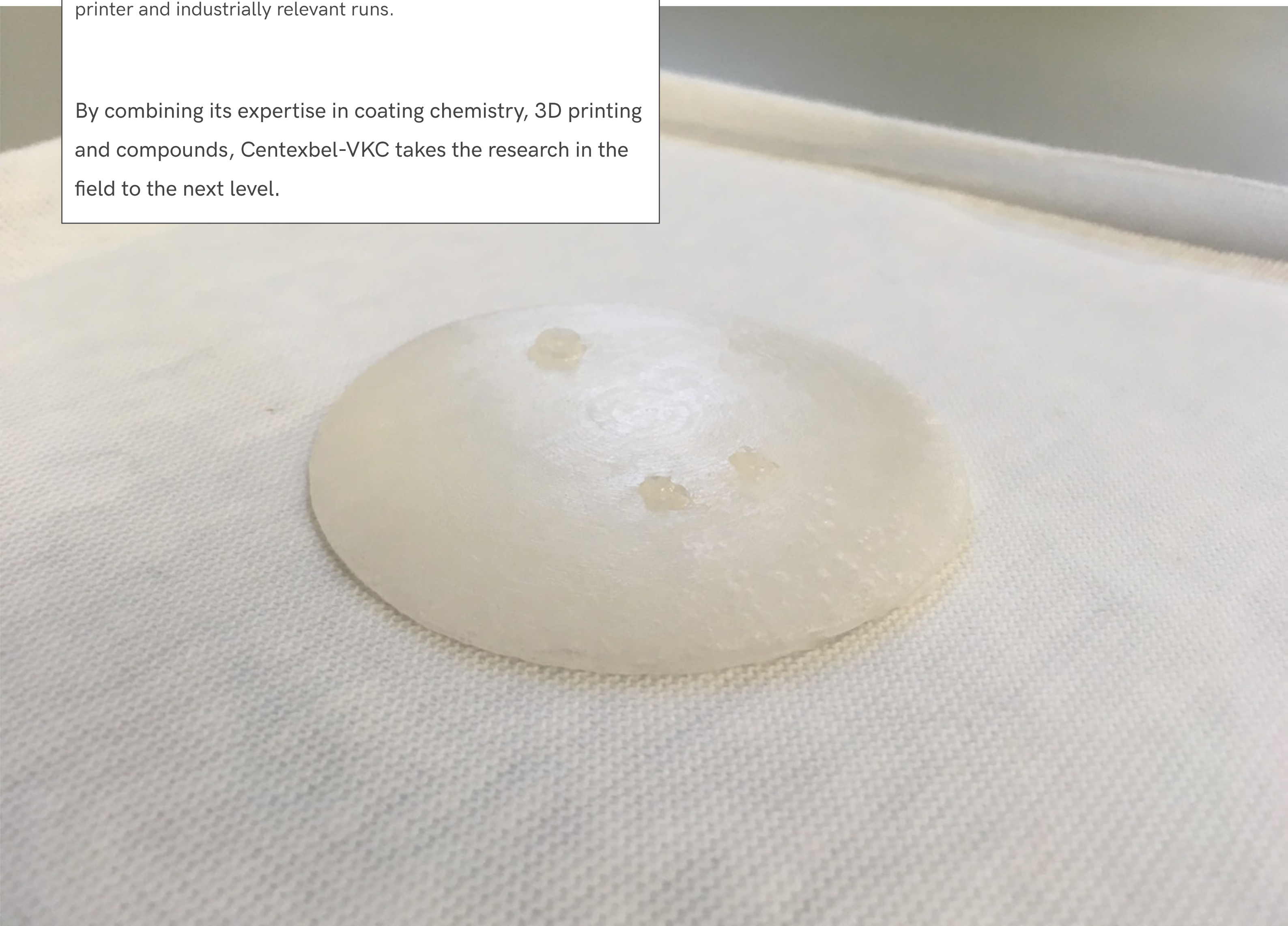
The new equipment also allows us to explore the technique of **POTTING**. With potting, electronics are simply coated with a resin, such as 2K polyurethanes or silicones. In the following years, we will be investigating whether we can apply this simple technique to textiles as well.

But it doesn't stop at electronics. The new techniques can be used to adhere a lot of structural plastic objects to textile substrates. The applications range from shoe soles to hangers or protective elements on protective clothing.

We can also imagine many applications on technical textiles. Low pressure molding bridges the gap between prototyping using a 3D printer and industrially relevant runs.



By combining its expertise in coating chemistry, 3D printing and compounds, Centexbel-VKC takes the research in the field to the next level.



Samen voor sterk innoveren

3-Year Event

Cluster 'Innovatieve Coatings'

On the occasion of the third anniversary of the Cluster 'Innovatieve Coatings' on November 26, 2019 at Fedustria (Sint-Denijs-Westrem) we looked back at the cluster activities and forward to possible follow-up itineraries. We also invited several companies to testify about their experiences and gave the floor to the students of the 'Agoria Solarteam', the 2019 world champions of the Australian Solar Race!

Some 40 participants attended the Cluster event.

Mark Meeus (Vlaio) kicked-off the event with a brief explanation of the cluster policy.

Hilde Beeckman (Centexbel) presented an overview of the Cluster activities during the past three years. Myriam Vanneste (Centexbel) looked forward to possible follow-up itineraries.

The Cluster 'Innovatieve Coatings' unites coating companies from several economic sectors, including the textile, wood, plastic converting, and metal sectors. More than seventy companies have joined the cluster, a number that remained stable over the three years. During the first year, the cluster mainly organized workshops with the possibility to attend B2B meetings, giving companies the opportunity to get acquainted and start up one-to-one collaborations. In the course of the project, these workshops resulted in technical workgroups striving at common collaboration projects.

The workshops addressed the following themes: low VOC coatings; functional coatings; energy-efficient coating techniques, construction & coatings, biobased coatings, coatings & corrosion. We also visited several cluster members: Europlasma, MEAM, Hammer, Sioen, Beaulieu, AGC Glass and EOC.

The technical workgroups include: easy to clean coatings, coatings & corrosion, fire retardant coatings & VOC.

What next after 3 year Cluster activities?

Inspired by the large interest among the cluster members in the workshop on biobased coatings, Centexbel and Sirris submitted the COOCK project 'Biocoat' to VLAIO, that has recently been approved. More information will follow.

The brainstorm session during the workgroup on fire retardant coatings revealed a common interest in the recycling of FR products from coatings, linked to identification in the framework of products authorized under REACH. A project proposal is in preparation.

A third point of action is the 'contract entrepreneurship', a public contract to stimulate entrepreneurship and innovation, including thematical sessions on coating related topics. More information will follow.

During the event 3 testimonials were presented.

Agfa - Frank Ruttens

Anric - Eric Van Nevel

Delta Applications - Kim Aerts

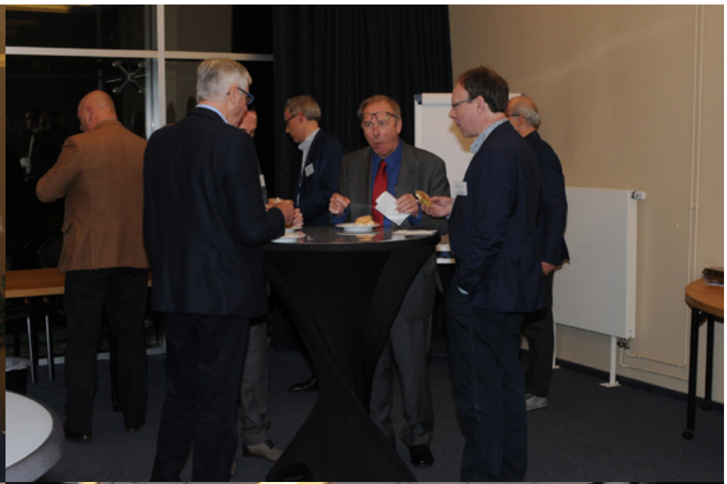
The keynote speech was delivered by the Agoria Solar Team, a team of students who have built a solar-powered car that enabled them to win the 2019 Australian Solar Race World Championship.

Hendrik Christiaens and Kenneth Goovaerts presented the team and mission.

Afterwards, the use of coatings in the solar car and the future necessity of coatings were discussed.

During the reception following this interesting presentation, the attendees engaged in long and lively discussions over a drink and a snack.

More information: Hilde Beeckman | hb@centexbel.be



Sponsors:

Upcoming events

April 21st, 2020

Breakfast session

"REACH and Biocides"

June 2020

Annual INFOHappening

"Textile Coating, Finishing & Dyeing"

June 23rd & 24th, 2020

Second International Conference

"Circular Economy for Textiles & Plastics"

October 2020

International Conference

"Composites"

November 2020

Fourth International Conference

"Fire Retardant Textiles and Plastics"

… and many more events on https://www.centexbel.be/en/agenda

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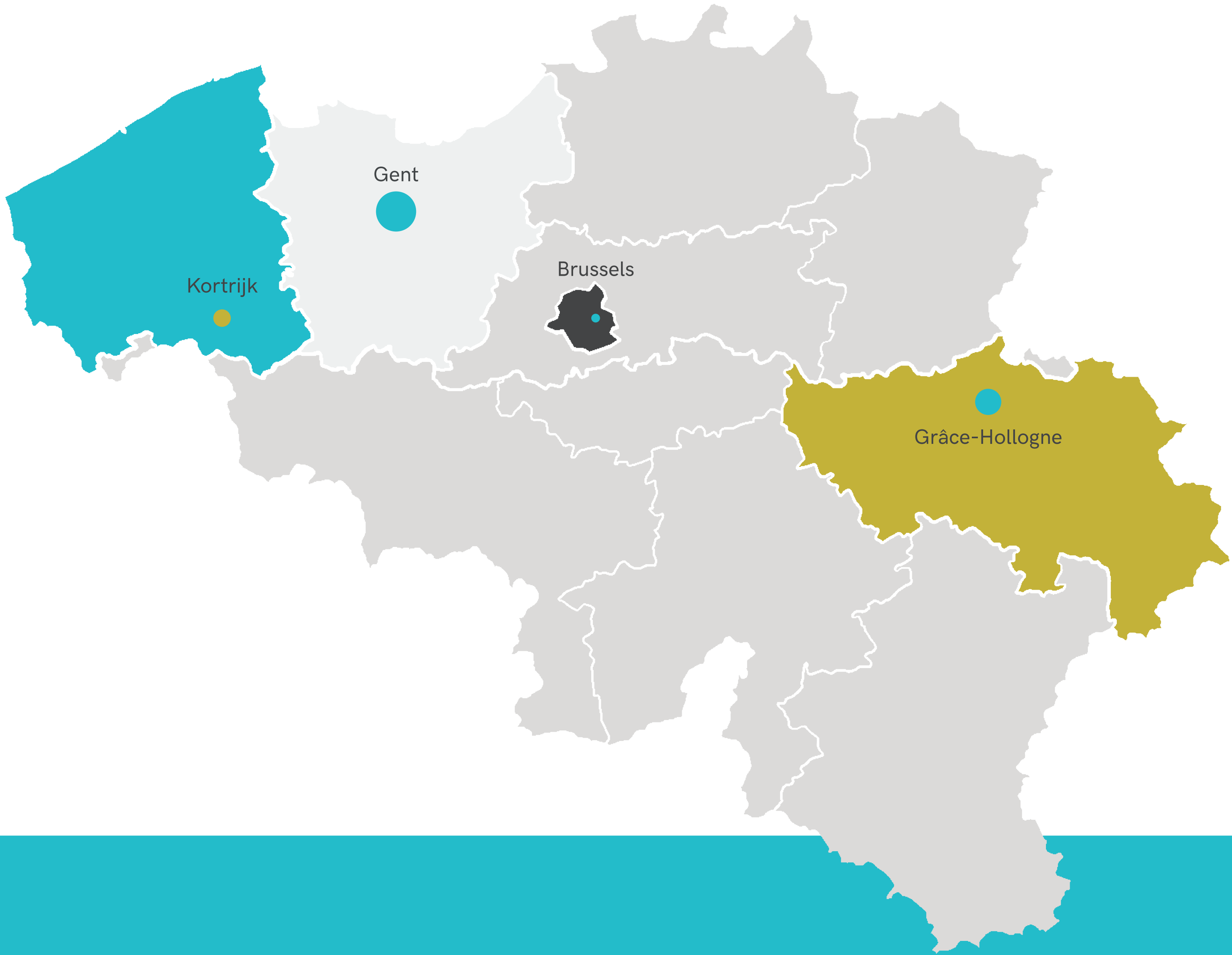

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