

# polyurethane **is** performing

technologies, methods and industry's experiences  
of flexible polyurethane foam

n° 01 - 2020



Foam-It, recycled polyurethane foam benches

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## Introduction

“Polyurethane is performing” is a new editorial series that intends to explore the multiple approaches that the flexible polyurethane foam industry is taking to the developing to respond to the growing need to have compatible processes with environmental balances.

The concept of eco-sustainability in the field of polyurethane foam includes a very wide and varied range of actions: from chemical recycling to treatments post-consumption mechanically based, from energy enhancement through combustion up to the organization of integrated processes that manage the passage of the product at the end of its life, from the delivery centers up to the areas where the materials are separated and reprocessed.

Without forgetting the importance of transforming the polyurethane recycled into new products capable of combining aesthetics and functionality, enhancing the often also the intrinsic charm of a recycled material not ‘to be hidden’ but to value.

Each issue of “Polyurethane is performing” will present focuses on several experiences, in Italy as well as abroad, as a testimony of an industrial reality made of large numbers and globalized but constantly dynamic and attentive to promote new forms of circular economy.

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## Profilo

## Poliuretano è

Poliuretano è represents an innovative and unique project of its kind, born in Italy 15 years ago by the will of some of the most important Italian companies in the production' sector of flexible polyurethane foam. Over the years to companies producers have also supported the project with a number of companies protagonists at international level in the production of additives and related raw materials to the production of flexible polyurethane.

Poliuretano è has carved out in recent years its own authoritativeness and a precise identity in the world of communication, production and design. Initially developed as a project oriented to improve the knowledge of the flexible polyurethane foam at the distribution operators, Poliuretano è has progressively widened its range of action, involving in a way more and more companies producing industrial products in polyurethane, from furniture to packaging.

Poliuretano è promotes a wide range of initiatives for the dissemination of culture on the polyurethane material, which include the organization of exhibitions and themed presentations, conferences dedicated to deepen the different themes related to polyurethane, training meetings with retailers and the publication of research and documentation on the subject.

[www.poliuretano-e.it](http://www.poliuretano-e.it)

Polyurethane é is promoted by the following leading companies in the polyurethane sector flexible foam:

Promoters - Flexible polyurethane foam manufacturers



[www.cires.it](http://www.cires.it)



[www.nir-spa.it](http://www.nir-spa.it)



[www.olmogiuseppespa.com](http://www.olmogiuseppespa.com)



[www.orsafoam.it](http://www.orsafoam.it)



[www.pelma.it](http://www.pelma.it)



[www.sip-srl.it](http://www.sip-srl.it)

Supporters - Manufacturers of raw materials and additives



[www.covestro.com](http://www.covestro.com)



[www.evonik.com](http://www.evonik.com)



[www.borsodchem-group.com](http://www.borsodchem-group.com)



[www.dow.com](http://www.dow.com)



[www.huntsman.com](http://www.huntsman.com)



[www.repi.com](http://www.repi.com)



[www.shell.com](http://www.shell.com)

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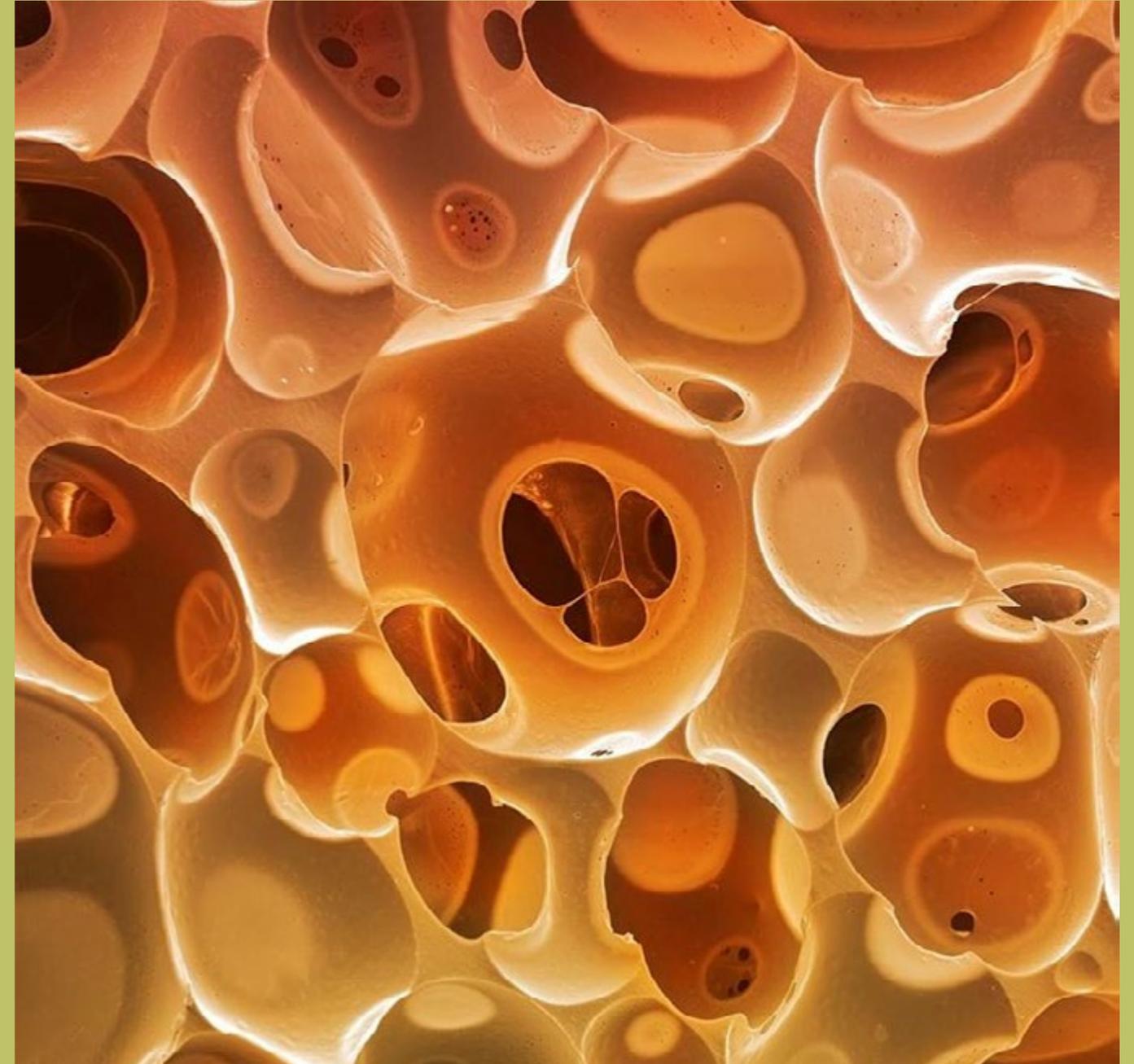
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# 1.

## Technologies for the chemical recycling of flexible polyurethane foam



## Glycolysis

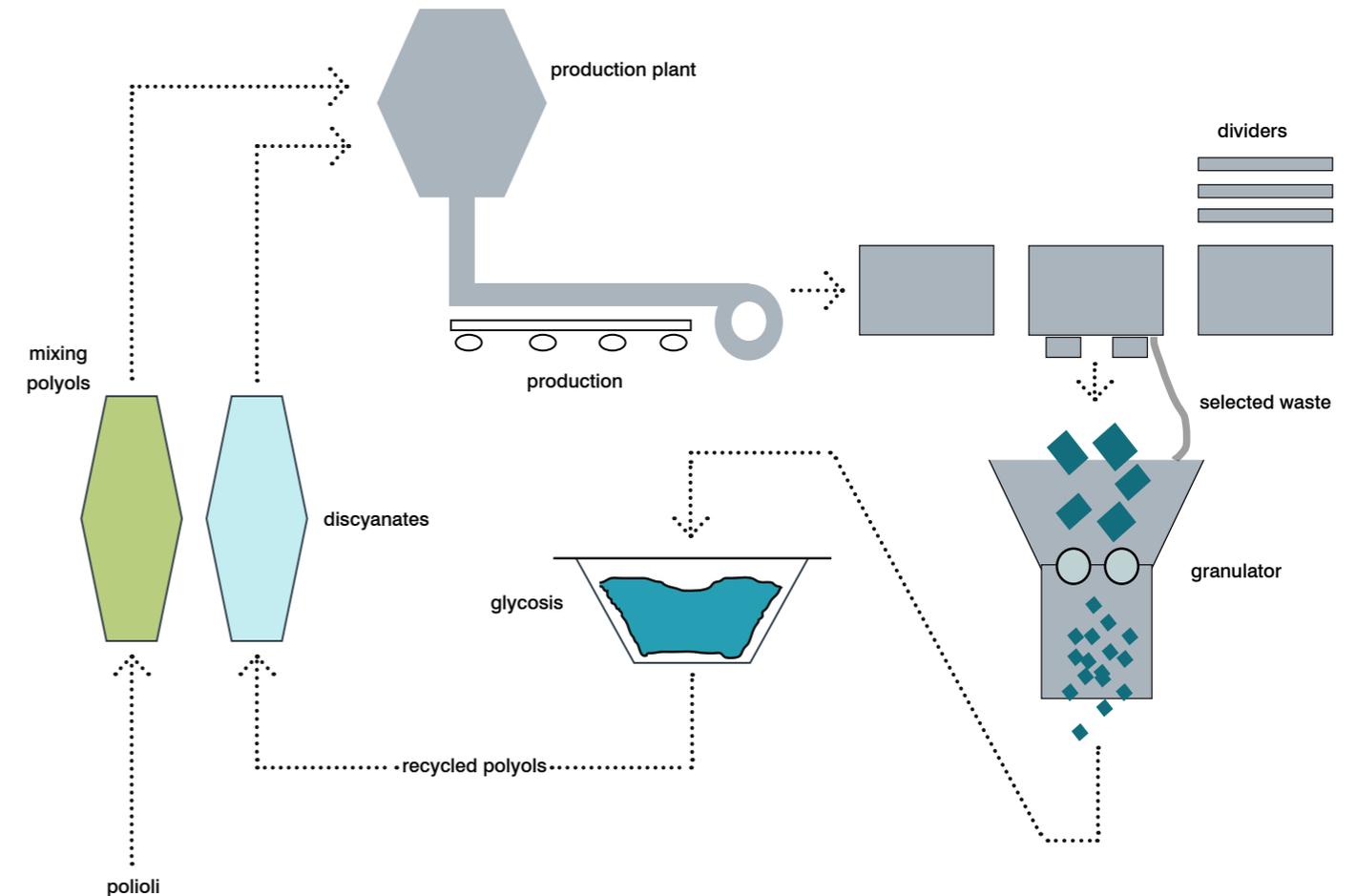
A chemical process that allows to break the polyurethane molecules expanded to regenerate the starting molecules

Alberto Lovato - Politecnico Milano

Glycolysis consists of a chemical procedure that allows to decompose the polymer in the different base elements in order to recover the original polyol and then reuse it in different applications. It is a chemical operation in which the long polyurethane molecules are broken down to regenerate the molecules of starting point or the shorter molecules that can be reused for the production of polyurethane.

The process consists in treating the foams with glycols of different types and appropriate catalysts which, when mixed at high temperatures of 200°C, lead to the formation of polyol and the generation of a series of by-products. The resulting polyols can be mixed with new polyols in different percentages, depending on its characteristics. In the best cases the percentage can arrive up to 90%, thus allowing the production of foams that contain up to 30% of recycled material.

Glycolysis is a closed-loop, single-material, chemical process which facilitates the possibility of further recycling over time. This technology applies mainly microcellular polyurethane foam used in the footwear industry, furniture and bedding, moulded polyurethane for car components and rigid and flexible insulating foams that find applications in building insulation.



Power plant with glycolysis technology

## Hydrolysis

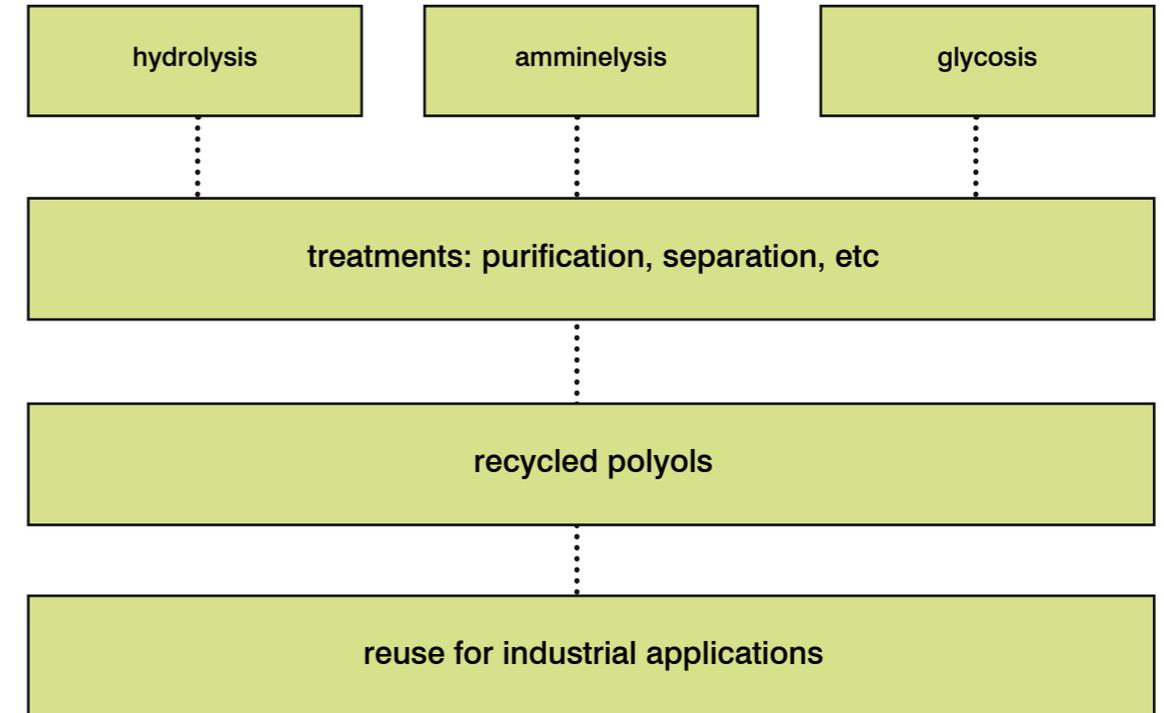
**By processing polyurethanes and water we obtain polyols and components intermediate chemicals to be reused in production.**

Alberto Lovato - Politecnico Milano

The hydrolysis process generates a reaction between used polyurethanes and water, leading to the formation of polyols and various intermediate chemicals.

Through hydrolysis a process of degradation of the molecular structure is generated in the presence of high temperatures between 250°C and 340°C. Polyols obtained from hydrolysis can be used as fuel and the intermediates are generally used as raw materials for the production of flexible polyurethane foam.

Polyether foams are characterized by a good resistance to hydrolysis.



# 2.

**New approaches of the industry  
polyurethane for  
processes eco-sustainable**



## Renuva®, the new recycled polyurethane mattresses

**Giving new life to the polyurethane contained in the decommissioned mattresses, Dow Polyurethanes develops an innovative and sustainable approach**

Davide Bellisario - PoliMi - Milano

Renuva® represents an ambitious initiative related to environmental sustainability promoted by Dow internationally, which aims to bring new life to the products used through an integrated approach involving the entire value chain. With redesign, recycling, reuse and re-production as core values, the key objective of Renuva™ is to optimize the use and recycling of resources and, in Final, minimize the volume of waste going to landfill or incineration. As part of this program, Dow has recently launched the project related to the new RENUVA® mattress which proposes to recycle the polyurethane foam from mattresses at the end of life. The RENUVA® mattress program aims to bring together the entire value chain in a new business ecosystem model with opportunities for companies operating in the recycling sector, equipment manufacturers and materials, for brand owners and, in general, for all players in the industry interested in developing eco-sustainable practices with respect to polyurethane foam. In the initial phase, Dow has formed a partnership with the German company H&S Anlagentechnik with the aim of developing a recycling system commercially viable for the production of polyurethane mattresses.



Dow's research team working on the RENUVA® program has succeeded in obtaining a replacement of up to 25% of the virgin polyol used in the basic composition of the flexible foam without generating a deterioration of physical properties polyurethane foam mechanics.

With these developments, the RENUVA® mattress project has become the flagship initiative within the circular economy program of Dow Polyurethanes, and it has been awarded the Sustainability Award 2019 for the high degree of innovation that it distinguishes. "Dow's leadership position in the production of materials polyurethanes offers us a unique opportunity through the Renuva® program, for play a responsible role in supporting the development and implementation of the life cycle of a circular product - from creation to use to reuse," he said. Marcel Moeller, global sustainability manager for Dow polyurethanes. "This program is an integral part of Dow's efforts to achieve our goals of sustainability 2025 - in particular the progress of the circular economy - and the entire industrial sector will benefit".

Link: [www.dow.com](http://www.dow.com)



Renuva® promotes a circular economy roadmap

## Cardyon®, the polyurethane mattress that uses CO2

**Polyurethanes formulated with CO2 polyols offer the same properties of conventional ones significantly reducing the environmental impact.**

Davide Bellisario - PoliMi - Milano

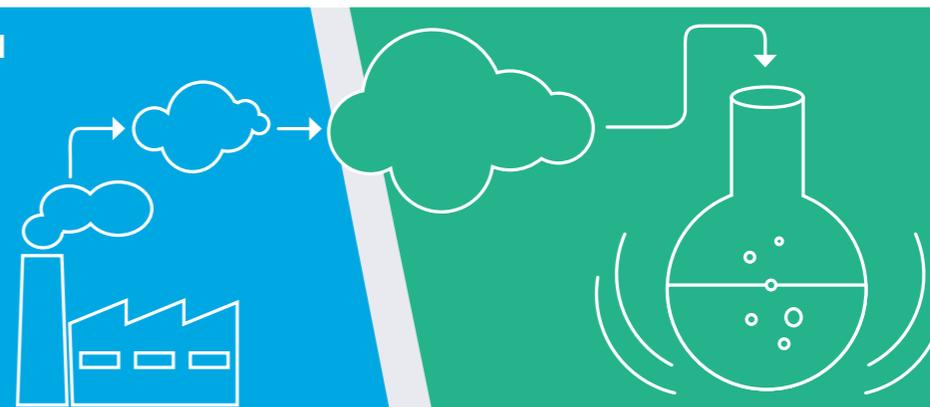
Attention to the environment and sustainability is an issue that can no longer be postponed and imposes a change of course in the actions of man to restore equilibrium ecological of the planet.

Every productive activity is required to activate virtuous practices that do not affect climate change, greenhouse gas emission and use indiscriminate resources. Now indispensable in various sectors including vital ones of medical or energy, chemical materials can become sustainable.

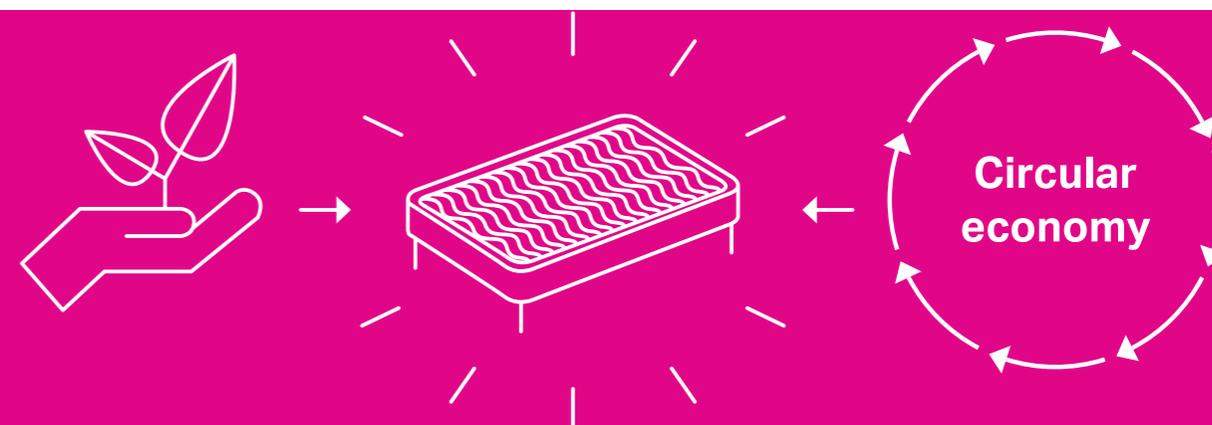
It is necessary to look at the production processes and their use in an innovative way. The topic of environmental sustainability is a central factor within the Covestro's strategy constantly directed towards the development of new solutions in the field of polymers that can combine high performance with an equally high performance significant energy saving.

From this point of view, Covestro has developed a revolutionary process that uses CO2 as raw material for the production of polyurethane foam flexible: Cardyon® polyols - which together with isocyanates are the main components of polyurethane foams - contain up to 20% by weight of carbon dioxide coming from industrial by-products instead of fossil raw materials, including oxide of propylene.

We have developed an innovative technology enabling carbon capture and utilization by partly substituting oil-based raw materials with CO<sub>2</sub>.



**Cardyon®** is a breakthrough raw material for the production of high quality flexible foams and other dynamic solutions.

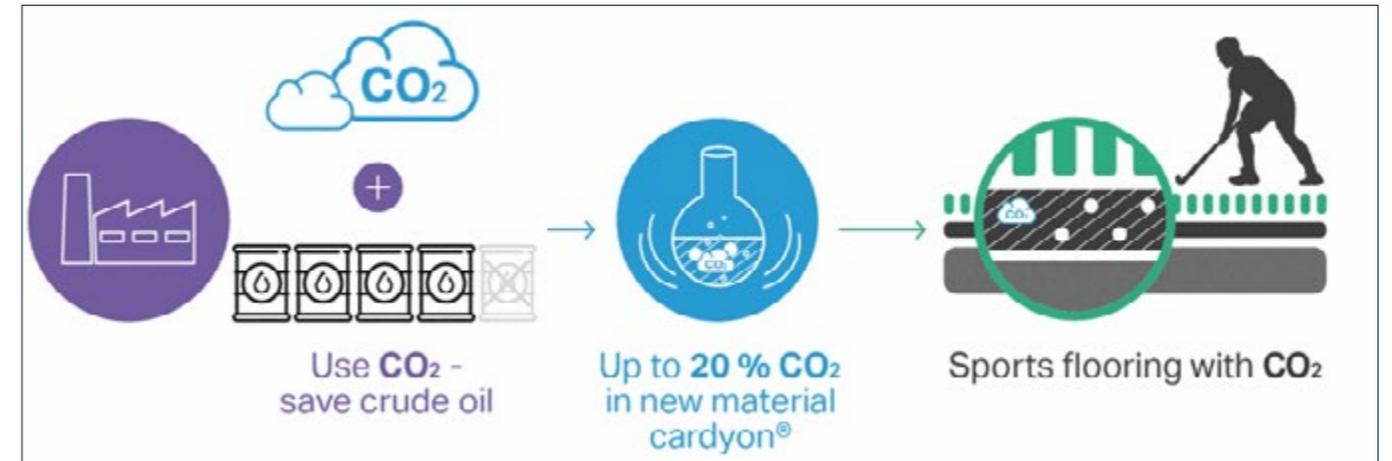


Developed by Bayer technicians in collaboration with CAT Catalytic Center of the University of Aachen, Germany, the process uses catalysts capable of effectively reacting carbon dioxide, a compound known to be inert, with other components.

The polyurethanes formulated with CO<sub>2</sub> polyols offer the same properties of conventional ones, but have less impact on the environment due to minors energy consumption of the process and the capture of CO<sub>2</sub> that would otherwise be dispersed in atmosphere.

Cardyon® is used to produce polyurethane foam to be used in the production of mattresses, pillows and padding in general for the world furniture. Further applications are also possible in a number of other areas, including plants sports: in fact, for the first time, synthetic sports floors can be produced with carbon dioxide and the first subsoil in the world of this type was now opened in a field hockey facility in West Germany. At the Crefelder Field hockey and Tennis Club of Krefeld, in fact, was inaugurated a field hockey field on lawns whose substrate is made using a polyol-based binder Cardyon® by Covestro, obtained from carbon dioxide. It is an application innovative, as this range of materials had until now been used to produce flexible polyurethane for mattresses and upholstery. It has been laid on a playing field of 99 x 59 meters and serves to cushion the effect of the new artificial turf.

Link: [www.covestro.com](http://www.covestro.com)



Crefelder Field hockey and Tennis Club of Krefeld whose substrate is made using a polyol-based binder Cardyon® by Covestro

## Decrease the volatility of organic compounds

Evonik produces a series of surfactants and amines that can reduce meaningfully the presence of VOCs in expanded polyurethanes

Davide Bellisario - PoliMi - Milano

Volatile Organic Compounds (VOCs), also called Volatile Organic Compounds (VOC), are chemical compounds such as aliphatic, aromatic and chlorinated hydrocarbons, aldehydes, terpenes, alcohols, esters and ketones. Among these the most common in residential buildings are the limonene, toluene, but the most important from a toxicological point of view and mutagen is formaldehyde.

According to paragraph 11, art.268 of Legislative Decree 152/2006, VOCs are defined as any of the following organic compound having at 293,15 K (20°C) a vapor pressure of 0,01 Upper KPa. Various are the sources of pollution of the Volatile Organic Compounds in the air of the indoor environments: the “occupants” through breathing and body surface, cosmetic products or deodorants, heating devices, cleaning materials and various products (e.g. glues, adhesives, solvents, paints,), clothes recently treated in laundries, cigarette smoke and work tools such as printers and copiers.

Other products that contain a certain amount of VOCs are interior furnishings including which the upholstery, flooring such as carpets and rugs, vertical coverings. VOCs are characterized by a certain volatility and, in the case of expanded polyurethanes flexible, tend to release from the material both during the processing of the block polyurethane that subsequently during the daily use of the product.



**Emission Management**

**TRADITIONAL EMISSIVE CATALYST SELECTION**

- Blow Catalysis (BDMAEE)
  - DABCO<sup>®</sup> BL 11
- Gel Catalysis (TEDA)
  - DABCO<sup>®</sup> 33LV
- Balanced catalysis
  - DABCO<sup>®</sup> BLV

\* available soon

**NO EMISSION CATALYST SELECTION**

Wide variety of choices including:

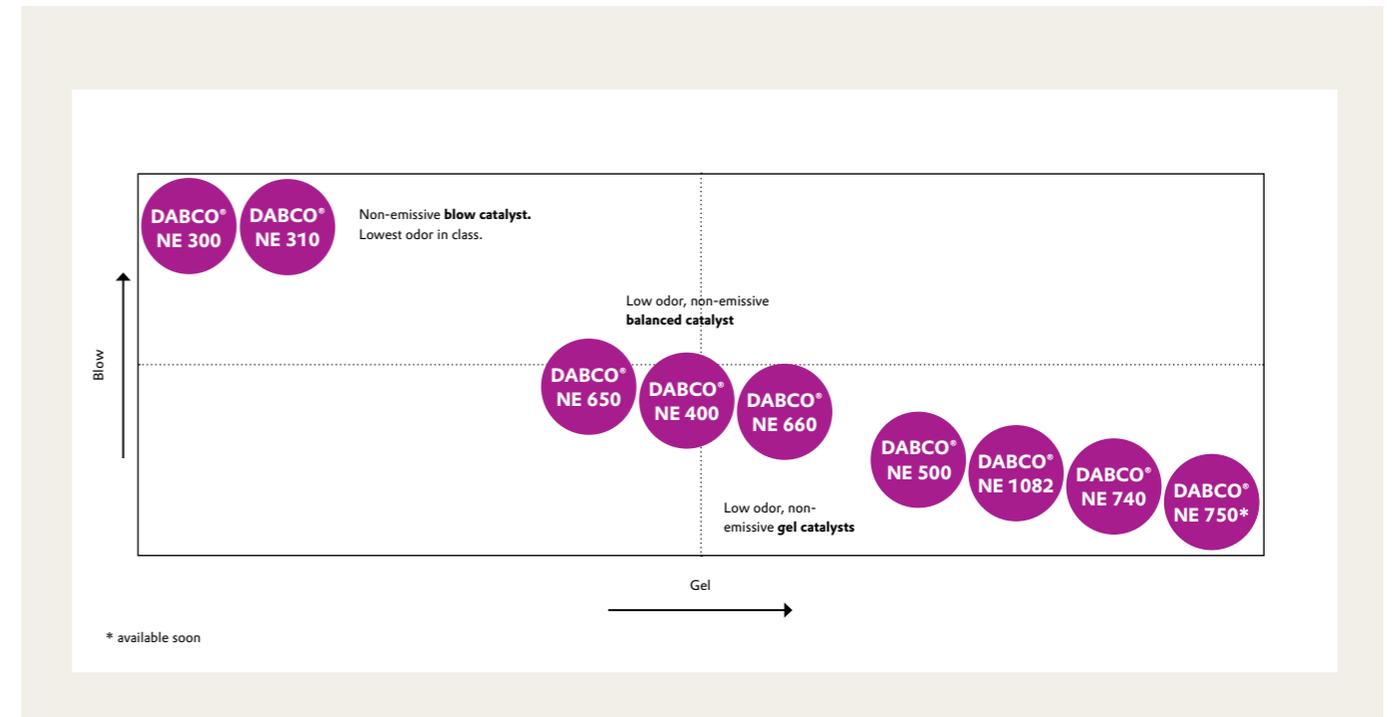
- Blow Catalysis
  - DABCO<sup>®</sup> NE 300
  - DABCO<sup>®</sup> NE 310
- Balanced Catalysts
  - DABCO<sup>®</sup> NE 400
  - DABCO<sup>®</sup> NE 650
  - DABCO<sup>®</sup> NE 660
- Gel Catalysis
  - DABCO<sup>®</sup> NE 500
  - DABCO<sup>®</sup> NE 740
  - DABCO<sup>®</sup> NE 750\*
  - DABCO<sup>®</sup> NE 1082

In order to avoid unnecessary alarmism, it should first be borne in mind that the most of the materials that make up the domestic habitat release compounds flying organic, as it happens inside the cockpits of the means of transport, in packaging and in many sports clothing and equipment.

Secondly that the decisive aspect lies in the quantity and type of compounds released. From this point of view, the products manufactured with Evonik products adopt a series of certifications issued by specific bodies such as CertiPUR® 43 44 and OEKO-TEX®, that through a complete and exhaustive series of specific analyses, allow to monitor the presence, quantity and quality of VOCs in the production of polyurethanes flexible expansions and to ensure that the presence of volatile substances is in a measure compatible with normal applications in mattresses and pillows, thus ensuring that the material is not hazardous to the health of the end user.

Many of Evonik's surfactant products, such as TEGOSTAB®, meet the following requirements Strict VOC emission limits. In addition, Evonik offers a wide variety of DABCO® amines that act as catalysts during the foaming phase, and integrate into the polymer matrix. Many DABCO® products contribute to significantly reduce VOC emissions from mattresses to the environment.

Link: [www.evonik.com](http://www.evonik.com)



DABCO® products contribute to significantly reduce VOC emissions from mattresses to the environment.

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# 3.

**New methodologies for  
facilitate recycling polyurethane  
at the end of life**



## Polyurethane products for end-of-life recycling

**A detailed overview of the different methods through which the polymer is currently used for the production of industrial products**

Alberto Lovato - Product Design - Politecnico Milano

Flexible polyurethane foam is used in many different sectors and each of them has developed over the years different methodologies through which the material is used for the manufacture of mass-produced products.

These processes are of production in which the expanded polymer is used from different technologies that refer, in general, to two modes of manufacture: on the one hand, the continuous production of foam blocks that, when cured, are cut, shaped and machined according to multiple possibilities while on the other hand side there is the production for cold foaming in moulds that allow to obtain semi-finished components of different shapes and geometries.

In both cases, thinking in the logic of a circular production that favors the recovery and enhancement of the material at the end of its life, it should be emphasized that each production process related to polyurethane has limits and potentialities that must be highlighted in order to define a correct setting of the activity productive from an eco-sustainable point of view.

The following chapters analyze in detail the production peculiarities related to each sector considering the degree of innovation and economic dimensions related to each productive behavior.



Each production process related to polyurethane has limits and potentialities

## Furniture

The furnishing sector presents a multiplicity of methods through which the flexible polyurethane foam is processed and then inserted inside the product.

The most significant part of the production is represented by the block processing which start from the cutting of the polyurethane blocks and pass, for subsequent trimming and shaping, to produce individual components to measure that are used inside the supporting structure to give comfort and elasticity to the final product.

In these cases, the use of shaped blocks or flexible polyurethane foam slabs embraces different types of materials, from those with the highest characteristics of flexibility to others with greater lift or physical-mechanical resistance.

The coupling of the different polyurethane components generally takes place through two different methodologies that impact on the possibilities of recovery and recycling of the material at the end of its life: on the one hand, with the aid of adhesives, the sheets of polyurethane are coupled and made solid in order to create continuous bodies and compact, functional to support the solicitations of people sitting or lying down. It is the case, for example, of many parts related to the production of sofas, armchairs, seating in general, coverings made by layering the padding and combining several types of polyurethanes.

On the other hand, the mechanical dry fastening, by means of industrial staples, screws or other standard components, allows you to permanently place certain soft materials inside the rigid structure of the padded product.

In this how the polyurethane parts are bound to the load-bearing structure, generally made of wood or metal, so that the stresses caused by daily use do not end up in disconnect the components from each other.



Used mattress recovery and recycling plan

Both of these processes present problems with regard to the recovery of the materials once the manufactured article has reached the end of its life: in particular the separation between various types of bonded polyurethanes or the detachment of the foam from screws and staples is a long and complex operation, with a strong component of manual skills and therefore implies a significant increase in disassembly costs. It should also be considered that the separation of glued or stapled padded parts frequently produces tears or tears in the polyurethane piece and that these are particularly frequent in the case of thin sheets. In the case of cold foamed products in the mould or obtained by pouring, it is necessary to instead distinguish between single-material products and products consisting of a structure internal load-bearing and polyurethane coating. In the case of mono material products it is evident that the recycling of the product is favored.

The fact that the object is made of a single material and that this does not imply a separation of different components. In these cases however it plays a role fundamental the final coating: if the latter is deeply integrated The structure of the foam will be complex and not easy to separate the parts and, in some cases, self-skinning molded articles, even impossible.

## Bedding

The world of bedding is based on two fundamental types of products: mattresses and pillows, to which are added a series of complements and accessories such as toppers, headrest, vertical padding for infants, cushions of various types. These typologies are produced, in some cases, through the use of only one polyurethane, generating products easily decomposable at the end of life.



Towards a circularity in recycling of mattresses

In these cases, which represent the largest slice of the total products, the parts are glued through adhesives that do not promote their detachment at the end of their life. There are also sprung mattresses made of metal and plastic that have parts of covering made by means of expanded polyurethane sheets: also in these cases, the separation of the components requires complex work with high incidence of labor. With regard to mono-material products, the separation of the product at the end of life is facilitated by the presence of a single material while the covering is removable through hinges positioned along the edges human-ecological safety of the polyurethane products, which takes into account the different areas of application of the material, among which are applications in bedding.

The CertiPUR® and OEKO-TEX® labels, while presenting some differences between each other in the VOC detection methodology, indicate, to the end consumers concerned, the flexible polyurethane foam materials that have as added value the guarantee that they have been analyzed to assess their harmlessness to human health. In other terms, constitute a tool at the service of the reseller and the end user to have a quality and healthy product.

## Sport

There are many sports equipment using flexible polyurethane foam, starting with courtside protections in basketball and volleyball, up to mattresses for the gymnastic activities, martial arts and other disciplines. In most cases, these equipment have a high degree of disassembly as blocks and internal sheets are generally made of a type of polyurethane foam.



Spare parts and recycling

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## Transports

The world of transport sees a significant use of flexible polyurethane foam, in particular concentrated on different components inside the passenger compartment. The seats, the inserts for the sides and other internal accessories are produced through co-molding, by integrating a metal or plastic frame or supporting structure: for this, similar components need to be broken down at the end of their life using special processes. separation and recovery.

The presence of flexible polyurethane parts also extends to mats and coatings in particular for the trunk area, which contribute to the soundproofing of the cockpit: generally these elements are die cut or shaped and have no particular complexity during the recovery phase.

## Packaging

Packing with flexible polyurethane foam components are present in several solutions, in particular dedicated to the protection of fragile or easily perishable goods. In the fruit and vegetable sector flexible polyurethane foam sheets are used as separating elements to divide the bunches of grapes harvested: in this way you can keep the fruit separate and, thanks to the microcellular structure of the foam, you can guarantee the necessary transpiration avoiding a rapid deterioration of the goods during transport and stationing at the points of sale. Packaging dedicated to the transport of particularly fragile objects such as glassware, fine bottles, porcelain vases, are made with shaped polyurethane blocks that can be recovered at the end of use.



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Wood frame and polyurethane foam cushion



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Similar attention must be paid to coatings for make them easily removable and, at the same time, able to contain volumes shaped foam.

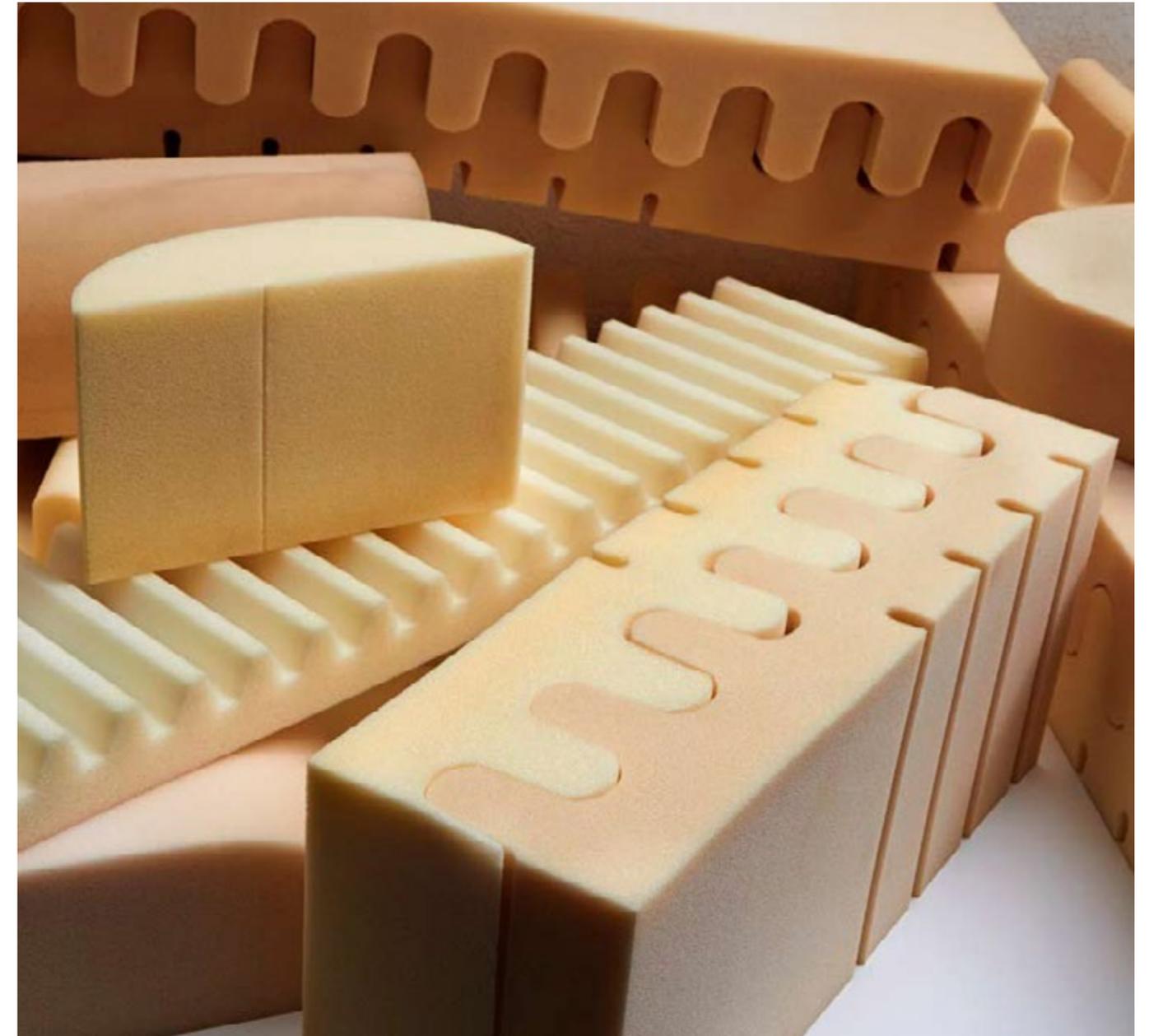
### **The connections between supporting structures and upholstered parts**

The design of the supporting structures, when necessary to ensure robustness and load resistance for the final product, must combine the criterion of integration between different materials with that of rapid separation at the end of life: from this point of sight, the polyurethane foam produced in blocks and slabs allows you to think about new geometries, customized and adapted to each individual case, to reach this important goal.

### **Producing with a view to the separation of components at the end of life**

During the design study it is necessary to take into account the processing of the material used during production and consider any waste. According to the material used it is necessary to consider the different production techniques according to the which different amounts of waste can be obtained. If you consider the technique for molding you must also take into account the materials necessary for produce the mold.

From this point of view it is also essential a tight synergy between designer and producer: the designer must know the production technologies so that, together with the company's technicians, it can determine the characteristics of the also produced according to the processing scraps.



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Polyurethane foam components



# 4.

**Projects for a new way  
to produce with  
polyurethane flexible foam**



## PUReSmart, the polyurethane in the Circular Economy

**PUReSmart represents a research and development project of methodologies of sustainability assessment more and more able to respond to the business needs in relation to the Circular Economy**

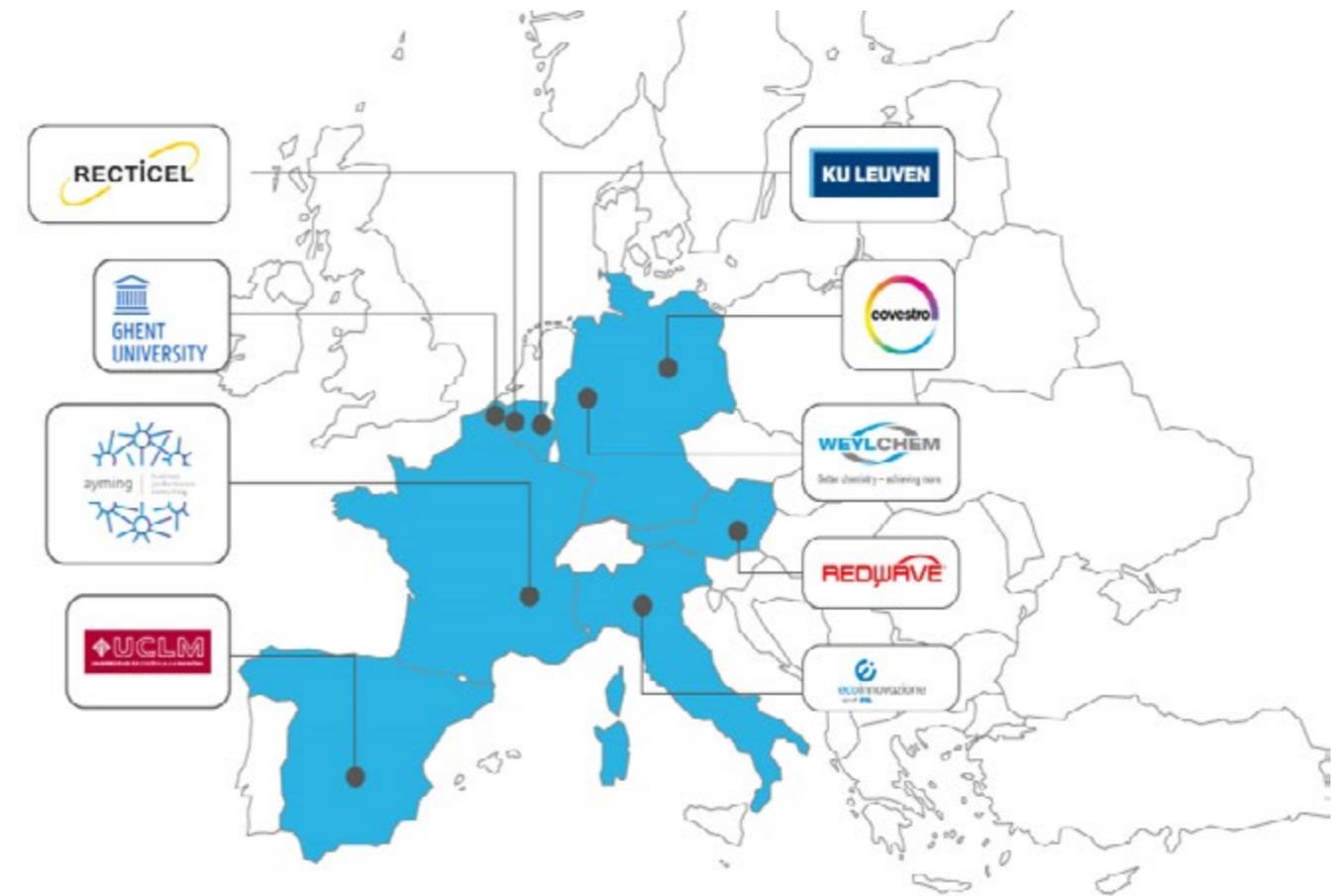
Marino Pietri - Politecnico Milano

From January 1, 2019 the project PUReSmart (PolyUrethane Recycling towards a Smart Circular Economy), coordinated by the Belgian company Recticel and that will benefit from for a duration of 4 years of the funding of 6 million euros by the program of research and innovation Horizon 2020 of the European Union.

PUReSmart groups together in consortium 9 subjects from 6 different countries that collaborate with different functions for promote a mode of transition from the current linear life cycle of products in polyurethane to a circular economy model.

Thermosetting polyurethane products, in particular flexible foams and rigid, have many advantages but are, as is well known, much more complex to recycle compared to thermoplastic materials.

The recycling of polyurethane in favor of an Intelligent Circular Economy is therefore a very ambitious project because the challenge is challenging: a recovery at the end of life of more than 90% by developing technologies intelligent separation of the different types of PU into distinct streams, then broken down into their basic components that can be used as input for PU products or raw materials for newly designed polymers.



PUReSmart members map

The goal is to combine the durability of thermosets with the circularity of thermoplastics. PReSmart intends to fully address the issue of the recyclability of thermoplastics. flexible foams, in particular polyurethane, adopting two strategies.

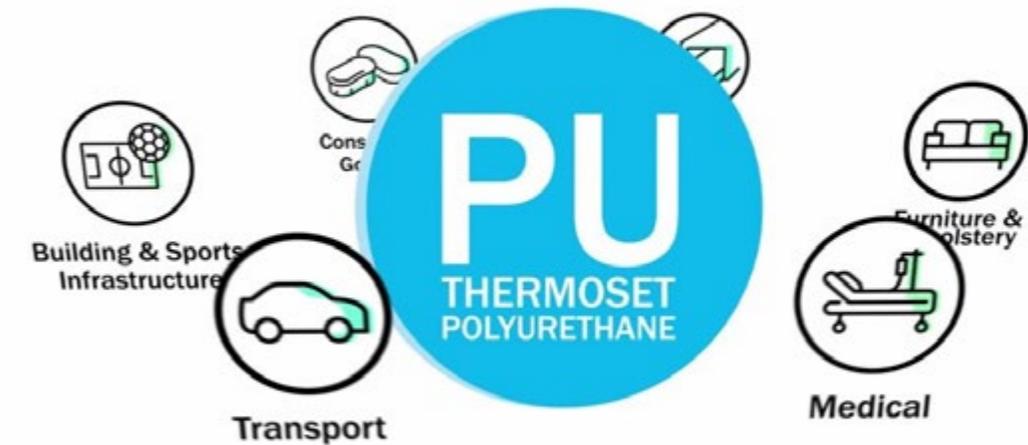
The first, long term, currently being tested, is the most ambitious one and aims to develop a different type of PU than the one currently on the market, which inherently possesses the possibility of being recycled. The products made with this inherently recyclable PU will come to the end of life after others 10 years or so.

In the meantime, the project with a second strategy aims to recycle the existing as part of a correct selection of polyurethane foams by means of a automatic system to select existing foams improving their recyclability mechanics, Recticel and Covestro, both involved in the PReSmart project, are collaborating on innovative solutions to make the mattresses more sustainable, from the research of raw material technologies to the production of end-of-life mattresses.

On the occasion of the furniture fair Imm Cologne 2020, Schlaraffia/Recticel Schlafkomfort GmbH presented the first completely polyurethane mattress recyclable with the Geltex brand.

Dr. Berit Stange, director of circular economy in the polyurethanes segment of Covestro, said: "The project is part of a long term program with the which Covestro is strongly oriented towards a circular economy. In particular, there We focus on the use of materials from sustainable sources, such as waste, plants and CO2".

## APPLICATIONS



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“The polyurethane mattresses are widely used for a long time and appreciated for their comfort,” says Boudewijn Dezutter, Commercial Director of Recticel. “Now is the time to further increase the sustainable value of the material in every phase of the life cycle.”

Recticel was the first company to support the development of Covestro’s polyol CO<sub>2</sub>, Cardyon® implementing it for the production of flexible polyurethane foams.

Link: [www.puresmart.eu](http://www.puresmart.eu)



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Geltex, a mattress made with recycled polyurethane foam

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# 5.

**Companies tell each other.**

**Technologies, materials and  
research of protagonists  
of the sector**



## The protagonist companies

Leading industrial reality in production of flexible polyurethane foam, the Elm Giuseppe spa constitutes a significant example of Italian entrepreneurship more evolved and dynamic. Born at the end of the years '50 to expand the Group's commitment Elm in the specific field of polyurethanes, increasingly strategic products in many fields applications, has quickly established itself for a business model characterized by precise choices. Production technologies at the cutting edge constantly updated, research of innovative products in performance and reliability, controlled quality and certified, constant commitment to a complete environmental protection. Olmo Giuseppe spa represents a large progress oriented company, the reference guide for your industry for quality flexible expanded polyurethanes.

[www.olmogiuseppespa.com](http://www.olmogiuseppespa.com)

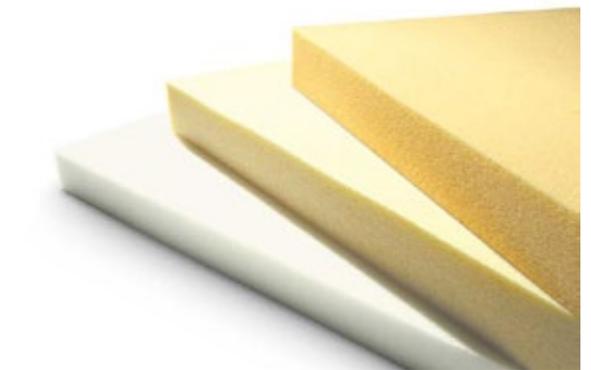


## EcoFoam, nature thanks

The Elm E-CO2FOAM foams, come produced with the use of a new polyol which reuses carbon dioxide (CO2) as raw material. Thanks to this polyol CO2 is brought back into the supply chain productive, with a consequent reduction of its emission into the atmosphere.

Moreover, this new technology allows have less use of raw materials of fossil origin. This polyol allows to make innovative and flexible foams more sustainable. E-CO2FOAM foams have physical and mechanical characteristics comparable to those of other foams conventional, excellent breathability and a low permanent deformation; fundamental elements for a mattress with a high comfort.

The E-CO2FOAM foams have therefore a double peculiarity: they allow everyone of us to participate in the safeguarding of the environment and at the same time of maintain an excellent quality of rest.



## The protagonist companies

Leader in production and processing flexible polyurethanes foamed fabrics non-woven and car interior parts, ORSA Group is recognized as one of the most important realities operating at the international and stands out for its strong innovative spirit and real attention to needs of constantly evolving markets. ORSA Foam spa, pride and joy of the group, bases its competitiveness on the quality of the products, on the continuous innovation and ethical choice based on an industrial philosophy respectful of environmental and health protection public. ORSA Foam spa produces over 200 types of flexible polyurethane foam between polyethers and polyesters, in block configurations and rolls, in an infinite range of colors and with the most various performance characteristics.

[www.orsafoam.it](http://www.orsafoam.it)

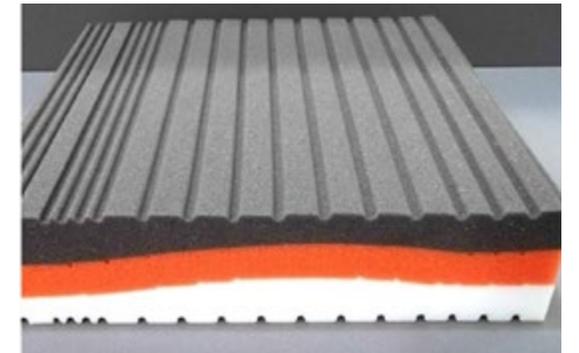
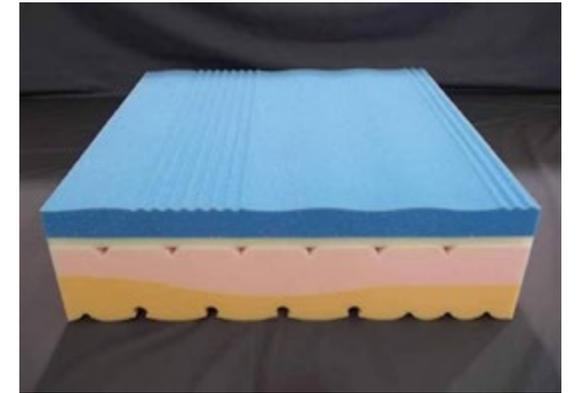
## ORSA foam



## Breeze®, rest with natural freshness

With Breeze®, in 2013, ORSA Foam has brought the polyurethane to breathability levels unprecedented. The detail open cellular conformation guarantees the free passage of air and the fast moisture and heat dispersion. In addition high resistance characteristics to aging in tests such as fatigue dynamics and residual deformation after compression, allow Breeze® to give the maximum sensation of well-being, ensuring the most complete repossession. The new Breeze® HS range born in 2019 also combines softness and Breathability: the optimal choice that ensures high levels of comfort in both bedding and in furniture. In fact Breeze® polyurethanes foamed are designed to adapt also to the many design shapes.

[www.orsafoam.it](http://www.orsafoam.it)



## The protagonist companies



Pelma spa was founded in 1962 and from the very beginning aimed to build an image of itself modern and dynamic to the point of making your own name synonymous with quality and reliability. A “Question of Form ... and Substance”. This is the philosophy that characterizes the products Pelma spa and that allowed us to improve research and service. Our commitment led us to the realization of a dream: Pelma spa is now capable of to face the complexities of the market thanks to the professional preparation of men and women who together believed to a challenge. Pelma spa is our way of designing the future by living the today without forgetting the past. The company is aware that only the right conjugation between human resources and technology will ensure that you look at the future with confidence and security.

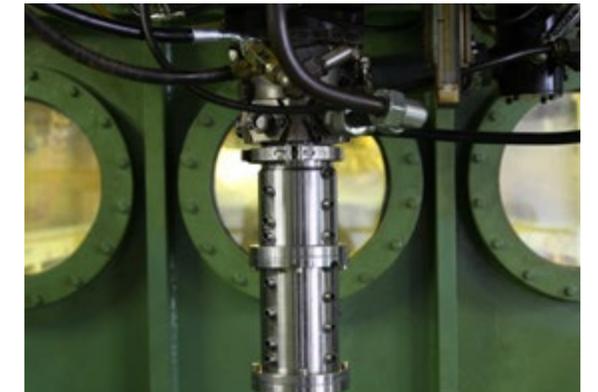
[www.pelma.it](http://www.pelma.it)



## VPF (Variable Pressure Foaming)

Always attentive to respect for the environment, the beyond what is imposed by law, Pelma has installed the VPF (Variable Pressure Foaming), a fully automated plant that moves the limits of the Expanded polyurethanes totally eliminating each auxiliary blowing agent (CFC/HCFC, methylene chloride, CO<sub>2</sub>, etc.), obtaining a foam material with only water, which is totally environmentally friendly and recyclable. The use of this sophisticated system also allows you to make foams with best physical-mechanical properties, with an improvement in stratigraphy compared to standards, and with greater consistency over time.

Pelma is the only company in Italy to use this technology that allows to have a higher quality and a constant verification of the characteristics of the finished product.



## The protagonist companies

Cires spa produces polyurethane foam polyester-based and polyether-based. Different physical-mechanical characteristics of the various products allow to space on several sectors: from automotive to insulation, clothing, without omit the padding market for the furniture and the mattress.

Each product reflects the know-how company that in decades of activity has permission to be always present on the polyurethane market, with a glance constantly focused on innovations in field of raw materials and technology.

[www.cires.it](http://www.cires.it)

# CIRES



## Polyester-based polyurethane

Polyester-based polyurethane is characterized, compared to the basic one polyether, with the following characteristics:

- flame laminability with different types of materials such as fabrics and plastic films;
- more regular and greater cell structure resistance to air passage, therefore better sound absorption;
- higher mechanical resistance;
- higher resistance to organic solvents.

It is used in various sectors such as: automotive, clothing, footwear, acoustics, home and personal hygiene, packaging, thermal insulation.



## The protagonist companies

The production site of NordItalia Resine srl (NIR) is located in Campodarsego (PD). NIR is specialized in the industrial production of flexible polyurethane foam, obtained with continuous block technology.

They are present two foam production lines polyurethanes: the 1 Maxfoam line, which uses water as a blowing agent, and the 2 CarDio line, which allows the use of carbon dioxide as an agent auxiliary expander. Flexible polyurethane foam is sold as raw block or can be further processed in sheets and shaped of various sizes.

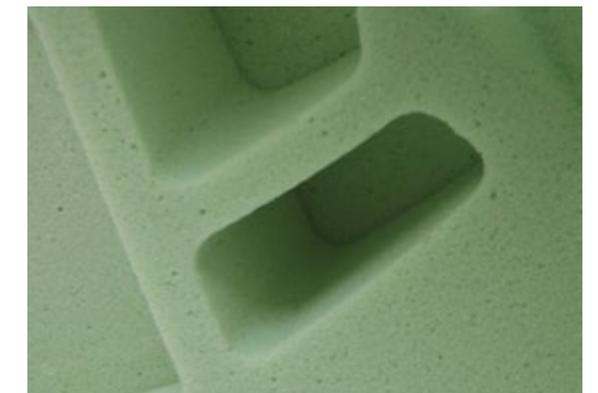
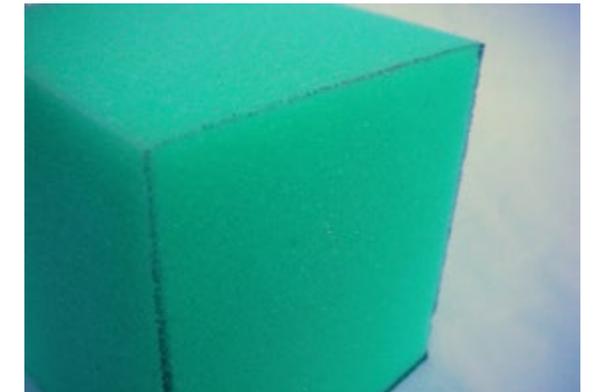
## NORDITALIA resine



## CarDio, use CO2 as auxiliary expander

CarDio technology represents a new generation plant for the production of flexible expanded polyurethanes.

This process allows the production of continuously, introducing the agent expanding CO<sub>2</sub> (carbon dioxide liquid) under high pressure conditions. Unlike traditional technologies, the use of this substance, widely available in nature, allows you to avoid the use of harmful expansion agents for the environment such as CFCs, chlorofluorocarbons, and VOCs, volatile organic compounds. It also allows to reduce the quantity of isocyanate necessary for the process of reaction by lowering the exothermia, i.e. the maximum temperature reached, and in turn reducing the risks of self-combustion.



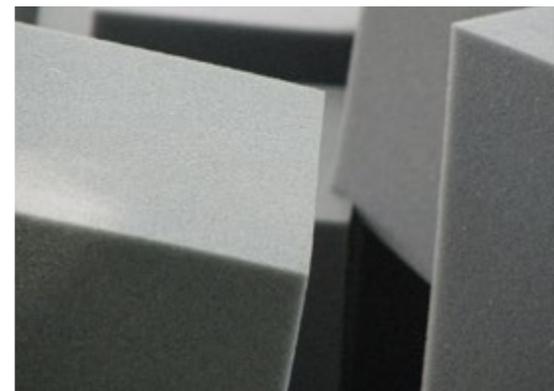
## The protagonist companies



S.I.P South Italy Polyurethanes specializes in the production of polyurethane foam flexible continuous polyether based, with realization of blocks, sheets and rolls.

The factory, located a few kilometers from Matera, occupies an area of 160,000 sqm. of which 27,000 covered.

The activity inside the S.I.P. plant is addressed exclusively to the production and sale of flexible polyurethane foam by continuous block, with different density, formats and colors. The different semi-finished materials are used in multiple fields of application, from furniture to thermal insulation and acoustic, from vehicle interior fittings until packing.



## One Shot Technology

S.I.P South Italy Polyurethanes specializes in the production of polyurethane foam flexible continuous polyether based, with realization of blocks, slabs and rolls.

The basic technology adopted is that of the so-called One Shot system, developed in the USA, with HENNECKE high pressure production QFM with technology: CO<sub>2</sub>, MDI and TDI.

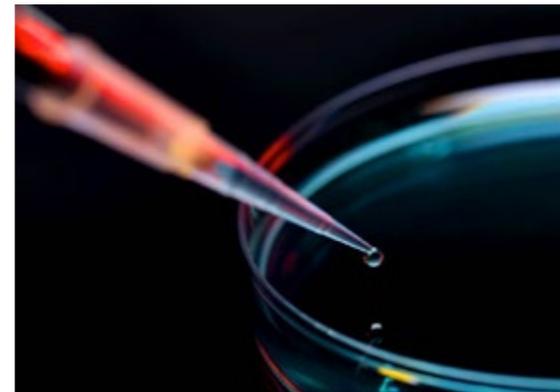
The laboratory is equipped with equipment for the control of the material produced and that purchased from third parties; is able to perform compressive strength tests and sinking, elasticity, deformation permanent, dynamic fatigue, fatigue static, elongation, breaking load, reaction to fire according to regulations Italian and international.



## The protagonist companies

Covestro represents one of the main worldwide producers of raw materials for flexible polyurethane industry over that of systems for polyurethane foams rigid, semi-rigid, flexible and elastomers polyurethanes. Covestro is constantly engaged in the development of technologies advanced for the polyurethanes sector, conceived with an attentive look at the performance and environmental sustainability processes.

[www.covestro.it](http://www.covestro.it)



## The protagonist companies

Evonik Industries is an international leader in the world of chemistry at the service of industrial production.

Evonik products for the polyurethanes sector flexible expanded find application in multiple sectors: from the production of household appliances to transport, from the padding for furniture up to solutions for the packaging, thermal insulation and acoustic to the production of articles for the sport and leisure time.

[www.evonik.com](http://www.evonik.com)



## The protagonist companies

BorsodChem is a leading manufacturer of plastic raw materials and products inorganic chemicals in the European region.

The integration of BorsodChem into the Group Wanhua has transformed the two companies regional into one global society, the third largest producer of isocyanates in the world.

BorsodChem provides high quality products MDI and TDI isocyanates to downstream industries, as the polyurethane foam industry flexible. BorsodChem adheres to most high safety standards and promotes “green chemistry” and responsibility environmental.

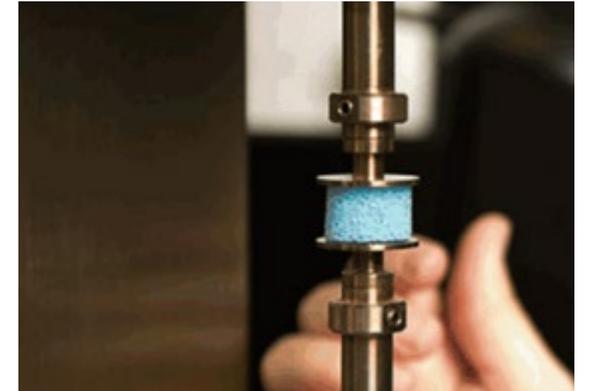
[www.borsodchem-group.com](http://www.borsodchem-group.com)



## The protagonist companies

Passion for innovation inspires and guides Dow's growth strategy by pushing to investing in new cutting-edge technologies in new sectors and new geographical areas. This results in solutions able to respond to major global challenges: in particular, in the field of polyurethane foams, constant collaboration with industries of multiple sectors, has made it possible to create unique solutions to meet specifications performance requirements.

[www.dow.com](http://www.dow.com)



## The protagonist companies

Huntsman's polyurethanes division in Europa produces and markets products MDI and MDI-based systems for production of flexible polyurethane foams used in the production of mattresses, cushions and furniture. Innovative technologies of Huntsman allow manufacturers of foam all over the world to produce a wide variety of high quality foams resilience, viscoelastic and other foams special.

With a constant focus on research and development, Huntsman provides highly differentiated technologies such as recently launched range of foam of RUBIFLEX® Cocoon polyurethane with excellent heat control properties and humidity and pressure distribution.

[www.huntsman.com](http://www.huntsman.com)

# HUNTSMAN

Enriching lives through innovation



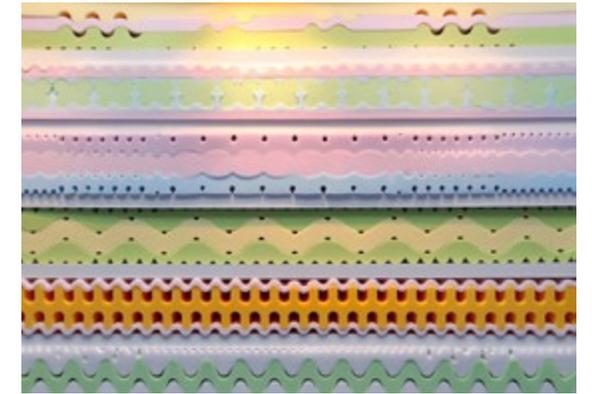
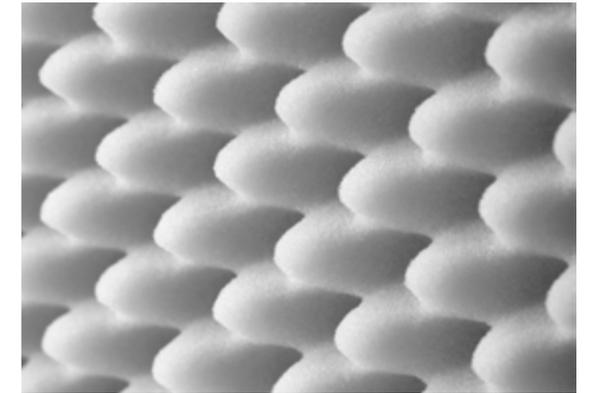
## The protagonist companies

REPI has been producing colours and additives for applications such as flexible, rigid, semi-rigid polyurethane foam, integral skin and polyurethane elastomers for over 45 years.

REPI offers carbon black and pigment dispersions that give the user infinite variations able to give colour and differentiate products with no impact on the properties of the material. The low viscosity liquid formulations are supplied ready to use and offer excellent dispersion and performance. REPI also offers a range of additives for polyurethanes used as both an aesthetic aid and in the performance and protection of the product: to protect against flame, improve the adhesion between sheets and heat resistance, reduce oxidation and protect against aging, key elements to preserve the physical properties of polyurethane.

[www.repi.com](http://www.repi.com)

# REPI



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## The protagonist companies

Shell is an energy company that operates in research, production, refining and marketing of raw materials for the polyurethane foam industry flexible.

Shell is present in many Countries cooperating with industrial manufacturers belonging to all the main sectors where the polyurethane foam finds applications.

[www.shell.com](http://www.shell.com)



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## Final notes

The written contributions published in this volume are made exclusively for this edition. In the case of publications of parts of this volume, we request that the source is expressly mentioned.

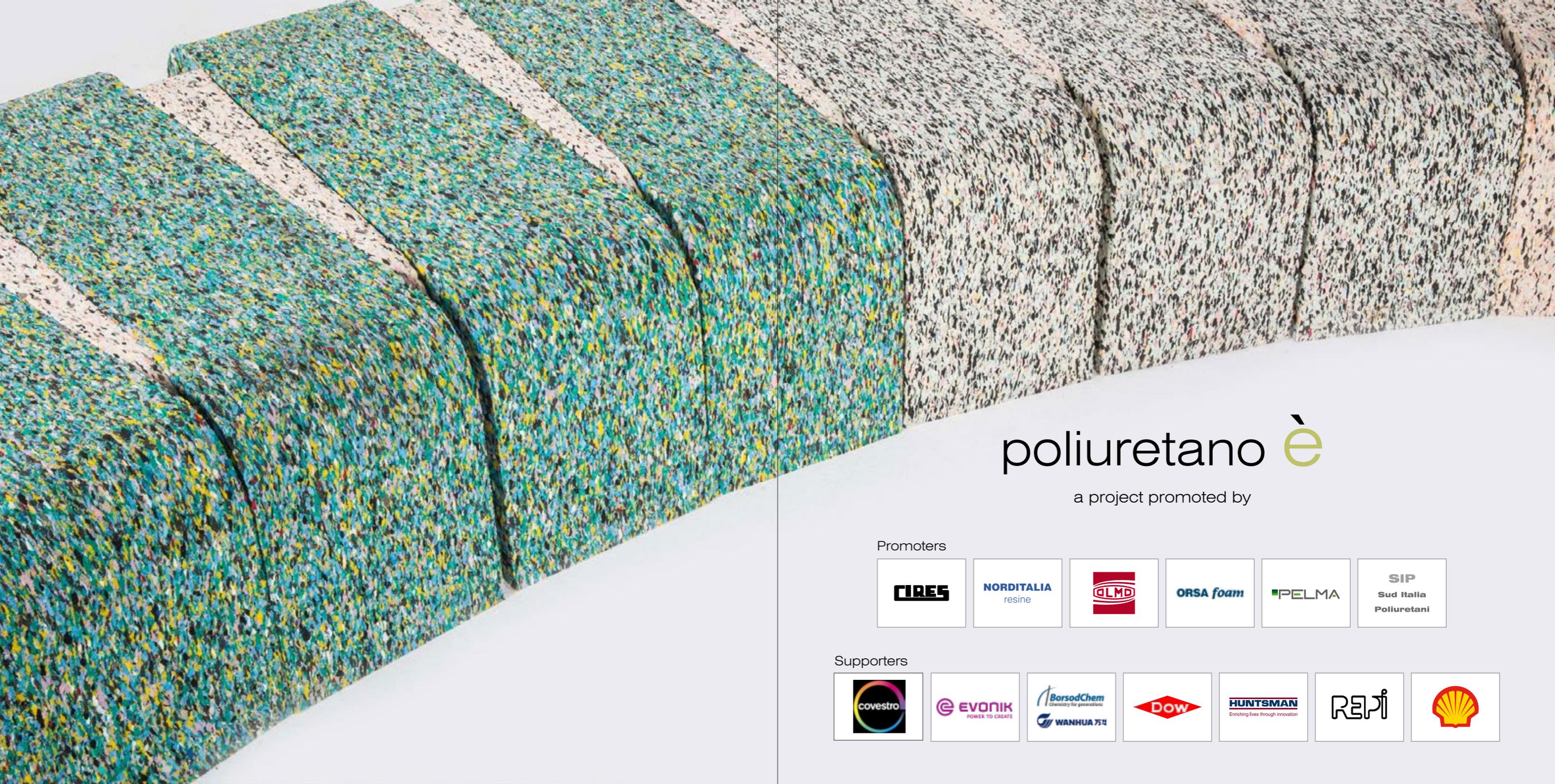
The illustrations accompanying this volume are edited by Studio Giovanetti, Luca Perani, Karl Rainer.

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