

A network of glowing blue spheres connected by lines, set against a dark wooden floor background. The spheres are arranged in a grid-like pattern, with lines connecting them to form a network. The lighting is dramatic, with the spheres casting soft shadows on the floor.

GRADO ZERO INNOVATION

**SUSTAINABLE MATERIALS &
PRODUCT INNOVATION**

Research, Design, Development & Production

WHO WE ARE

Grado Zero Innovation is an Italian SME performing, in a business to business approach, applied Research and Development, designing and scaling-up production of innovative materials and final products. Grado Zero Innovation (GZI) is a spin-off of Grado Zero Espace (GZE) a company with more than 17 years experience in technical textile and engineering of advanced flexible structures.

Thanks to its multi-disciplinary group made of complementary technical figures, from chemistry to mechanical and aerospace engineering, to product and interaction designers, GZI is able to offer a 360° design service, from the development of the Proof of Concept, to the industrial value chain analysis of the final product.

What marks Grado Zero Innovation out is that it creates personalized finished products, garment and accessories highlighting the local handcraft value and the ethical issues. GZI takes into account the product life cycle and reuse of materials for a more sustainable world. In this field we apply ECO Design, Design for reuse, Life Cycle Assessment and Eco-efficiency

THE TEAM

Giada Dammacco

Co-responsible of the R&D team of GradoZero



Qualification:

Senior Industrial Designer @ Prototyping, Sustainability and Life Cycle Engineering Lab of GradoZero Lead the Industrial Design team of GradoZero

Skills and competencies:

She has a M.Sc. in Industrial Design and is co-owner of Grado Zero Innovation S.r.l. She is responsible for product development, concept design and prototype development within the Business & Product consulting group of GradoZero. A selection of products designed and realised by her for GradoZero are: Zero Waste shirt for Trash2Cash project. Circular business model and zero waste design pattern. Using post-consuming waste cellulose yarn (IonCel F); Cooling suit designed for McLaren racing team and Spidi for Moto GP; Thermal insulating jacket - Everest edition (QUOTA ZERO): System jacket designed for a scientific expedition to Everest. Patented sleeve/glove system design and AEROGEL DESIGN SYSTEM; S1 Suit: Sailing suit for Transat 6.5. Study and integration of smart textiles and shape memory membranes that resists to abrasion and salinity; Healthcare&Wellbeing (GLOWE): Smart hand rehabilitation device. Design of piezoelectric flexible membrane integrated into OLED screen printed textile.

Filippo Pagliai

Responsible of the Managing team of GradoZero



Qualification:

Technology Transfer Manager @ GradoZero Lead the Technology Transfer activities of GradoZero

Skills and competencies:

He has an MSc in Social Sciences and Science and Technology Communication. He has founded the GradoZero group in the early 2000s. His entrepreneurial activity and his scientific exploitation and dissemination focus was always devoted to high-tech materials and applied engineering (mainly shape memory materials, composites/nanocomposites and metamaterials) and in the development of functional materials and their applications into PPE, Sportswear and Outerwear, and Textile Industry in general. He has worked in the field of multifunctional coatings, as well as Hydrogels and Aerogels. After that, he moved to the field of shape memory solutions and structures, and then on sensing technologies to be applied in smart wearables. His activity addressed both the study of the fabrication techniques to control and optimize the material structure at the meso- and micro-scale to optimize its functionalities as well as the exploitation of these material structures, especially in Textile applications. He is extremely skilled in Technology Transfer,

has being a pioneer in working with ESA (European Space Agency), in research and ToT activities.

Enrico Cozzoni

Main responsible for the R&D team of GradoZero



Qualification:

R&D Team Manager @ Materials Lab of GradoZero; R&D Team Manager @ Prototyping, Sustainability and Life Cycle Engineering Lab of GradoZero; R&D Team Manager @ Systems, Sensors and Sensing Techs. Lab of GradoZero

Skills and competencies:

He has an MSc in Aerospace Engineering, a BSc in Mathematics, and PhD in Industrial Engineering. After having worked for several years in academic research projects dealing with the use of advanced materials mainly in Aeronautics & Space, in 2007 he started his career as R&D consulting engineer and project manager for different private companies (Piaggio, IDS, SICAM, Galileo, Leonardo, Aermacchi, Augusta, etc.). He works for GradoZero from 2011, as main responsible for R&D projects @ European, National, Regional and Trans-regional levels (e.g. 3D-LightTrans; FP7 project; ManuCFBlade; MANUNET II project; Trash2Cash - H2020 project; EUCALIVA - H2020 project; PORTABLECRAC - H2020 project; Repro-Light - H2020 project; EcoliSens - MANUNET III project;

3D Blade - MANUNET III project, and several others, more than 15).

His skills and competencies are strongly related to innovative high-tech and advanced materials, composite (with Polymer, Ceramic and Metal matrices), hybrid nanocomposites, metamaterials, shape memory and stimuli-responsive materials (SMAs, SMPs, Magnetorheological), functional and mesoporous materials (including SH materials), nanomaterials (Si, C, h-BN, etc.), Graphene, structured Carbons and Biomaterials (mainly Hydrogels) based on HAP, Keratin and Collagen. He is strongly skilled in Technical Fibres Techs., including Carbon, Quartz and Basalt fibres. He is also an expert in Surface Techs. (including Metal, Polymer and Ceramic coatings).

His competencies extend also to Multiphysics Simulation and Simulation Modelling, Feedback Control Systems, and Systems and Life Cycle Engineering (including LCA, LCC, SLCA and Efficiency and Ecosystemic Impact Analysis). He is an expert in Digital and Cognitive Manufacturing, applied to several fields of the industrial manufacturing, (including 3D Printing, Additive Manufacturing, IIoT and Industry 4.0). He has worked extensively in Plasma Physics and Vacuum Techs. applied to Space, having designed for the Italian Research Centre in Aerospace a special probing system composed of 12 probes (Faraday and Langmuir probes), plus the Electronics, for Hall thrusters testing (unique in the world, since movable within the vacuum chamber).

In his consulting work and research activity, he also deals with Photo-assisted and Photocatalytic Techs., mainly for the (bio-)fabrication of green chemicals and biofuels.

He is an expert in (bio-)Sensors and Sensing Techs., including Microfluidics, Graphene-QDs, wearable sensors and IoT devices, also for applications in Space Health.

He is author and co-writer of several scientific papers and patents related to advanced

materials and manufacturing processes. He won several prizes with his R&D projects and activities, between these to mention the JEC Innovation Award in 2015 in the Automotive composites field for Europe.

Ludovica Cantarelli

Junior R&D Project Manager



Qualification:

Junior R&D Project Manager @ Materials Lab and @ Prototyping, Sustainability and Life Cycle Engineering Lab of GradoZero

Skills and competencies:

She has a MSc in Materials Science, and a BSc in Materials and Nanotechnology Engineering at Politecnico of Milan, where she has explored the nature and behaviour of materials and the process of creation from the drawing board to mass production. She has developed a solid understanding of the industrial production, focussing specifically on metallic and polymeric material products. With her master's project Wine Matters, she explored how waste streams created from the winemaking process could be better utilised to become intrinsic to the end product. Through a new process, the agricultural waste materials become packaging for the wine and paper for the labels. She has worked through an internship at RATTI S.p.A. at the textile technical office, at The Sustainable Angle for the Future Fabrics Expo 2019, and with Baolab, a

multidisciplinary Milan based CMF studio, before getting hired by GradoZero. She is responsible for the development of the digital tailored platform for the European project FBD_model.

Claudio Pucci

Senior Industrial Designer and Project Manager



Qualification:

Senior Industrial Designer and Project Manager @ Materials Lab and @ Prototyping, Sustainability and Life Cycle Engineering Lab of GradoZero

Skills and competencies:

He has a MSc in Industrial Design at Politecnico of Milan. He is a product and systems senior designer with design management and product management skills and experiences acquired working for the following companies: LG Electronics, Whirlpool, Elica, Targetti, Atlas Concorde. Claudio has proven design project abilities with long years of experience on a wide range of products, from household appliance to furniture, from interior design to lighting products. Claudio has also an extended knowledge in LCA analyses and Life Cycle Engineering (including Social LCA). He is strongly skilled in Multiphysics Simulation and Simulation Modelling, Design for 3DP and Eco-Design. He has designed a modular and smart lighting system for Repro-Light H2020 project.

WHAT WE DO

Materials Development

GZI working network has access to well-equipped laboratories and well-skilled people to modify, adapt and combine together different materials and technologies in order to obtain the best application results and performances.

Engineering

The Engineering activity employs the latest design techniques in an integrated way. The work starts from the idea and the development of the project in 3D settings, arriving to the use of the 3D digital model in every simulation area.

Microclimate management

The microclimate management that is more than just the management of the temperature since there is also the humidity / transpiration factor. In this section we would combine all the technologies and / or materials aimed at managing the temperature and humidity inside the garments, but also the design, ie the way in which everything is built to promote heat exchange, transpiration, etc. Whether they are jackets, shoes, trousers, etc. But also suitcases or bags (especially for moisture).

Research and Development

The Research and Development division was created to study materials and innovative technologies being aware of the importance of experimental analysis for the development and improvement of new products and processes.

Industrial Design

GZI Design follows the entire design activity for the development of new products with high technological content from the initial idea and first project concept, to the feasibility analysis, considering new materials and connecting all the divisions.

Rapid Prototyping

Rapid prototyping (RP) is an innovative technology that enables the production, in few hours, of objects having complex geometry directly from mathematical model, created using a three-dimensional CAD system.

FIELDS OF INTEREST

Green Economy

We also have, in Grado Zero Innovation, a Dept. specifically involved in Life Cycle Engineering, including all the facilities to prototype and test the product/technology/system/material solution that we develop. One important scope of this Dept. is the R&D on technologies for recovery precious/valuable materials from waste streams, and the development of material solutions and products incorporating these, reprocessed. We are extremely active in supporting the development of sustainable and circular models of supply chains and new business models for a more responsible production and consumption. We are massively active in projects implementing integrated concepts of energy production, saving and responsible consumption. 1. Energy production: chemical and thermochemical production from biomasses; renewable energies; geothermal plants. We mainly work in the development of integrating systems at zero waste and working in closed loop. 2. Energy saving: materials and technologies for an efficient and responsible use of the resources. 3. Energy consumption: ("smart") monitoring systems. We evaluate application of new green materials/technologies also in Building & Construction Life Cycle Engineering Dept. To act as a controlling and internal evaluation body with respect to sustainability effects during the design, development and prototyping stages of a new material or product. To give directions and recommendations for technology and product choice prior to developments by holistic multi-criteria scenario analyses. To quantify the R&D results and go beyond the environmental issues, with an eco-efficiency assessment aimed to achieve a balance between environmental and economic factors. Tools used: Life Cycle

Assessment (LCA), Life Cycle Cost (LCC) analysis and Eco-Efficiency (EE) analysis; Environmental, Health and Safety Risk Assessment (especially in relation to the adoption of innovative materials or technologies).

Vegan Materials

One peculiarity is the capacity of re-elaborating traditional materials or materials easily found in nature and turn them into products of highest degree of technology. GradoZero is able to apply in terms of sustainability. From the analysis of the operational metabolism on which the products and components consume their use phase, the Company, using a special IT-based approach, is able to identify new business models and new supply chain concepts through which completely reinvent a value added "life" for the disassembled materials, so providing a more sustainable and ecofriendly way to conceive products and components.

Wearables

"Wearable technology" includes all technologies developed to be worn and accessible by the user. This is a field in which we are hugely working, especially in projects related to the topic of: "Smart Cyber-Physical Systems". In this topic, our main aim is especially the development of new typologies of wearable HMIs (Human Machine Interfaces). Specifically, we are interested in integrating novel sensing technologies based on the developing of a completely new generation of "smart" materials that can sense, touch and respond with acoustic, luminescent or other types of output. In this

topic - design and prototyping advanced specific wearable interfaces and systems - we have a lot of competencies and experience. Those systems are developed to: be helpful for the user be "always on" and accessible by the user be controllable and interactive, augment the intellect or augment the senses be in synergy with the body, not limit the user's functions and mobility be used as a communications medium.

Biotechnologies

Grado Zero Espace also conducts continuous research into new technologies, processes and techniques - from biotechnologies to nanotechnologies, on assembling and manufacturing techniques which can be environment friendly, as well as on innovative equipment able to increase the performance of the product.

Fiber & Textile

One area of great importance is textile, where Grado Zero Espace is able to perform demonstration and prototyping activities in the field of technical fabrics design, including the development of complex textile structures, as well as the study of physical-mechanical behaviours. Thanks to the support of specific geometric textile modelling software package in combination with software for the analysis of thermal, mechanical and engineering properties, we are able to improve the possibilities to produce and test several new textile configurations, joining together our expertise the textile field and in the engineering one. Some relevant experiences in new materials

include thermo-active alloys or polymers and high performance fibres or smart coating with innovative added properties. The experimental activity includes the development of eco-friendly fabrics using natural fibres such as cypress, peat, kapok, nettle, spider-web and processes following eco-compatibility's parameters. GZE is able to provide the development of wearable technology systems consisting in the integration of smart sensors for monitoring vital-functions, conductive textile for data acquisition and transmission, thermal regulating systems, electroluminescent devices and other new functionalities. Starting off from the consideration of the fibres for the yarn design and ending with the optimization of the fabric production using specific finishes, Grado Zero Espace utilizes the same technological innovation and experimental research aspects which the company is renowned for.

Industrial Design

GZ Industrial Design follows the entire design activity for the development of new products with high technological content from the initial idea and first project concept, to the feasibility analysis, considering new materials and coordinating the different divisions in GZ during the steps of designing, prototyping and final manufacturing. The importance of this task has become an expression of the tangibility of the innovation that Grado Zero brings up to its projects and turns into its products. GZE design offers: Virtual Prototyping: To evaluate a new product before creating the physical model. Through the use of SolidWorks 3D CAD design software; Ergonomics Laboratory: To test and evaluate the relation between physical object

and human. The aim is to improve efficiency, comfort and safety of the users. Ergonomics incorporates elements from many subjects including anatomy, physiology, psychology, bio-mechanics and design. Thanks also the use of Rapid Prototyping; Materials Integration: Thanks to a close collaboration with GZE Lab, we select and implement the suitable materials into a new product to obtain enhanced properties and improved efficiency, following the referred standards; Design and prototyping of technical/sports clothing and safety equipment: concept design, pattern model, CAD modeling, physical prototype. Product Restyling. Grafica e Packaging. From Furnishing to Transportation.

Sports & Safety

Our expertise in PPE system development could be used by costumers. In particular our skills in design and product development for clothing and apparel components (shoes, head protection, gloves) ground on decennial experience in new materials and technology development and integration with a strong connection to the industrial requirements and user needs. GZE has also experience in anti NBC suit (Nuclear, Biological, Chemical) validated by nuclear flash test. We are equipped with rapid prototyping (3D printer) which can be used in the project to manufacture ad-hoc accessories components (design and testing). One of the main characteristics of our company is the continuous effort to the realization of working prototypes and made with equipments and techniques as near as possible to the most common ones in the industries of the field of interest: this characteristic implicates that our research jobs continuously consider practical

necessities and limits linked to industrial production of the desired item; so, the development of every new product is always aimed to the industrial production process optimization, necessary for everything wants to have commercial importance.

Health Care & Well-being

GradoZero major area of expertise is in wearable and ambient technologies for assisted living. Devices for monitoring/intervention, and for helping people in their daily life. Design and development of easily deployable and cost-effective ambient devices equipped with sensor technologies and producing big amount of data. • Design and development of unobtrusive wearable devices equipped with sensor technologies easily linkable with the ambient solutions. • Design and development of multitasking robotic devices that can act as caregivers with autonomous and social interactions. Personalized Remote Healthcare Solutions Goals • To provide innovative monitoring and intervention solutions (ambient sensors/wearable devices/robotic solutions), in order to facilitate personalized remote care by professional and/or informal carers. • To improve the acceptability of the monitoring and intervention solutions, incorporating aesthetic, ergonomic and functional factors. • To investigate how the solution can affect the care ecosystem - change in care practices, call for regulations, etc. - and which issues can arise from it. • To elaborate a framework for regulating the use of such solutions, taking into consideration ethical issues, e.g., privacy, security, etc.

PROJECTS

Eucaliva BBI Project

EUCALIVA is a research project based on extracting high-purity soluble lignin from chemical wood pulping processes (black liquors from Kraft pulping). The use of waste components from industrial activities as raw materials to obtain high value-added products is worth being investigated as a sustainable process. Lignin from pulping process is present all over Europe and represents a big source of underexploited material. There is an estimated 70 million tonnes of lignin available from pulping processes worldwide, but much of this is not isolated but burned onsite to provide steam for heat and power production. Until now only about 2% of the lignins available in the pulp and paper industry is commercially used. EUCALIVA aims to create a valorisation chain of the lignin fraction, using Eucalyptus globulus waste as a source.

Trash-2-Cash

Trash-2-Cash is an EU funded research project aiming to create new regenerated fibres from pre-consumer and post-consumer waste. It's also pioneering a whole new way of developing materials. One resource that's becoming more abundant is waste. The idea of recycling textile waste has been popular for decades, but current mechanical methods give poor quality fabrics suitable only for industrial applications like insulation, and upcycling of pre-consumer textile waste into products is impossible to scale. Trash-2-Cash (T2C) proposes a new model where paper and textile waste is recycled chemically, resulting in fabrics that are the same quality as new materials, to make products that are industrially replicable and infinitely recyclable.

FBD_BModel

FBD_BModel will generate a new supply chain that will permit smooth information flow from fabric materials to consumers, in order to dynamically organize design and production in the big data environment. The proposed technology platform will integrate two interconnected knowledge-based systems (one for design and the other for supply chain and production management). The platform will provide a range of data-based services (product and design recommendation, supplier selection, dynamic tasks planning, production simulation, ...) dedicated to consumers and concerned supply chain professionals (producers, designers, retailers, ...). An extended virtual space will be created for visually displaying and evaluating fashion and functional performances (thermal comfort, skin touch comfort, skin pressure comfort, ...) of designed products in order to integrate consumers' lifestyle into the product design process. The platform will enable direct connection of the professional networks of producers, designers and retailers and optimize all supply chain activities. Based on the platform, a novel B2B2C business model will be built that will help in creating customized textile production in Europe, promoting material innovations of European SMEs with connected professional networks, and preserving and updating professional knowledge in Europe.

MATERIALS

Shape Memory



The Shape Memory Alloys are characterized by their extraordinary ability to recover any shape pre-programmed, upon heating until reaching their Martensite-Austenite transformation temperature. Nitinol, in particular, is the name of a light weight alloy having a content of Titanium of 45% and, until today, it has been used in advanced sectors like aerospace and, recently, in medical applications. Biocompatibility of Ni-Ti alloys depends on the intrinsic strength of Ni intermetallic bond, that avoids the presence of its particles on the external surface of the wire, and on the inertness of superficial TiO₂. Through the Technology Transfer Programme of the ESA, Grado Zero Espace has transferred this knowledge in traditional sectors, like, in this case, for textile applications. In this framework, Grado Zero Espace has used Shape Memory Alloys to obtain a fabric used for the manufacturing of a shirt with long sleeves. The sleeves could be programmed to shorten immediately as the room temperature heats up. The shirt can be screwed up, pleated and creased, then, just by a flux of hot air (even a hairdryer), it can pop back automatically to its former shape. Later, the name "Oricalco" was associated to the fabric Oricalco obtained by Grado Zero Espace and

used to manufacture the first shape memory shirt. Besides, after Oricalco development, Grado Zero Espace continued its study on Shape Memory Materials and on other type of Ni-Ti Alloys accumulating a lot of experience in manufacturing different type of Smart Textile Structure (fabrics, knits, tubular, special yarn, hybrid yarn,...), and permitting, in some cases, to optimize the manufacturing processes also for serial production. Grado Zero Espace, in fact, had an important role within the Loose&Tight project, which aimed at developing a novel concept of elastic graduated compression hosiery based on the exploitation of the superelasticity of Nickel-Titanium based alloys integrated as thin wires in a properly designed textile structure. At present time, Grado Zero Espace is dealing with the development of a textile product (more in the specific an ortopaedic support) within the Avalon project, which has the principle objective to develop novel hybrid textile structures integrating multifunctional Shape Memory Alloys (SMAs) and the related processing techniques as well as design, simulation and organizational methodologies. (see Shape Memory Shirt made of Oricalco Fabric in Science Museum of Chicago). Shape memory polymers have the capability of changing their shape in response to external stimuli, one of them is temperature. Thermo-responsive shape memory polymers consist of two polymer components and resulting two phases, one with a higher melting temperature than the other. The shape-memory effect is not related to a specific material property of single polymers, but instead is realized from a combination of the polymer structures and their morphologies. The phase responsible for the highest thermal transition, such as highest melting point among all the phases, is the basis for the permanent

shape. Above this temperature the polymer is completely in the melt state. While the glass transition temperature of the other phase can be used as a molecular switch for a temporary shape. This material, in fact, after processing into a form, assume a permanent shape which can be deformed to produce other shapes and then, by applying heat, is able to return to its initial shape. Some of the shape memory polymers are bio-compatible and biodegradable and, currently, their main applications are in the medical field. Potential non-medical applications include carrier systems for cosmetic and beauty care products, optical, electronic and mechanical parts for control systems and special plastics for the repair of accident damage or cars. However, since shape memory polymers are not expensive to produce, their applications could be easily broadened to other areas, e.g., niche textiles, to take advantage of their unique properties. This is, in fact, one of the objectives of Leapfrog project that is aiming at a technology breakthrough in the clothing industry. In ambit of this project Grado Zero Espace shared its competence in non-conventional textiles in order to solve, together with the other partners, some problems regarding shape memory polymer's synthesis, their extrusion, the physical and mechanical properties of the obtained yarn, its workability in current textile machines, design of the most suitable weaving structure to obtain a well valuable effect and, at the end, it was possible the realization of the first smart orthogonal hybrid fabric made of Shape Memory Polymer.

Cooling Jacket



Space suits need internal cooling to allow astronauts to withstand high temperatures occurring during sun exposure in open space. A Canadian company has developed a simple concept which was identified by Grado Zero Espace within the framework of the Technology Transfer Programme of the European Space Agency. 50 meters of plastic tubing, 2 mm wide are needed to construct the internal cooling circuit. This probably gives you an idea of the complex manual labour required to make a jacket structure in this way. The whole of an Italian Summer 2001 fashion collection was built around the 'Cooling System', from the choiced fabrics, to the complex tubing details which echoes throughout the entire collection. Grado Zero Espace is addressing its efforts to improve our standard of living.

I.O.W
(Intelligent Object to Wear)

This jacket, thanks to the research by Grado Zero Espace, uses the latest technology from some of the most innovative deep sea diving equipment. The I.O.W. is a motorbike jacket with an internal heating mechanism (produced by a specialist English firm). This garment is the first

portable heating system for motorbikers. This sophisticated device can be connected directly to a motorbike or a scooter, and can monitor body temperatures in 4 different areas of the torso (arms, chest, back and shoulders) and regulate those temperatures accordingly. The philosophy of this garment follows the research for solutions which can improve the quality of life, whatever the occasion. Inside the jacket lining is a computerized microprocessor with hard disk (no bigger than a packet of cigarettes) which controls the body temperature over a series of electric heating pads. The five pads, (located at the lower back, the shoulders, the chest and the arms) can be individually monitored to desired temperatures. It is the ingenuity of these pads that makes this temperature management system different from other previous attempts at heating systems in jackets. These soft body forming pads heat in this following manner. A thin strip of metal is vacuum sealed between two layers of gel and then covered in KEVLAR™ (bullet proof fabric used by Police/Army) On this thin strip of metal is a chip that sends impulses to the computer relaying messages on the internal body heat inside the jacket. The special aspect of this gel is that it diffuses the heat rapidly to the body. When the pad temperature reaches the 'preset level', the power will tail off until required again. This prevents over heating and perspiring. The temperatures can be adjusted by a software available on a CD that can be used on almost any PC. The jacket, via a short cable, is attached to a well designed leather pouch that houses a 12 volt supply. From this pouch runs a cable to the bike. By plugging in the cable to the bike you start the heating system. When you unplug the cable, (which folds neatly into the pouch) the batteries which have been charged by the bike's engine give you up to one hour of heating

power. The microprocessor is shock resistant.

MotoGP AIS (Anatomic Intercooler System) Grado Zero Espace, together with Spidi and its research centre Safety Lab, present a new anatomic cooling system developed for motorcycling that Sete Gibernau will wear during the Qatar MotoGP race on 3 October 2004. Maintaining the rider cool inside the suit and managing to keep his body temperature low even at high environmental temperatures: these are the whys the AIS (Anatomic Intercooler System) is born for. The AIS is an anatomic cooling system developed by Grado Zero Espace and Spidi for Sete Gibernau and for what is going to be the hottest race of the year: the Qatar GP in Losail. The AIS will be integrated in the usual Setes racing suit guaranteeing him a better comfort and thus improving the rider safety. (Scheme of the Anatomic Intercooler System) With AIS, Spidi technicians transferred to motorcycling a technology originally developed by ESA (European Space Agency) and Grado Zero Espace research centre: a personal cooling system technology previously used in Formula 1 and aerospace ambit that no one imagined could have been transferred to a motorcycle racing suit. In this sense, AIS represents the realization of a collaboration project between the Spidi Safety Lab, who translated into the motorcycle racing world a Grado Zero Espace/TTP (Technology Transfer Programme) idea that was already applied in other fields. "By far, the most difficult thing was to integrate all the AIS vital components together with the anatomy of the suit, because we could just not compromise on the original safety and fitting of Setes suit. It's been tough, but in the end I can say we are really satisfied by the result", explains Lorenzo Faggionato, Spidi racing developer in chief. The

cooling system is based on icy gel cooled water running through a serpentine that is placed on chest and back by a custom made anatomic vest to be worn under the suit surface, while an ultra light battery and a micro pump are inserted inside the suit hump. Check this link for a more detailed profile. All these elements have been integrated so well into the original suit structure that Sete will be able to drink while racing thanks to a special bag filled by rehydrating drink also integrated in the hump and linked with the helmet. A rehydrating system that Sete successfully already used last year at Sepang for the Malaysian GP.

F1 McLaren's cooling coveralls in collaboration with the European Space Agency (the transfer technology programme directed by Pierre Brisson) and Med-Eng Systems Inc. designed and produced an hyper-technical overall for the big fashion producer "Hugo Boss" destined for use by McLaren's Formula One mechanics. The design of the coveralls is by Mauro Taliani.

Spider silk



GRADO ZERO ESPACE PRESENTS SPIDERWEAVE!

The first spider-web fabric. Astonishing result

and extraordinary performances : it looks like silk, is as elastic as nylon and is thirty time stronger than Kevlar.

For years, textile research has attempted to integrate the DNA of a particular spider species, the Nephila Clavipes, into other organisms, in order to obtain organic material with the performance features of a spider web: elasticity, lightness and unrivalled strength. So far, however, no significant results have been achieved and the only possibility today involves working with the actual spider web, a solution with numerous operating difficulties. Grado Zero Espace, in collaboration with the University of California, has created the world's first spider-woven fabric produced using modern processes. Previously, the process was done by hand and is unfeasible today. During the last century, the spider webs were gathered in the Solomon Islands and were used to made work bags and fishing nets. However, the technique involved a hand-weaving process. Grado Zero Espace's workmanship process for this fabric is instead done entirely by machine, using state-of-the-art techniques.

These extraordinary results have been achieved using the web produced by Nephila Clavipes spiders bred as part of an experiment conducted by Dr. Cheryl Hayashi to discover new super-light and ultra-resistant fibres. The spider variety - also known as the golden silk spider - produces a web that is the quintessence of the incredible and unique characteristics of spider webs. It feels like silk, is as elastic as nylon and is thirty times stronger than Kevlar. These results potentially pave the way for a full-fledged revolution in the textile field, given the fact that the performance features of this particular type of fibre, as natural as animal fibres like wool and silk, surpass the ones achieved using the top technical materials

currently available on the market. Grado Zero Espace confirms its particular vocation for research - continuously striving to integrate past and future, craftsmanship and industry, natural and synthetic - and it always selects the very best solution in relation to product objectives.

Aerogel



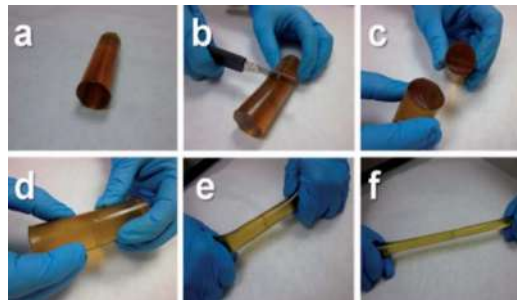
The Aerogel is a very light and solid substance, like a gel whose liquid component has been replaced by gas. The result is a translucent and transparent material, composed by 90-99.8% air and having many particular properties; the most important one is its thermal insulation, that made them famous because of their use in the space probes sent to Mars. Commercial Aerogels, in fact, have a thermal conductivity of about 0,013-0,018 W/mK, making them the best thermal insulating materials in the world. The formation of these materials, in general, involves two major steps, the formation of a wet gel, and the drying of the wet gel to form an Aerogel. Steven Kistler of the College of the Pacific Stockton, California was the first who understood, in the 1931, the necessity to operate in supercritical conditions in order to avoid the collapse of the solid structure. Aerogel materials can be produced as monoliths,

thin-films, powders, or micro-spheres to respond to given application requirements. There are three major types of Aerogels: inorganic, organic and carbon; Silica one are the most famous. Aerogels by themselves are hydrophilic (so much that can act as a strong desiccant), but chemical treatment can make them hydrophobic. Their remarkable thermal insulation property depends on the almost abatement of three methods of heat transfer: convection, conduction, and radiation. The most insulating Aerogel is the Silica Aerogel with Carbon added to it, which can insulate up to -200°C and which melts at 3000°C. Aerogels are also the lightest solids in the world having typical densities of 3-150 mg/cm³; in their purest form they can even float on air. Gze has used this material aslo in the garments thank's to the development of the Aerogel Design System , a special padding thermo-insulating padding, made with aerogel.

Aerogel Design System - Thermal Insulation Padding. Aerogel Design System is a specific technique developed with the aim of creating a padding with extraordinary thermal performances, using one of the most insulating materials in the world, the Aerogel. Aerogel, usually employed into space probes and buildings, is a nanoporous solid materials possessing no less than 50% porosity by volume, composed of 99.8% air, the best natural insulator. Thanks to Aerogel Design System is now possible to integrate this material on a padding offering not just a high-level of protection against freeze, heat and fire, but at the same time an high-level of comfort too. The Aerogel Design System is able to warrant the same softness, flexibility and breathability of a traditional padding, together with Aerogel's thermal insulation characteristics: all these kept in an extremely reduced thickness, due to the fact that

a normal padding, for reaching the same thermal insulation proprieties, should have a much more big thickness. By Aerogel Design System the amazing capacities of Aerogel can now be exploited not just in a lot of different fields as clothing, automotive, naval or furnishing, but also for manufacturing specific products as sleeping-bags, cases, pipelines, etc...

Self healing



From the last scientific researches, several different self healing materials were studied and developed : thermoplastic polymers containing high quantity of hydrogen bonds, hollow fibers or hybrid resins containing healing ingredients and scratch guard coat. In particular Grado Zero Espace is studying supramolecular polymer based materials, in order to integrate and develop complex self healing structures for many different applications including building, furniture, textiles, medical, sport and safety equipments, protective coatings,... Supramolecular polymer are thermoplastic polymers doped with a special healing agent able to change viscoelastic properties of the final co-polymer by temperature increasing. The objective was, in fact, developing of thermoplastic polymers able to melt at very low viscosity, in order to increase their workability.

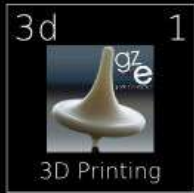
Many scientific studies were carried out, bringing to obtainment of self healing materials also at industrial level. An example is demonstrated by a coating made of polybutadiene elastomer modified with a dimer developed by SupraPolix BV. It was damaged with a sharp object, heated at 140°C, observing a good flow of liquid material able to expand and cover all the damaged surface. After cooling down the original coating properties are restored again and the damaged area is not visible anymore. Similar approach was used by Prof. Tournilhac from Industrial Physics and Chemistry Higher Educational Institution (ESPCI) of Paris, obtaining a rubber-like material able to self heal after being snapped in two and gently pressed. Advantage in using supramolecular polymer is related to their non-toxic components or catalysts, their possible customization for integration in several thermoplastic polymers and simplicity and low cost of their synthesis. Possible applications, still not developed, include building, cosmetics, ink-jet printing, electronics and as coating for wood, textiles, shoes, gloves,...

Muskin

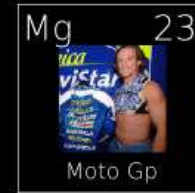
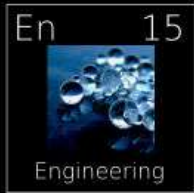
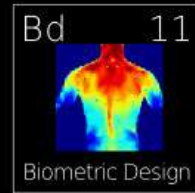


Muskin is a 100 % vegetable layer alternative to animal leather. It is completely animal and oil

free. It is approved by PETA and rated as VVV+ (maximum rate) by Animalfree.info (LAV). It comes from the *Phellinus ellipsoideus*, a kind of big parasitic fungus that grows in the wild and attacks the trees in the subtropical forests. The total absence of toxic and chemical substances, involved in its production, makes Muskin ideal for the use in close-to-skin applications. Its very natural origin and the presence of natural penicillins substances, limits bacteria proliferation.



elements





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