



NewSkin Catalogue of Services

NewSkin: Industrial Uptake of Nanotechnologies

Open Calls and Services to the Industry

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862100 (NewSkin). The output reflects the views only of the author(s), and the European Commission cannot be held responsible for any use which may be made of the information contained therein.



@NewSkinOITB



www.NewSkin-OITB.eu



[NewSkin OITB](https://www.linkedin.com/company/newskin-oitb)



platform.NewSkin-OITB.eu





Open Innovation Test Bed for nano-enabled surfaces & membranes

H2020 OITB | Apr 2020- Mar 2024



Access for Research labs, SMEs and Industry to a support structure providing up-scaling and testing facilities, to allow stakeholders to develop, validate and commercialise new advanced nano-enabled surfaces and membranes

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NewSkin: An Open Innovation Test Bed (OITB)



15 countries

Research

Industry

Innovators



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NewSkin Open Innovation Test Bed (OITB)

- Accelerate market uptake of new advanced surface & membrane nano-technologies.
- Meet key challenges of key European Industries and Society.
- Innovative manufacturing **up-scaling and testing facilities**.
- **Route-to-market services** & access to a wide NewSkin innovation ecosystem network (e.g., start-up incubators, private investors, public funding, standardisation, regulatory bodies).
- **Integrated Research Centres**, European Industry representatives and early adopters.



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NewSkin OITB Single Entry Point (SEP)

NewSkin OITB services' access conditions are harmonised with open access through a **Single Entry Point**:

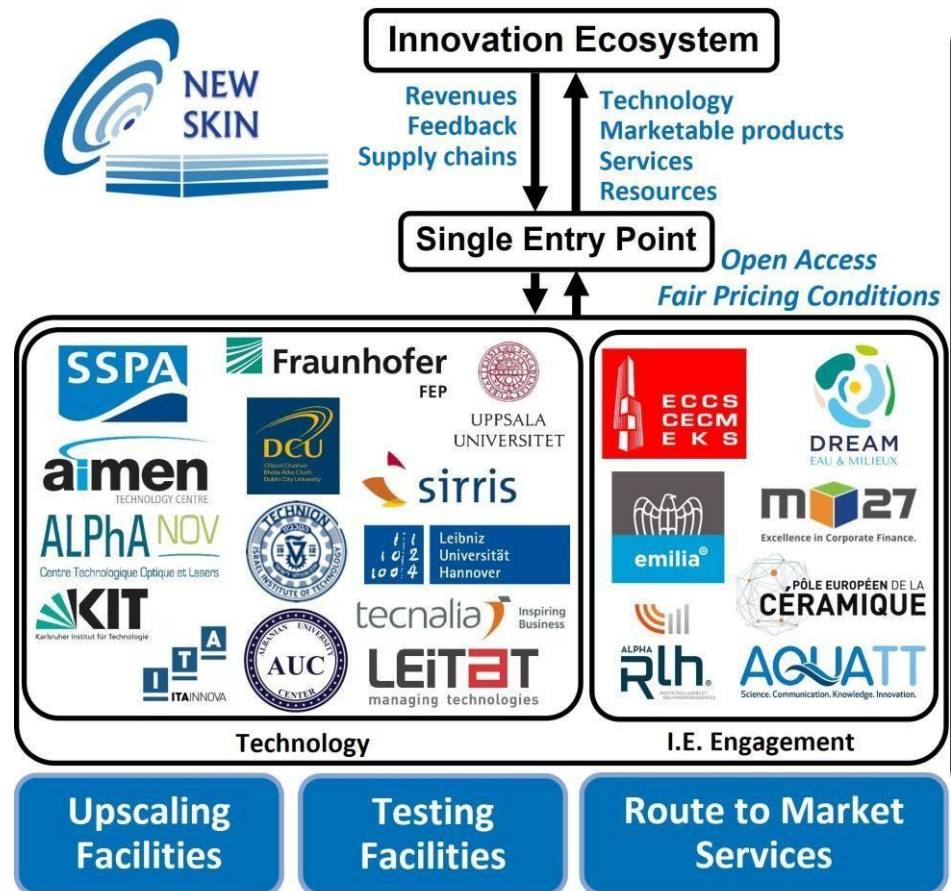
- acts as an “architect office”
- supports clients to contract all services in one place
- coordination of all interactions to complete contractual processes

Access to services will be granted under **transparent and fair access conditions**, including IP aspects, in a simple process:

- OITB customers keep their IP
- For OITB owned IP - access is granted under fair conditions

Access to NewSkin OITB services:

- Free of charge for applicants awarded in **Open Calls Process**
- By paid private contracts



Services will be accessible through platform.NewSkin-OITB.eu
Contact the Architect Office through info@NewSkin-OITB.eu

NewSkin is part of the H2020 OITBs



Energy Storage materials design and testing



Tribological Characterization



Sheet Metal Testing Forming Hub



Light Metal Alloys (Nano)



Light Ceramics (Nano)



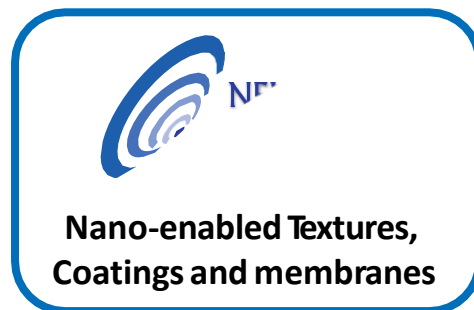
Flexible Electronics



Nano-enhanced composites



Nano-enabled gas and water membranes



Nano-enabled Textures, Coatings and membranes



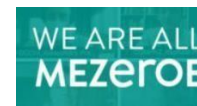
Nano-functionalization for sustainable and smart plastics and paper-based products.



Lab on-foil Systems



H2020-DT-MNBP-04-2020 OPEN INNOVATION TEST BEDS FOR NANO-ENABLED BIO-BASED MATERIALS

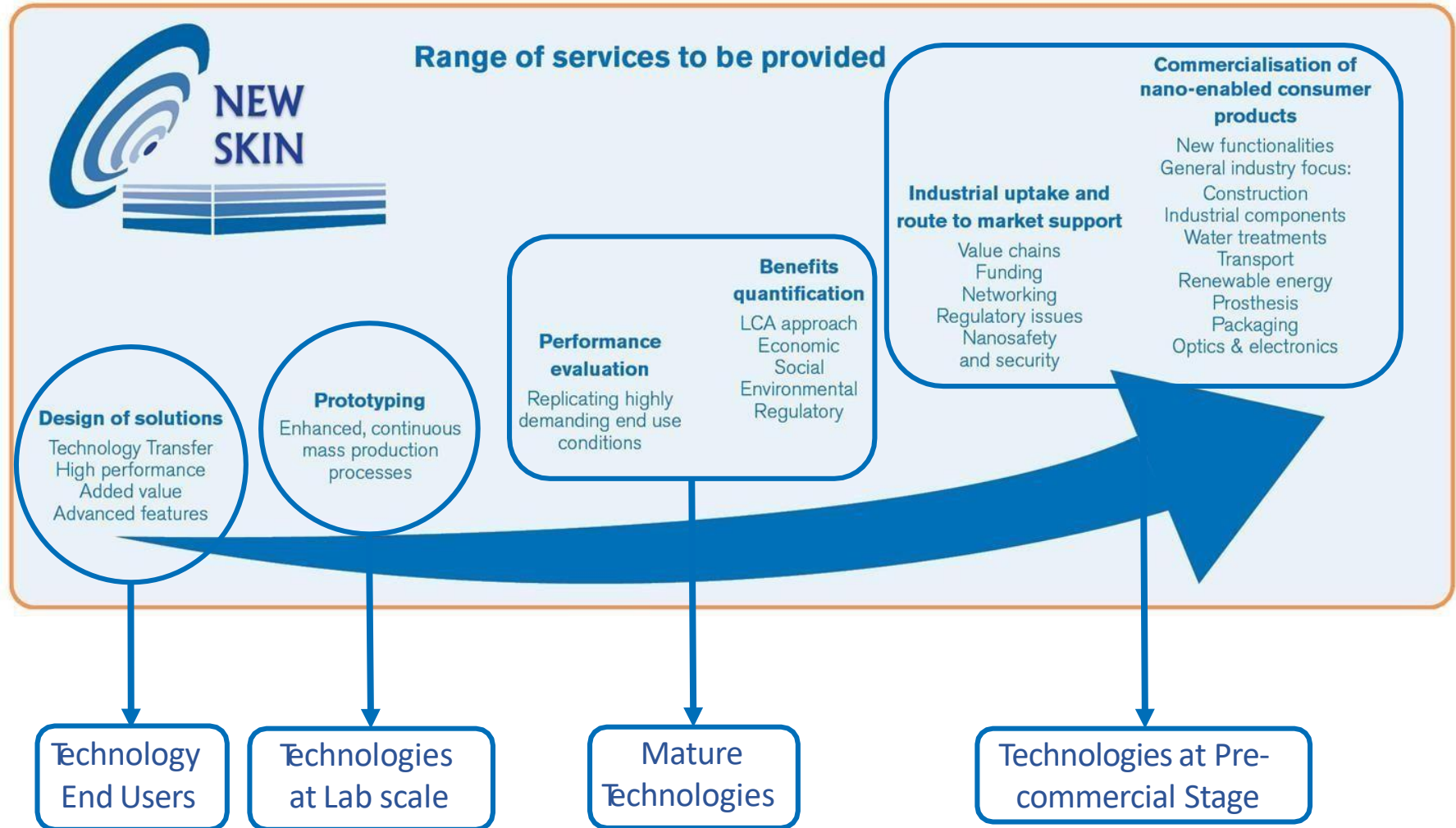


H2020-DT-NMBP-05-2020: OPEN INNOVATION TEST BEDS FOR MATERIALS FOR BUILDING ENVELOPES (IA)

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NewSkin OITB Added Value (I):

NewSkin offers services a 360° services portfolio to the Innovation Ecosystem.



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Open calls

1st Open Call

Deadline: extended to 31st January 2022




General NewSkin Open Call Procedures



- **4 Open Calls with ~25 awarded entities awarded** per call
- Support in form of **free service provision** on the NewSkin test bed facilities –with estimated average service value 30-60K€
- **Forecasted deadlines** for each Open Call – with the evaluation complete, contracts signed, and execution of the service delivery commenced within 3 months:

Open Call #1	Open Call #2	Open Call #3	Open Call #4
31 st January 2022	29th July 2022	31 st December 2022	30 th June 2023

 NewSkin: Innovation Eco-system to Accelerate the Industrial Uptake of Advanced Surface Nano-Technologies																
2020				2021				2022				2023				2024
Start	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
01-abr	30-jun	30-sep	31-dic	31-mar	30-jun	30-sep	31-dic	31-mar	30-jun	30-sep	31-dic	31-mar	30-jun	30-sep	31-dic	31-mar
SEP and OITB structure, procedures, and services definition								NewSkin New Legal Entity Creation and OITB Operation								
Pilot Plant Facilities Upgrade																
Testing Facilities Upgrade																
					Facilities Calibration											
							Show Cases									
									1st Open Call		2nd Open Call		3rd Open Call		4th Open Call	
									Open Call Preparation							
On-line Platform		Innovation Ecosystem Engagement														
Dissemination and Exploitation																
Project Management																

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Eligible Entities



Companies:

- Start-ups
- Small and medium-sized enterprises (SMEs) as defined in the EU recommendation 2003/361
- Large enterprises

Research organisations:

- Research organisations including Higher education establishments
- Research & Development organisations

Other entities

There are no geographical restrictions

If you have any doubts on your
eligibility, contact us
info@newskin-oitb.eu



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Short open call application form



PART A)
Applicant/Company information

1

Possibility to attach supportive documents or images to each section

PART C)
Description of the case study

Excellence (*problem to be solved – challenges to be addressed*)
Implementation (*service which can technically solve the problem*)
Impact (*expected results and impacts*)



PART B)
Company presentation



PART D)
Authorisations



How do I apply?

a) Register for free into the NewSkin Platform:

https://platform.newskin-oitb.eu/users/sign_up

b) Go to the Open Calls section & click on apply

Click [here to start your application](#)

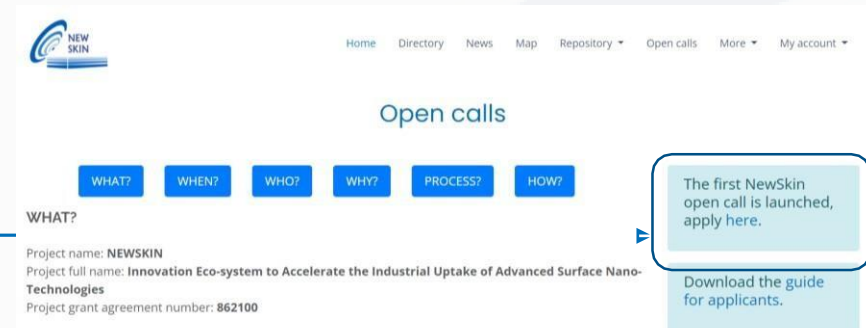
Note: You need to register on the NewSkin Platform as a user to apply for the [Open Calls](#)

c) Fill in and submit your application

Applicants can request an NDA before filling the open call application - please email info@NewSkin-OITB.eu to arrange this.

After the deadline, you will be informed about the results of your application.

Click here to access the **GUIDE FOR APPLICANTS**. We encourage you to [contact us](#).





Services in Detail



NewSkin OITB Added Value (II):

Horizontal portfolio of (55) showcases, easily recognisable replication in a wide range of potential products. Including Dynamic seals, the creation of nano-pores on thin film membranes, the demonstration of high performance nano-coatings and a set of functional surfaces; coating and textures from electronic applications to improved cell growth.

Services portfolio strongly aligned with the main industrial societal European challenges: Circular and Climate Neutral Economy, Energy and Resources Efficiency, Knowledge based Economy, Efficient Construction etc.



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- Durable coatings - gears and shafts
- Improved lubrication and vibration dampers
- Functional coating for PV systems

- Anti-soiling, anti-reflective durable coatings
- Erosion resistant - anti-ice & rain
- Improved aero/hydro dynamics

- Continuous coatings
- Functional nano-surfaces
- Smart thermal management
- Mass production of surfaces to reduce CO₂, NO_x, VOCs

- Anti-microbial
- Biocompatible
- Scratch & wear resistant
- Orthopaedic prosthesis
- Textures and coatings

- Conductive, anti-reflective
- Anti-microbial
- UV, O₂ & water barriers
- Improved food shelf life
- High performance bio-based

- Graphene membranes
- Laser and plasma treatment
- Pore creation
- Desalination, water filtration, wastewater
- Anti-fouling
- Anti-cavitation in centrifugal pumps

- Durable reusable components and connections
- Wear impact and corrosion resistance
- Durable fire resistant intumescent coatings
- Anti-ice, photocatalytic & functional coatings
- Off-shore protective coatings

- Friction reduction in engines
- Fuel /energy savings
- Increase moving parts life-span
- Vibration mitigation
- Vacuum and high temperature

- Anti-fouling, hydrodynamic surfaces resistance
- Increased fuel efficiency
- Reduce drag
- Eliminate biofouling
- Cavitation reduction

- Increase life-span of components
- Extreme temperatures, wear and corrosion resistance
- Enhanced wear resistance
- Laser textured & hardened metals



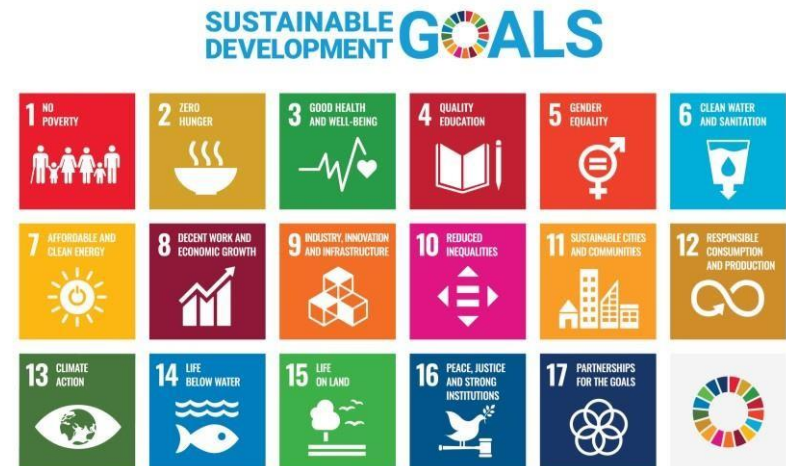
Our Offer:

The main objective for an OITB it is to support the Innovation Ecosystem to successfully address the industrialisation of their nanotechnologies. To do so NewSkin offers:

- Scale-up and testing facilities,
- supply chain management,
- access to funding and investors, and
- networking to customers.

We aim to match nano-enabled surfaces and its superior performance to specific applications in order to meet:

- the **Sustainable Development Goals**,
- **Green Deal**
- and other relevant challenges.

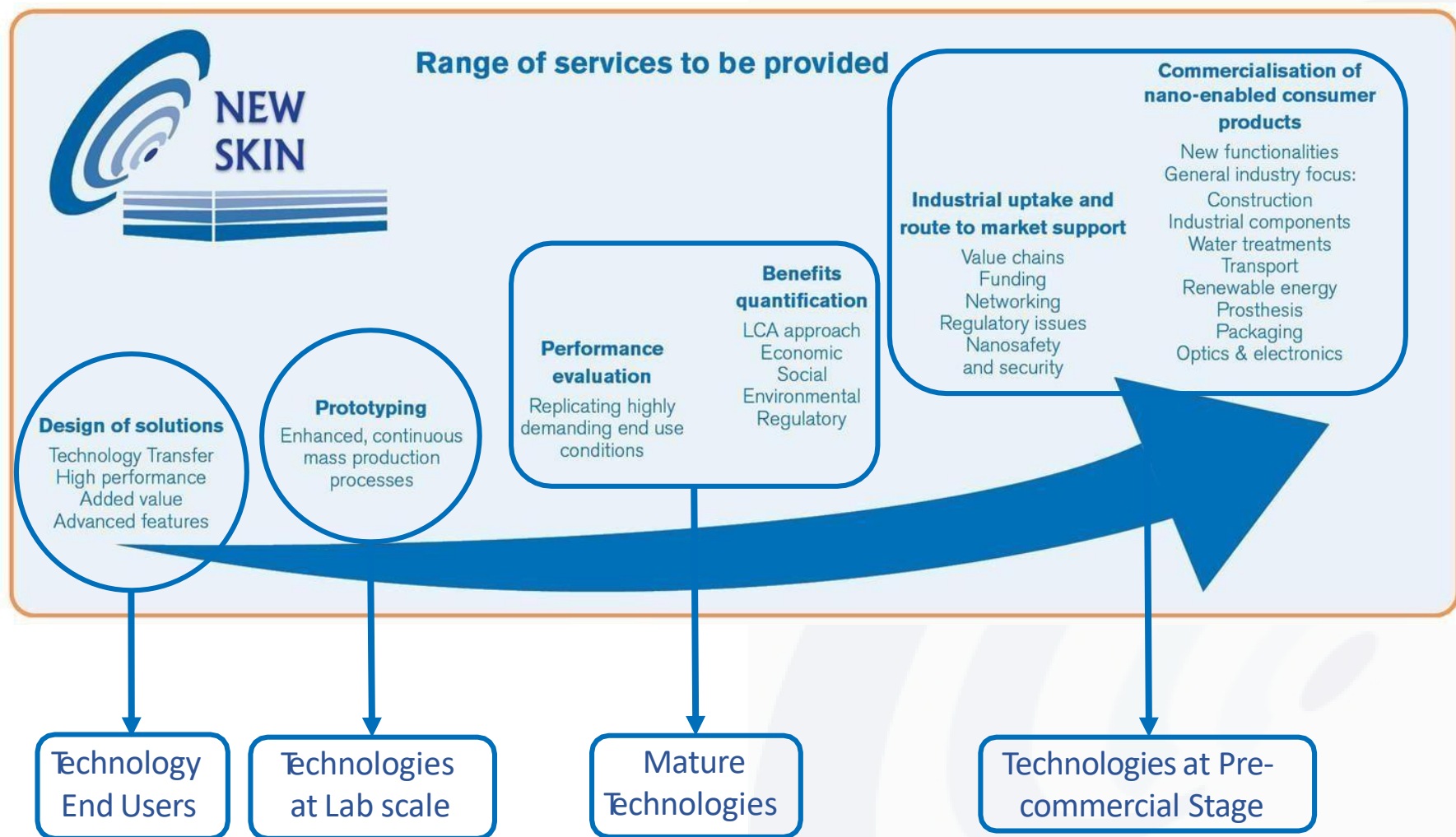


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NewSkin OITB Offer

NewSkin offers services a 360° services portfolio to the Innovation Ecosystem.





Facilities and Value Propositions



Overview of NewSkin Value Propositions



- High Performance Surfaces for High-Performance Components Working in Dynamic Conditions.
- Mass Production of High-Performance Functional surfaces. From Automotive to Construction
- Nano-enabled Surfaces and Membranes for the Water Treatment Industry
- High Performance Nano-enabled Coatings
- Other High Performance and Functional Surfaces

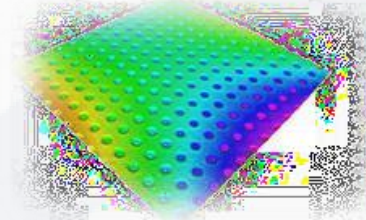


High Performance Surfaces for High-Performance Components Working in Dynamic Conditions



Textures and Coatings in dynamic environments:

- The combination of **textures and coatings** may result in significant improvements for components working in dynamic regimes, as well as hydro and aerodynamic regimes.
- The range of **texturing technologies** included in these value proposition includes:
 - Direct Laser Texturing.
 - Texturing during Moulding.
 - Roll to roll processes.



By texturing processes, structures are created on the surface of components subjected to reciprocating movements **improves lubrication, prevents the damages created by particles resulting from erosion** and the environment and are able to **cushion the energy losses and damages caused by vibrations**.

- The range of **coating technologies** includes:
 - Thin film deposition.
 - Sol-gel.
 - Ceramic coatings.
 - Polymeric coatings.

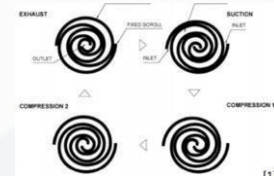
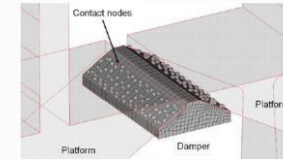


By coating components **high performance surfaces** are created increasing **hardness, wear resistance, reducing the friction coefficient and increasing thermal and chemical resistance**.

- Combination of both technologies results in **synergistic effects** to achieve, durable, robust and efficient components working in dynamic environments and harsh conditions.
- **Target materials** to be textured and coated comprises: Metals, alloys, composites, ceramics, polymers, others.

The range of applications include:

- **Dampers** for steam and gas turbines for efficiency gain.
- **Shaft/bearings** in electric cars for torque friction reduction.
- **Gears** for gear boxes in wind energy and other industrial applications.
- **Scroll compressors for heat-pumps**, thermal management in electrical vehicles and air conditioning systems.
- **Propellers, bearings and motor components** in pumps and compressors.
- Components working in **vacuum and cryogenic conditions**.
- **Drilling tools** for energy production, mining and machining working at high wear environments.
- **Textured During Moulding polymeric components** : Handles Sport Equipment, Radial shafts Seals, Piston and Rod Seals and Rod Seals. **Potential extension to other materials; CIM**

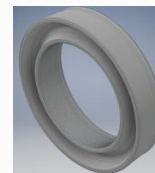
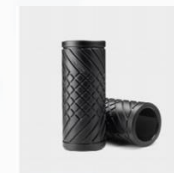


• **Propellers, bearings and motor components** in pumps and compressors.

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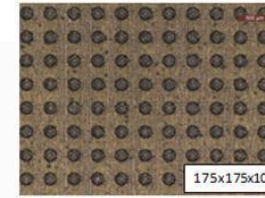




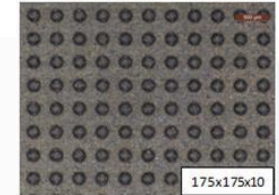
Texturing During Moulding



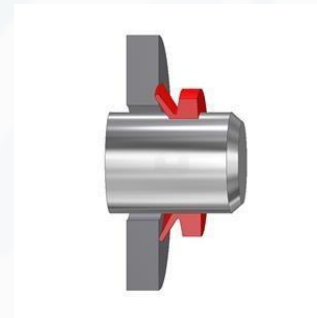
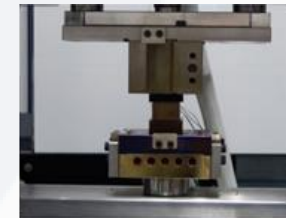
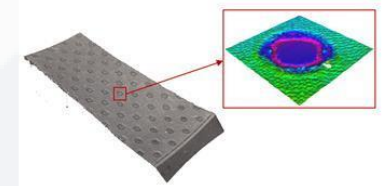
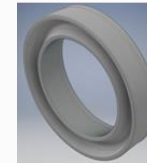
- **Transfer of textures** to polymeric components **during the molding process.**
- **Mass production** process developed to **industrial scale**
- **Design tools and test rigs** have been developed:
 - Design
 - Demolding
 - Manufacturing processes
- **Strong effect on equipment efficiency:**
 - Reducing lubricant leakages
 - Reducing friction losses
 - Increased durability for components and equipment.
- **Depends on the contact pressure and the speed.**
- The technology is available for **both rigid and elastomeric materials** .
- **Any molded component:**
 - Seals
 - Polymeric gears
 - Molded component working in dynamic lubricated regimes
 - Potential use in CIM, casting and other processes
 - Other potential functionalities



Textured Metal Plate

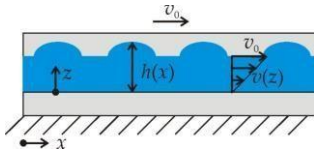
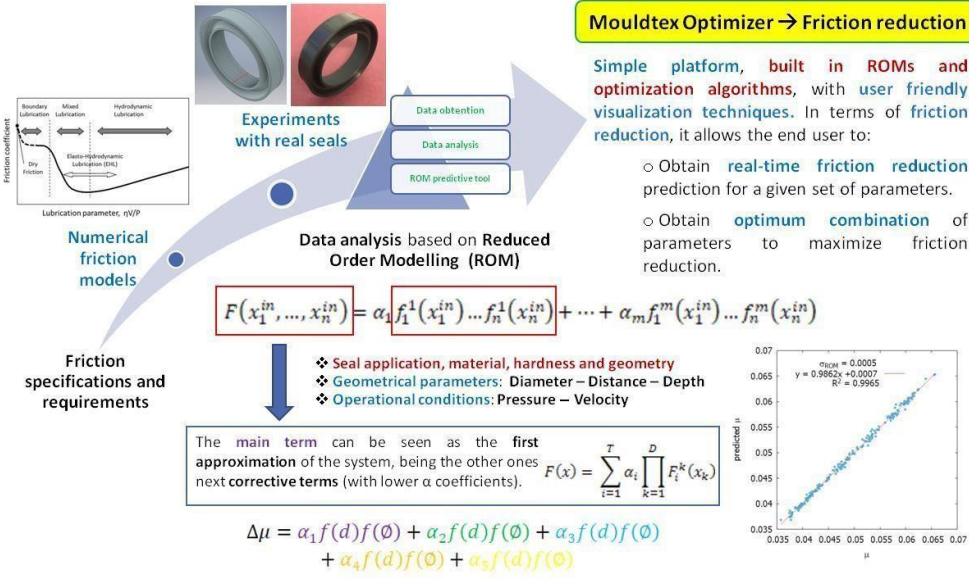


Textured Rubber Sample



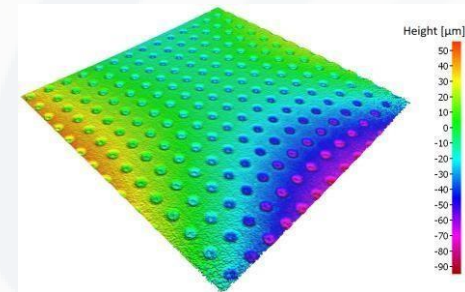
An in-house real-time friction prediction tool for optimizing the design of moulds prior to the production

Friction modelling → Mouldtex Optimizer



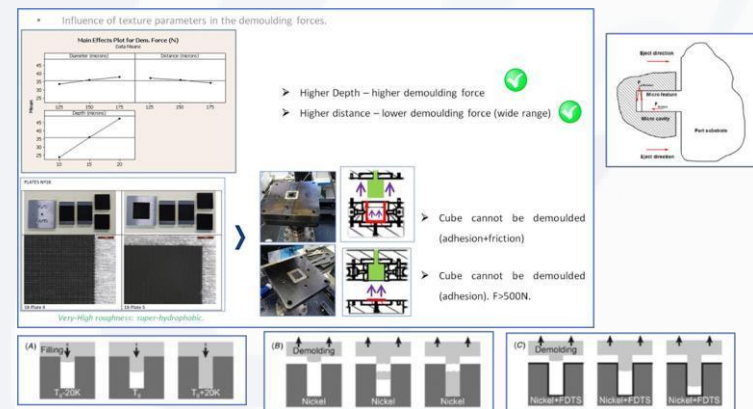
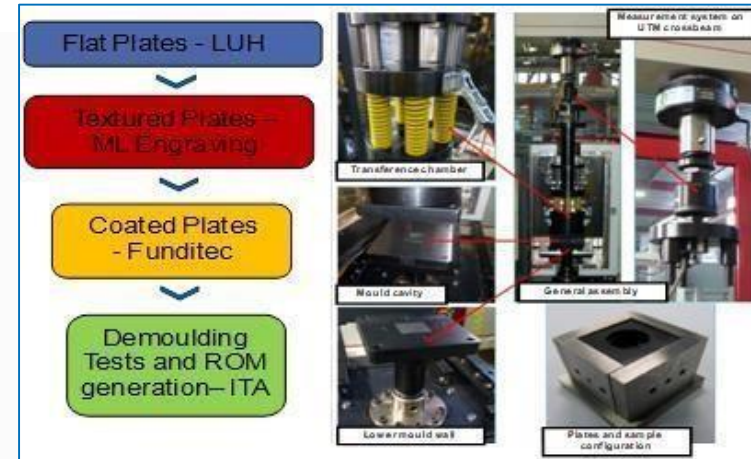
Effects of surface texturing:

- Contact area reduction
 - Reduction of real contact area → Reduction of dry friction
- Viscous friction reduction
- Friction reduction due to higher fluid film
- Lubricant storage
 - Dimples can store lubricant
- Wear particle storage
 - Dimples can store wear particles



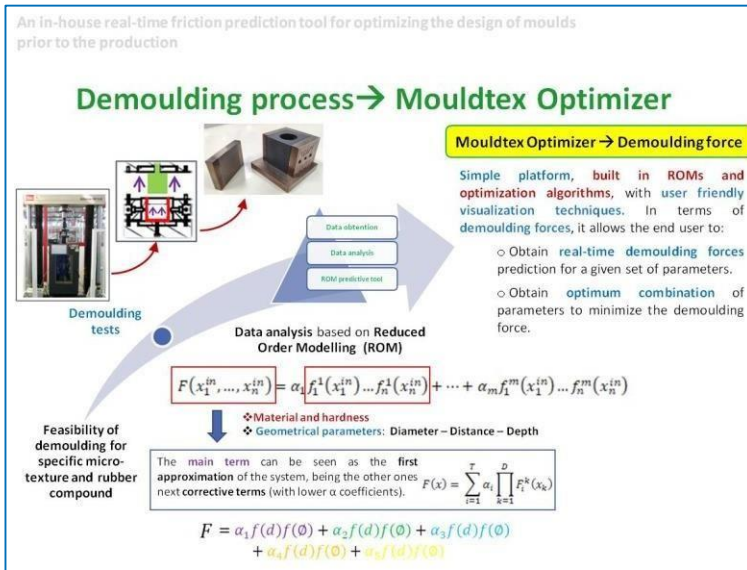
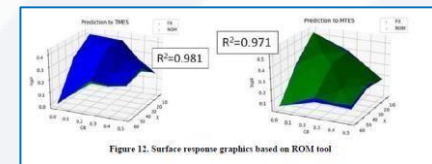
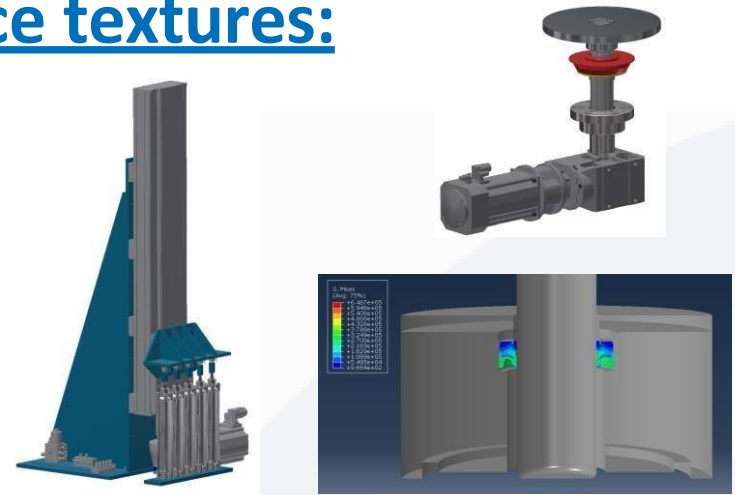
Production of surface textured seals :

- Texturing during moulding Production → It's necessary to test in the laboratory if there is a correct transfer (small and cheap mould).
- Due to texturing of the metallic mould, demoulding forces always increase due to adhesion + friction (sometimes one order of magnitude depending on the geometry of the texture). Use of semi-permanent release coatings (Sol-Gel; thickness below 1 micron) can be a solution to avoid that problem.
- Test rig for the assessment of release coatings and micro/nano-textures transfer during moulding. Demoulding processes are more demanding with micro/nano textured surfaces and interaction between polymers and release coatings must be evaluated. Adaptable process for a large variety of seal types.
- Influence of parameters. Example of failed transfer:
 - Hydrophobic nanotexture without coating creates a super-adhesion between rubber and metal plates.



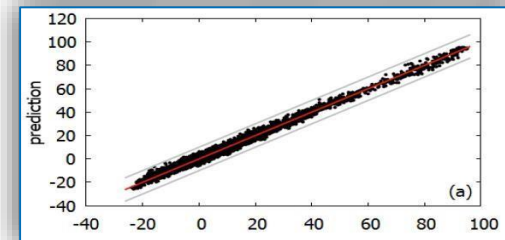
Selection of optimal surface textures:

- Based on knowledge that was compiled during the EU projects TDM-Seals, SoftSlide and MouldTex
- Surface texture selection is based on experimental studies and simulations
- Friction measurement test rigs for components in reciprocating and rotational motion
- Knowledge in friction simulations
- Reduced Order Model based tools for efficient design of nano/micro structured functional surfaces and for definition of integrated “Smart” test plans.



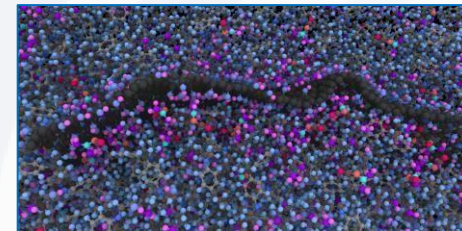
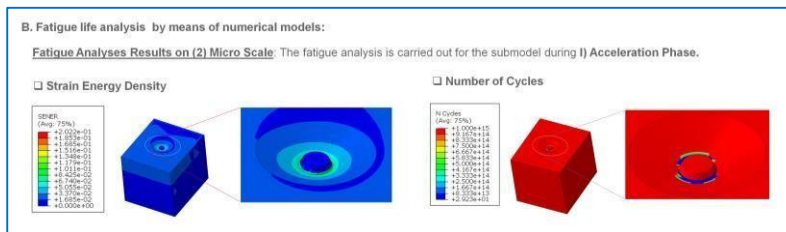
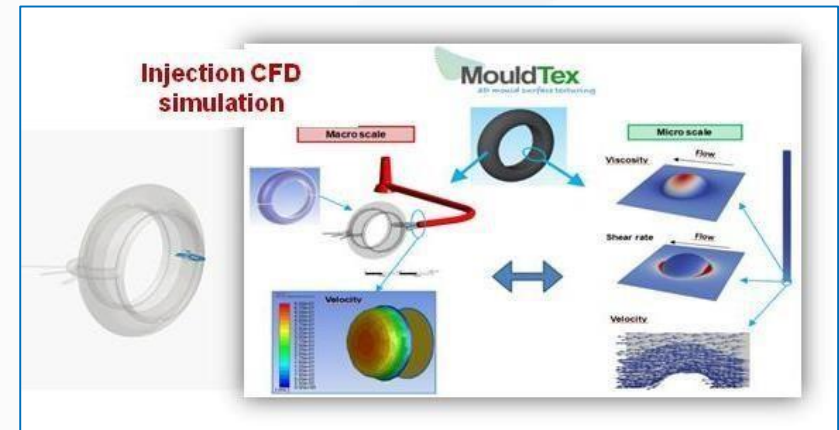
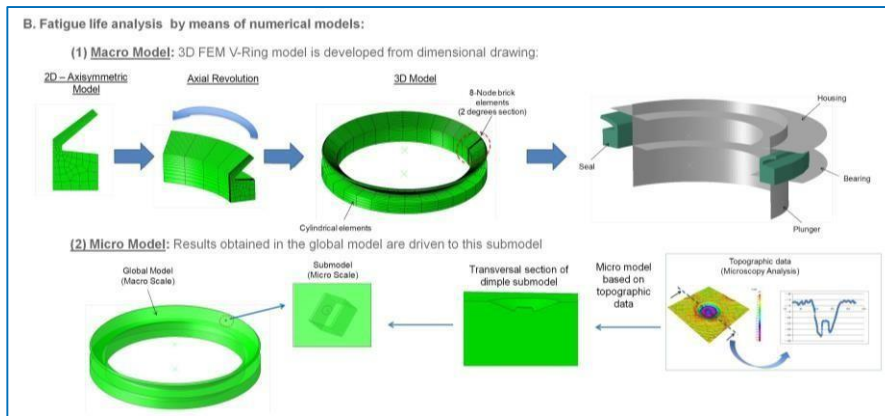
Analysis of chemical compositions of coatings in demoulding forces. Reduction of fluorinated components

Prediction of demoulding forces.



Selection of optimal surface textures:

- Knowledge-based – Simulations (KBS) for the efficient design of micro/ nano-structured functional surfaces and generation of surface data focused on “material management”.
- Estimations of fatigue behaviour at macro/micro scale (Abaqus)
- Simulations of the injection and filling behaviour with micro-cavities. Analysis of forces at molecular level.

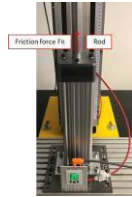
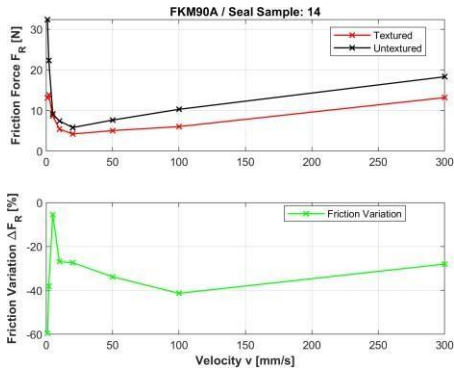


Fatigue estimation of durability (cycles). Analysis of the microtexture (Abaqus).

Mass production Functional and High Performance Surfaces: TDM Processes

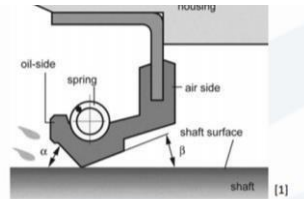
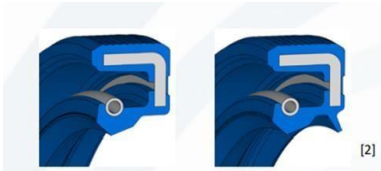
- **Reciprocating rod seal:**

- 60% initial friction reduction
- 25 to 45% friction reduction depending on dynamics.



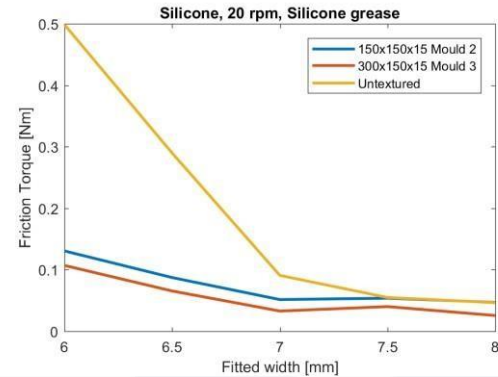
- **Radial Shaft and wipe seal:**

Textured radial shaft seal and wipers for transient conditions (start-stop cycles) in electric drive trains with static friction coefficient < 0.01 and extended lifetime of > 30 .



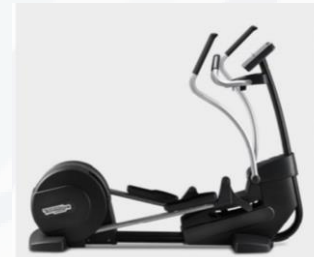
- **Rotating V-Ring seal :**

- Dimple diameter: 150/300 μm
- Dimple distance: 150/150 μm
- Dimple depth: 15/15 μm



- **Polypropylene Handles and grips:**

Polypropylene handles and grips for sports equipment and hand tools with anti-scratch surface texture. Service life extension $>100\%$.



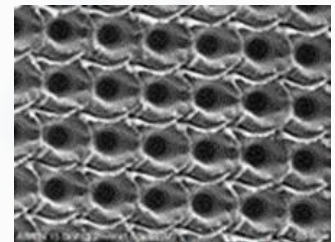
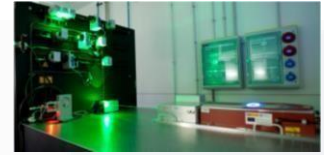


Direct Laser Texturing



Direct Texturing of Components for Automotive and Industrial Components:

- Textures are directly created on the surfaces by different laser sources in a batch to batch process.
- The selection of laser sources will be conducted according to the following criteria:
 - Component shape and dimensions.
 - Requested precision
 - Textures to be created.
 - Productivity and functionality.
- Components are produced. Textures definition will depend on functionality and operation conditions. Tribological applications will be linked to lubricated conditions, speeds and contact pressures.
- The range of functionalities include:
 - Vibrations attenuation.
 - Friction/wear reduction
 - Improved tribology.
 - Improved drag, anti-fouling resistance and cavitation resistance.
 - Electronics and optics
- Coating may also be included, mainly sol-gel and thin film deposition as nano-conformity is requested to induce synergistic effects such as super-hydrophobicity, corrosion resistance, reduced coefficient of friction or improved wear resistance compared to base material.
- Services:
 - Design of solution for components.
 - Prototyping and features demonstration.
 - Supply chain management and Route to market services.



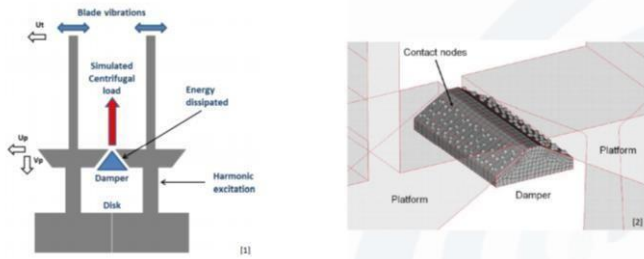
Direct Texturing of Components for Automotive and Industrial Components:

Example 1: Retrofit under platform damper:

Vibration attenuation leads to an efficiency gain over 0.25% in gas and steam turbines.

Component:

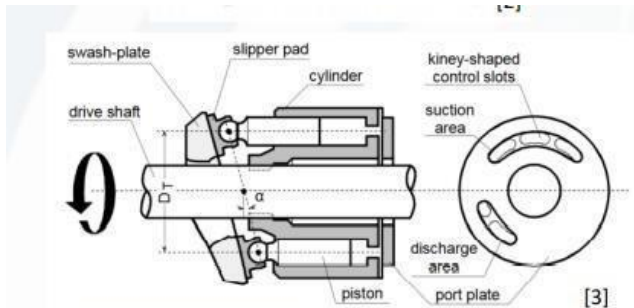
- Function: Dissipate vibration energy in gas and steam turbines
- Material of the Damper: Steel



1. Pisaresi, L. et al. "Numerical and Experimental Investigation of an Underplatform Damper Texting." Applied Mechanics and Materials, Vol. 849, 2016, 1-12.
2. Pisaresi, L. et al. "An advanced underplatform damper modelling approach based on a microslip contact model." Journal of Sound and Vibration, Vol. 436, 2018, 327-340

Example 3: Scroll Compressor:

Friction reduction of 10% and extended service life of 20%



Example 2: Shaft/Bearing in electric cars:

Friction torque reduction of 15%.

Component:

- Functions:
 - Bearing of a rotating shaft
 - Carrying of loads (F_{Ay} , F_{Bx} , F_{By})



Example 4: Components in maritime engines and centrifugal pumps:

Propeller and nozzle system: anti-fouling, cavitation prevention and improved drag texture designed and implemented 30% improved fuel efficiency.^[1]





Coatings



Portfolio of Available Coatings.



HiPIMS DLC.

- Wear rate: $2.3 \cdot 10^{-16}$ m³/Nm to $2.1 \cdot 10^{-17}$ m³/Nm.
- Coefficient Friction: 0.22 to 0.17.
- Improved T^o Stability.



CrAlN based coating.

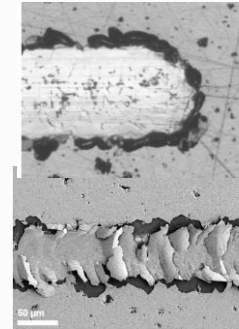


- Increased wear resistance
- Oxidation resistance:
 - 650°C 100% steam
 - 850°C in air.



MoSx-WC based coating:

- Low friction coefficient vacuum and ,cryogenic,
- Resistance to humid environment at atmospheric conditions.



CrN on Al2O3

- Al2O3 Friction is unstable in vacuum
- HiPIMS CrN –stress engineering to increase Life-time 10x by the coating



DLC-Ti (Prosthesis)

- Bio-compatible DLC-Ti coating for prosthesis.
- Reduced friction and increased wear resistance and durability.

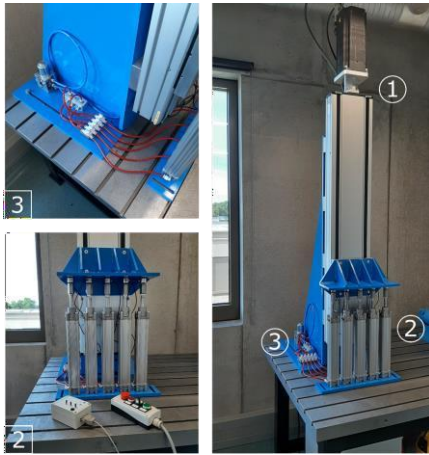


Testing Facilities

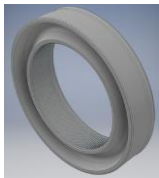


Testing facility for nano-textured/coated Technical Components in relative motion

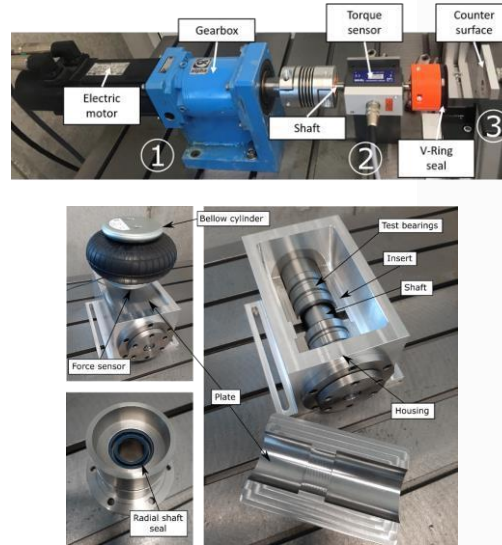
- Longitudinal test-rig:



- Pneumatic seals
- Hydraulic seals
- Pistons



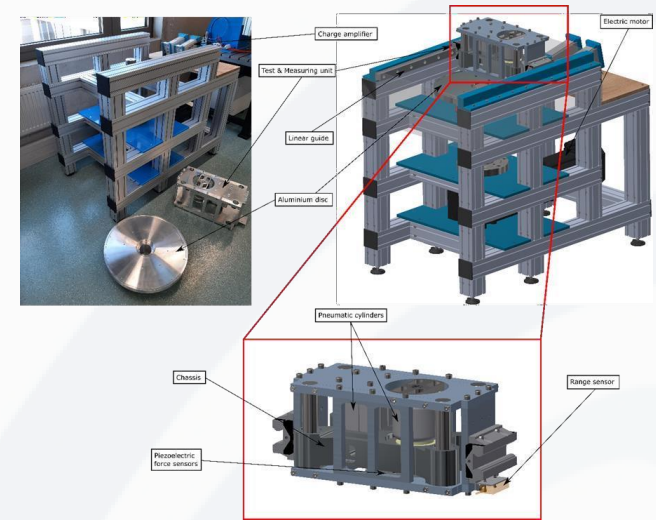
- Rotational test-rig



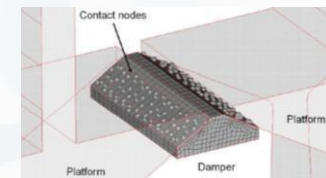
- Roller bearings.
- Radial shaft seals.
- V-Ring seals.



- Test rig for the evaluation of contact surfaces in general

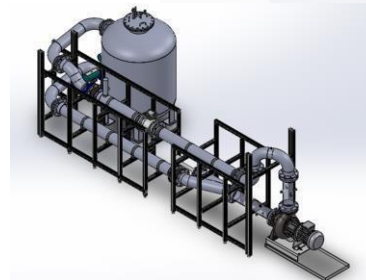


- Under platform damper

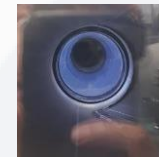


Closed cavitation test loop for centrifugal pumps:

- Inlet pipe designed to allow for direct visual access by high-speed imaging for characterization of cavitation sites.
- Pressure-controlled gas separation tank and pressurization system to control the pressure at the pump inlet and dissolved gas level.
- Pump selected to allow de-coupling of the pump-motor housing and the insertion of a torque sensor for dynamic measurement of torque.
- Vacuum pump and a gas compressor to control pressure below and above the hydrostatic level.
- Temperature control loop.
- Piping and electro valves with digital controller
- Torque measurement on shaft (dynamometer) to correlate imaging data with power and torque measurements.



(a)



(b)



(c)



(d)



(e)



(f)



(g)



Mass Production of High-Performance Functional surfaces. From Automotive to Construction



Nano-conformable, low temperature and functional and high performance metallic, ceramic polymeric and hybrid **nano-coatings** for the **synergistic** combination with **nano and micro-structures** in continuous processes for coils and others. Low temperature deposition and accurate texture and structures control.

Available technologies:

- CVD.



- HiPIMS.



- APGD and Coating.



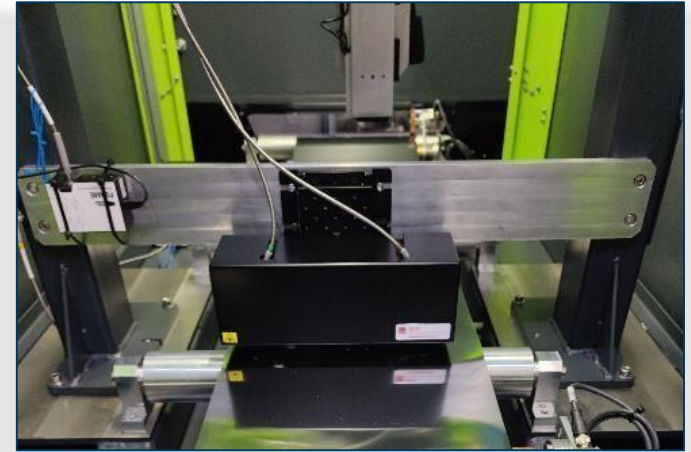
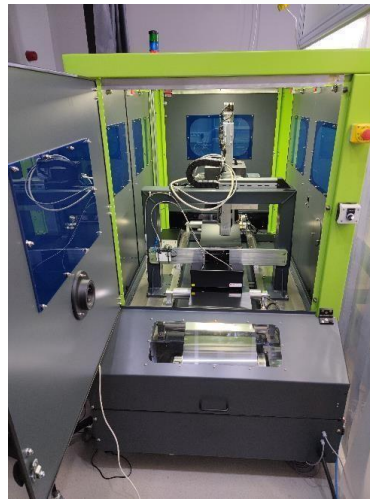
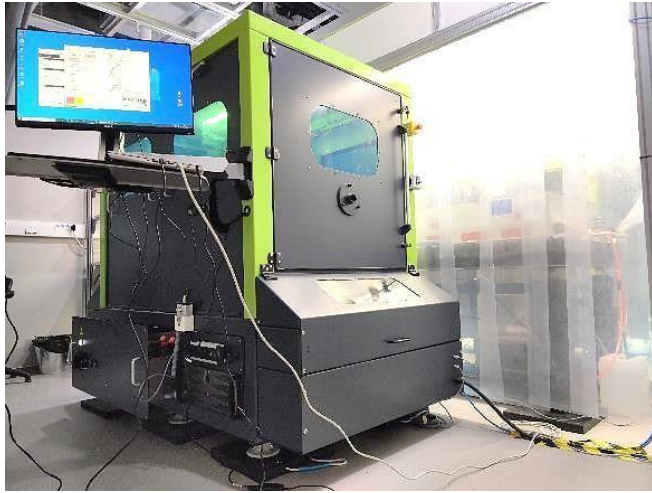
- Laser processes & Thermal Imprinting



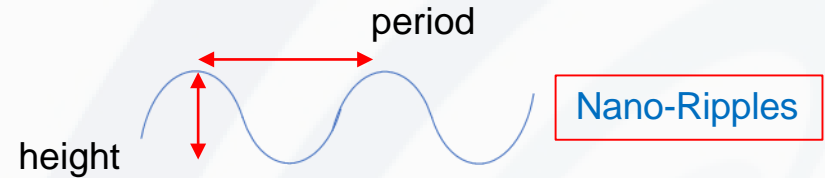


R2R Laser Processes

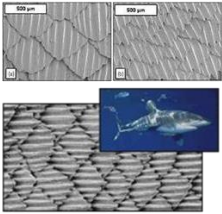




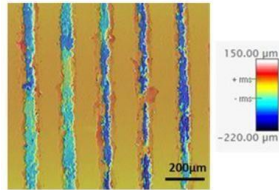
In-line Production monitoring



- First 15 m nano-textured metal coil produced.
- Possibility to nano-texture large flat surfaces.
- Wide range of functionalities and applications.
- Femto second continuous texturing.



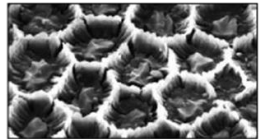
Hydrodynamics



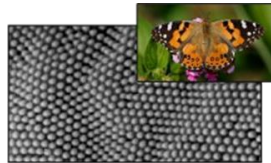
Heat Exchange



Anti-ice



Kongo-Rose Bug (*Pachnoda marginata*)

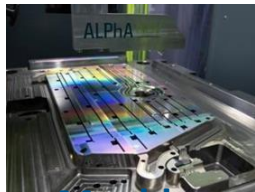


Butterfly (*Vanessa kershawii*)

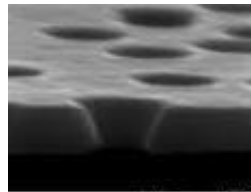
Biomimetics; optical, antifouling, easy to clean ...



Current Collectors



Moulds



Pore Creation



Current Collectors



Vibration, wear and friction mitigation



- Wide range of functionalities.
- Nano-conformable coatings synergy; sol-gel PVD and others.
- Possibility to transfer to:
 - TDM
 - Thermal Imprinting
 - Others processes
- Pores and nano structures creations of wide range of materials including metal and ceramics.
- Services:
 - Design of solutions
 - Validation
 - Upscaling
 - Supply chain creation
 - Investment
 - Commercialization support



HiPIMS





Metal strips and sheets



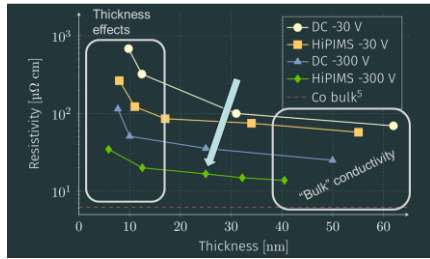
Roll-to-roll on foils



Complex bulky components

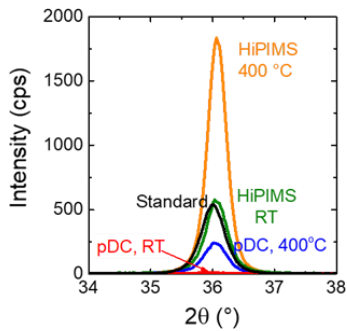
- **High Power Impulse Magnetron Sputtering :**
 - PVD Best Available Technology
 - Large fraction of the sputtered material ionised
 - HiPIMS compatible with standard sputtering systems
- **Development of Vacuum Deposition and High-Performance Layers:**
 - Metals, alloys, functional oxides and compounds.
 - Control of stoichiometry, microstructure, surface chemistry, optoelectronic properties.
 - Control of growth temperature (heat sensitive substrates).
 - Nano-conformity.
 - Improved optical, functional, tribological, mechanical properties:
 - RT Photocatalytic TiO₂ on polymers.
 - Nano-conformable oxides.
 - Highly conductive metal layers.
 - Tribological and wear protection.

Portfolio of Available Coatings.



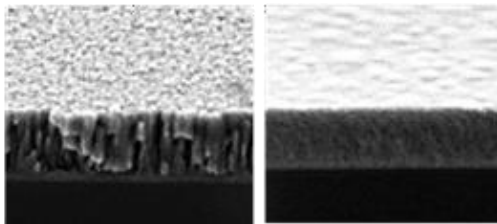
- Resistivity reduced, huge improvement at lower thickness!
- Increases density, grain size and affect nucleation

Metallization: Co on SiO₂.



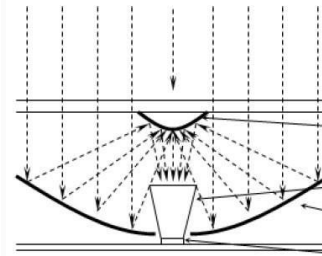
- HIPIIMS films at RT comparable with the optimized reference process at 400°C

Piezo-electric AlN coatings



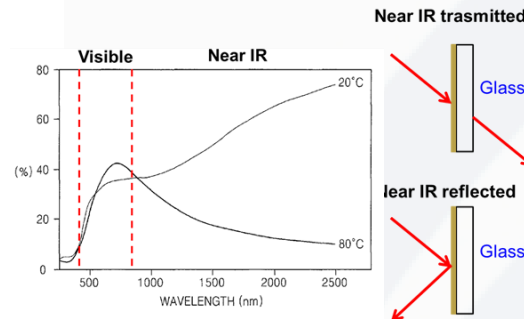
- Much higher activity of HIPIIMS TiO₂ for RT
- Heat sensitive substrates.
- Tuneable microstructure and density.

Self-cleaning Low Temperature TiO₂



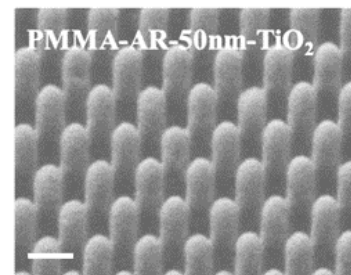
Reflective Multilayer coatings for Surface mirrors.

- Primary optics in high concentration photovoltaic (HCPV) systems.



- Low Temperature Synthesis.
- Self-tunable IR filter
- Smart windows and switching applications
- Energy saving.

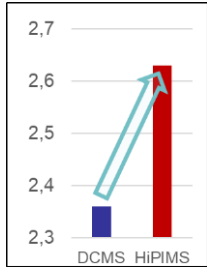
Thermochromic VO₂ Thin Films



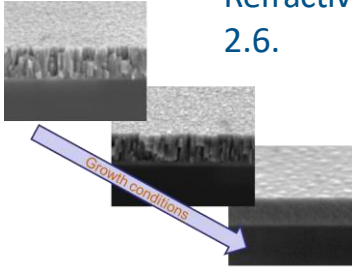
- Antireflective nano-structure. coated with TiO₂
- Stability from ~100°C to 250°C
- Improved scratch resistance and surface hardness
- Super-hydrophilic WCA ~4°

TiO₂ on nano-structured polymers.

Portfolio of Available Coatings.



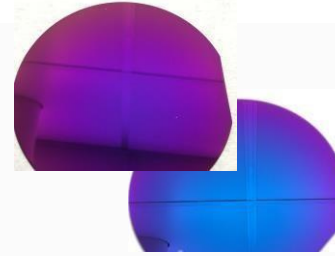
- Increases refractive index and reduces roughness
- Tune surface roughness and density.
- Refractive index from 2.4 to 2.6.



Optical Coating TiO₂.

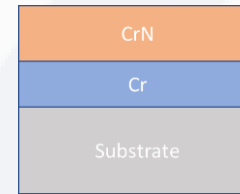
Others:

- Layers for solar absorption CrC, a-C:H, C:H-Ti.
- Electric contact layers Cu, Al, Sn, Mo
- High-temperature functional layers YSZ
- Photovoltaic absorption layers Cl(G)S, CdTe, Si
- Special functional layers Al, Cu, Sn,
- Transparent conductive oxides: ITO, ZnO, NiO ,



- HfO₂ IR transparent -suitable for IR optics.
- Under development.
- Improved transparency and resistance.

HfO₂ for optical elements



- For Al Fuel Cell Plates
- Under development.

Corrosion resistant, electrically conducting CrN:





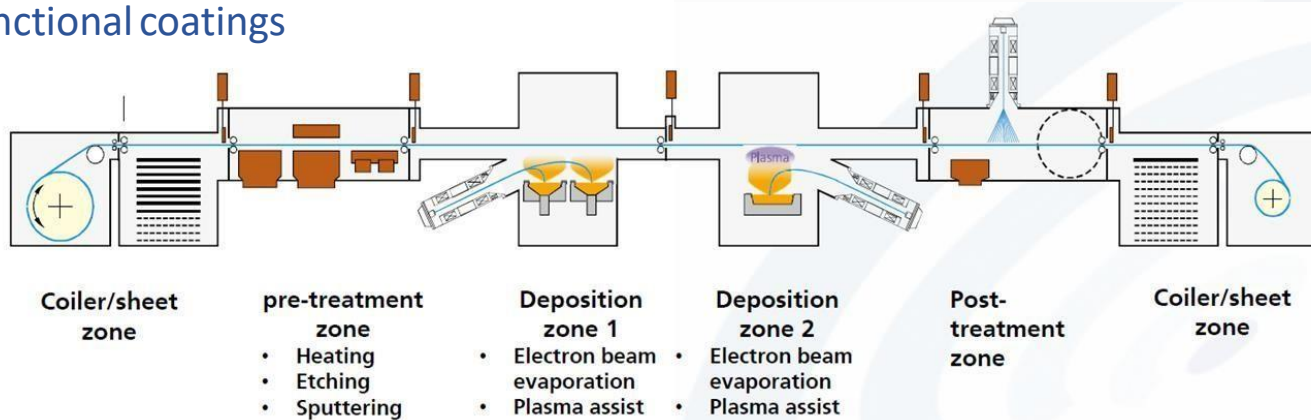
PA-CVD / PE-CVD



Metal sheet and foil deposition facility

- Continuous Coils and sheets (500mm x 500mm)
- Functional oxides and metals
- Photo-catalytic, corrosion protection, e-coatings, hard and functional coatings

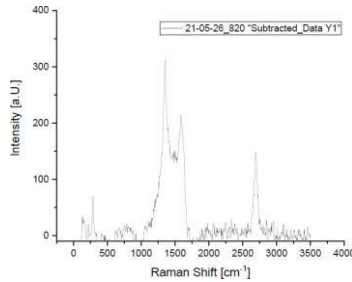
- Cost effective mass
- Production process
- High Production rate



- Flexible substrates (polymer webs, thin metal foils)
- Hybrid organic inorganic polymers with barrier, optical, mechanical and other applications

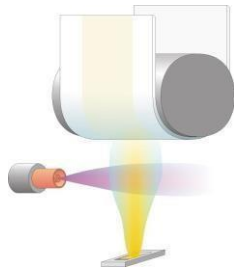
- Double Side coating, 5 coating stations
- Evaporation, sputtering and PECVD
- Packaging bio-based and functional





Graphene on Cu continuous process

- Filtering media for gas and water.
- Continuous process.
- Later Nano-pore creation

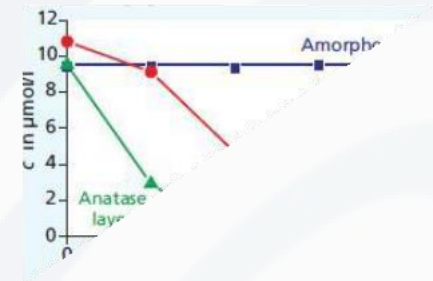
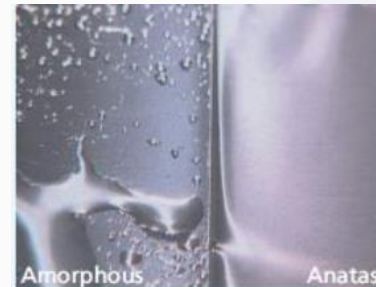


Si-C Coating

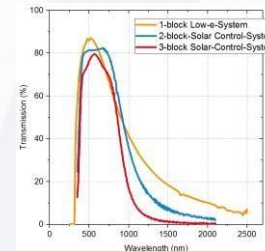
- Improved packaging:
 - Water and oxygen barrier
 - Scratch resistance
 - Hydrophobicity
 - Optical Properties



Corrosion protective layers



Photocatalytic TiO₂ on metal strips



- Low-e /solar control coating
- Single layer material development for smart windows and cladding

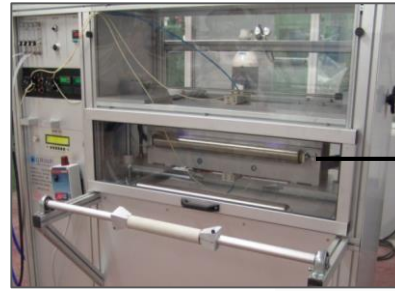
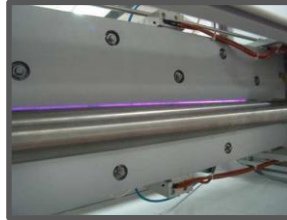
Heat Reflective Finish



APGD and Finishing Processes



Atmospheric Pressure Glow Discharge (APGD) system and surface finishing

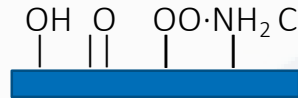


Low pressure plasma

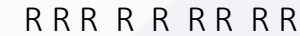
Atmospheric pressure plasma jet

Atmospheric pressure plasma glow discharge

Surface activation



Functionalised surface



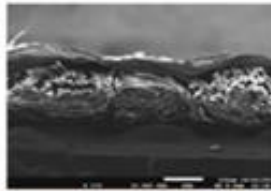
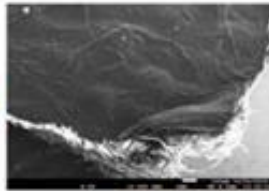
Surface grafting induced by plasma
R: functional moiety

Plasma polymerization (PECVD)



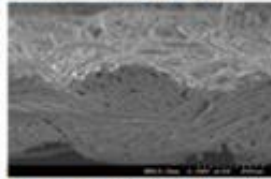
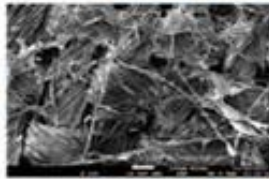
Plasma polymerised nanocoating

Coating



Textile completely covered by a coating a layer

Padding



Impregnated textile fibers – fiber treatment

Finishing



No drying and curing extra processing



No generation of wastewaters

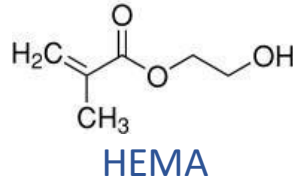
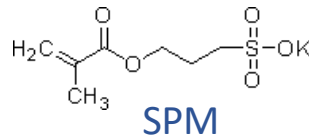
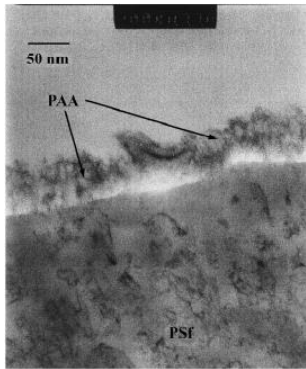


Very low or null consumption of chemical

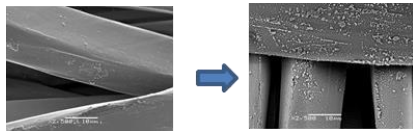
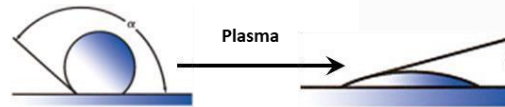


No water consumption

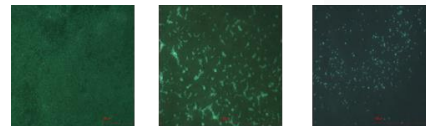
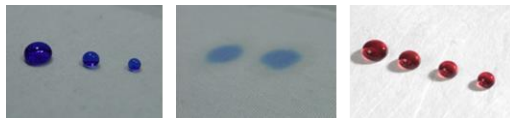
Atmospheric Pressure Glow Discharge (APGD) system and surface finishing



- Membrane finishing to increase:
 - Selectivity
 - Microbial and Fouling resistance
 - Superhydrophilic and superhydrophobic

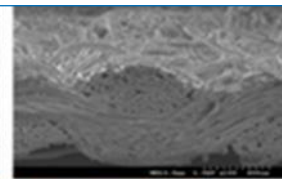
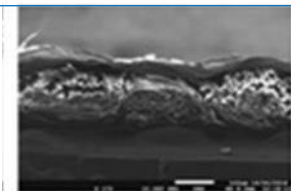


$\begin{array}{c} \text{CH}_3 \\ \\ \text{---O---Si---O---} \\ \\ \text{CH}_3 \end{array}$	Untreated (20-24 mN/m)
$\begin{array}{c} \text{OH} \\ \\ \text{---O---Si---O---} \\ \\ \text{CH}_3 \end{array}$	Plasma treated (>72 mN/m)



Antimicrobial surfaces

- Improved wear resistance.
- Surface activation for finishing.
- Nano-particles coating:
 - GO
 - Graphene, CNT
 - Nano SiO₂ and others
 - Nano-cellulose and others
- Pore creation on graphene.



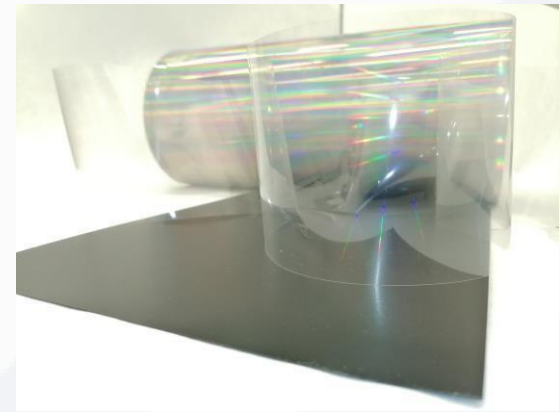
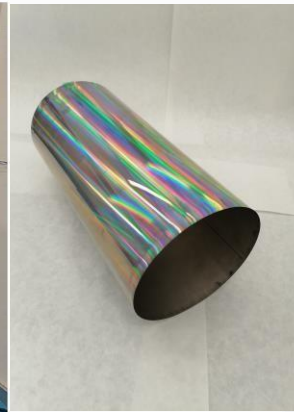
e fibers - fiber treatment



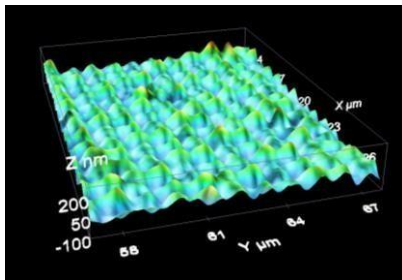


R2R Thermal Imprinting processes

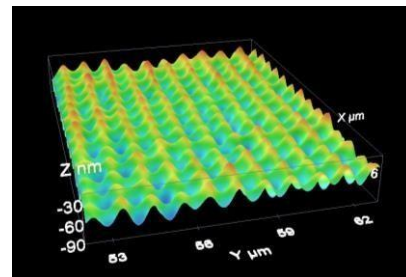




Cylinder texture



Replica



Texture transfer in a roll to roll process by means of a hot cylinder.

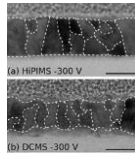
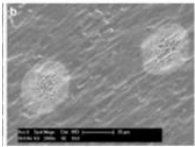
- Wide range of functionalities.
 - Anti-fouling
 - Increased active surface
 - Optical
 - Others
- Polymer rolls membranes and thin metal foils.



Inter-operability



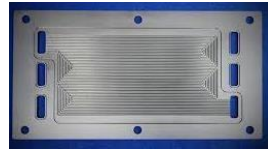
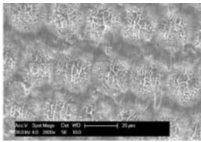
R2R systems interoperability:



Wettability + Conductive → Current Collector

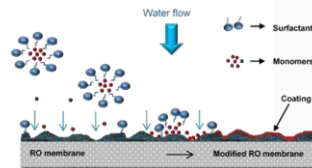
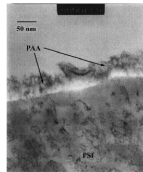
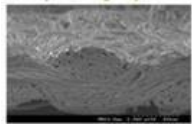


- Reduction of interface resistance
- Increased capacity after cycling



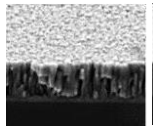
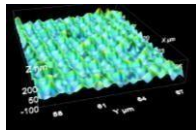
- Increased corrosion resistance
- Increased interface conductivity

Improved contact + Conductive Corrosion layer → Fuel Cell



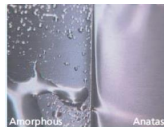
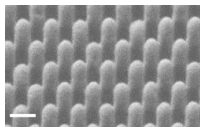
- Increased selectivity for B and others
- Increased resistance to fouling and aggressive media

Nano coating + Plasma polymerization → Selective/Antifouling membrane.



- Antireflective
- Antiviral, bacterial and moulds
- Hydrophilic

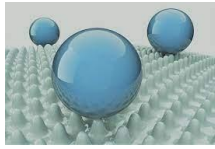
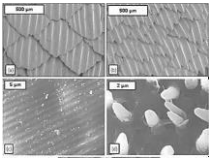
Active Surface + TiO₂ → Antibacterial surfaces and packaging



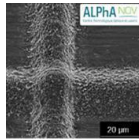
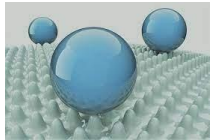
- Increased corrosion resistance
- Easy to clean
- CO₂ mitigation

Active Surface + TiO₂ → Easy to clean CO₂ reducing facade

R2R systems interoperability:



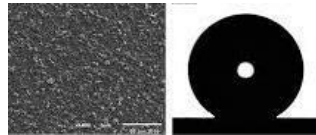
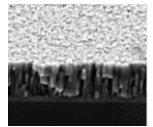
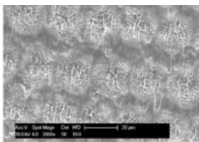
Drag texturing + Hydrophobic → Hulls



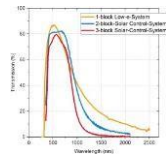
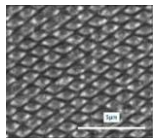
Anti-ice + Hard Hydrophobic → Anti-ice wings and lead erosion resistant blades.



Graphene layer+ Nanopores → High Permeability membrane.



Active Surface + TiO₂ → Antifouling photocatalytic membrane



Active Surface + e-coating → Energy Efficient Facade



- Polymer free corrosion resistance.
- Improved drag
- Chemical-free Antifouling



- Ice prevention on wings.
- Cold climate wind energy.
- Leading edge erosion resistant
- Improved aero dynamics.



- High permeability media.
- Membrane distillation. MF, UF, NF, RO.
- Leading edge erosion resistant
- Improved aero dynamics.



- Self cleaning.
- Super-oleophobicity.
- Controlled structures.



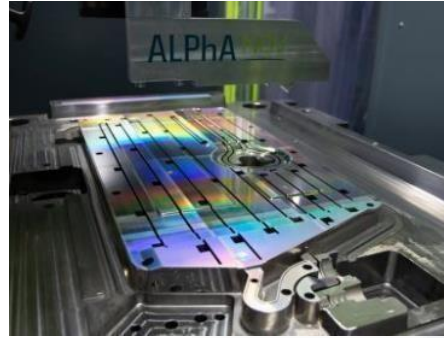
- Energy efficient envelopes.
- Heat reflection properties

From the coil to a product

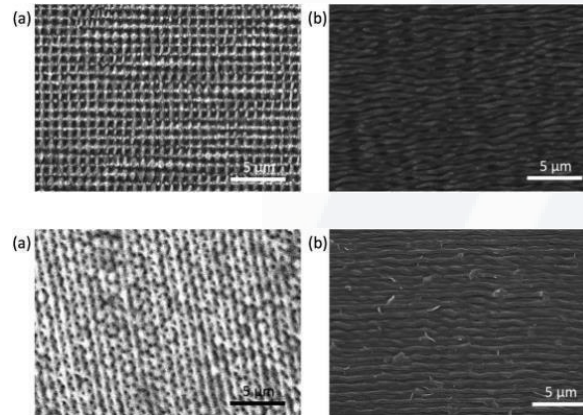
FORMING



MOLDING



LAMINATION

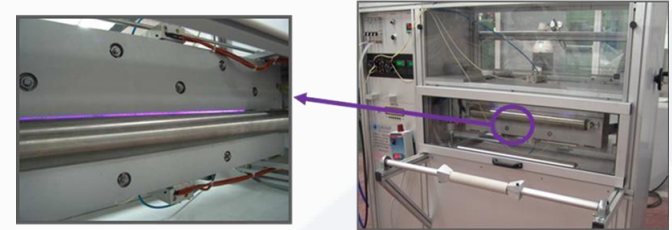




Nano-enabled Surfaces and Membranes for the Water Treatment Industry



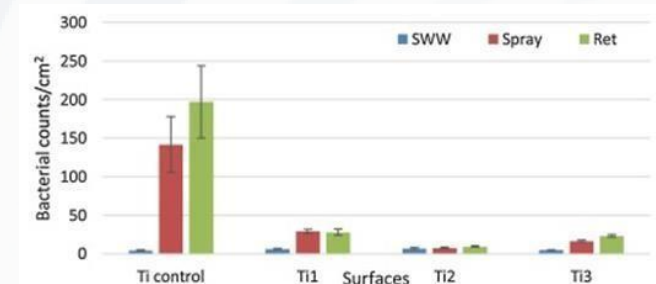
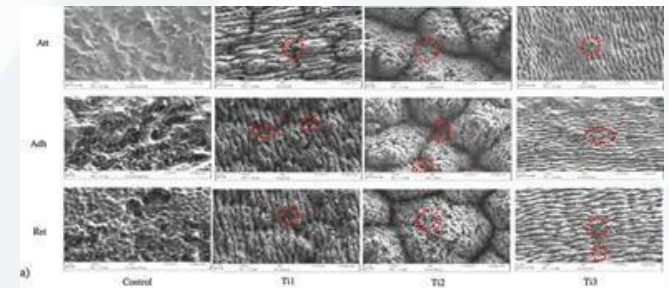
- NewSkin will bring laser processes and APGD processes for membrane surface modification in order to improve selectivity of and fouling resistance of filters and membranes.
- By creating tailored nano-structures on the surface of membranes and filters, microbial and foulant adhesion is prevented.
- Laser and APGD + Finishing processes also chemically modify surfaces allowing to tailor the hydrophobicity, oleophobicity, hydrophilicity, oleophilicity and amphiphilicity of surfaces.
- Surface texturing and chemical modification can be combined synergistically.
- Important savings can be achieved due to:
 - Durability.
 - Selectivity
 - Reduced cleaning operations
 - Reduce pressure drop.



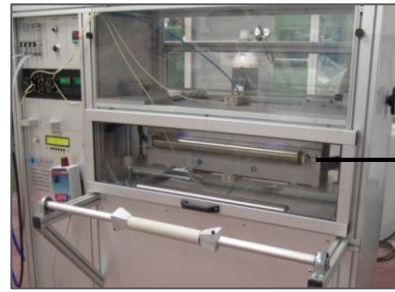
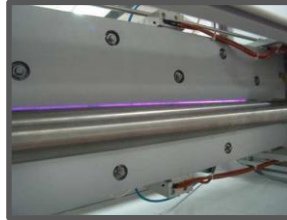
R2R APGD pilot-plant plasma system



R2R surface finishing system



Atmospheric Pressure Glow Discharge (APGD) system and surface finishing

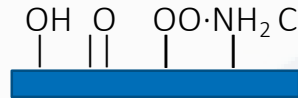


Low pressure plasma

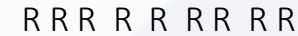
Atmospheric pressure plasma jet

Atmospheric pressure plasma glow discharge

Surface activation



Functionalised surface



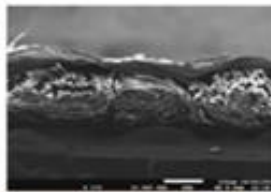
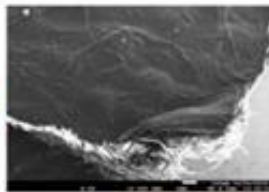
Surface grafting induced by plasma
R: functional moiety

Plasma polymerization (PECVD)



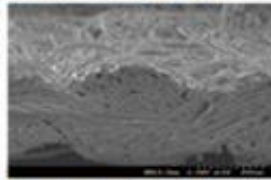
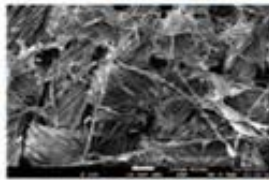
Plasma polymerised nanocoating

Coating



Textile completely covered by a coating a layer

Padding



Impregnated textile fibers – fiber treatment

Finishing



No drying and curing extra processing



No generation of wastewaters

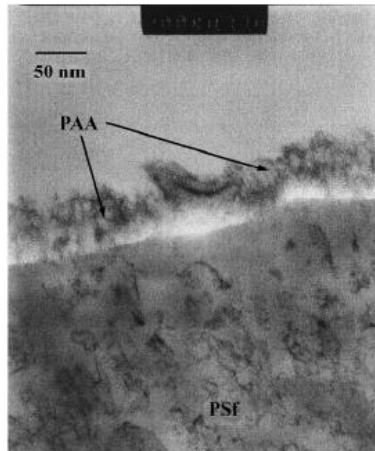
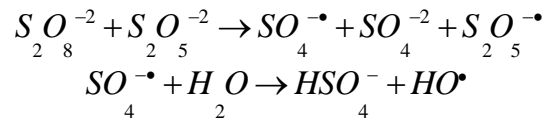
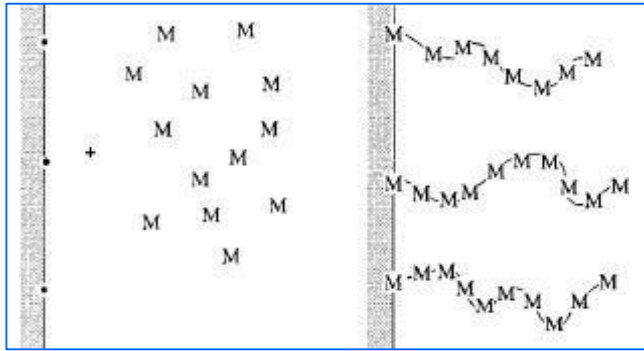


Very low or null consumption of chemical



No water consumption

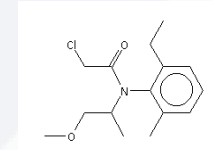
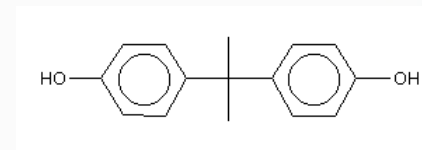
Grafting of polymers on RO membranes to increase selectivity.



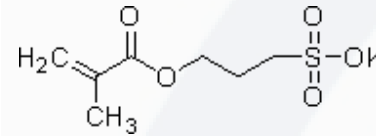
Ben-David et al. *JMS*, 2010

- Fouling mitigation - minimal grafting required
- Tuning selectivity - grafting optimization required

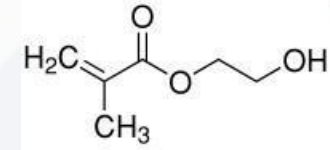
Model Contaminants



Hydrophilic Monomers



SPM

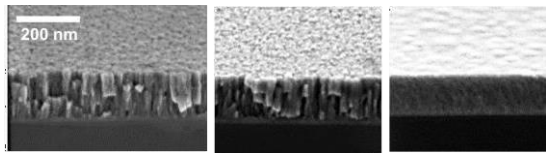
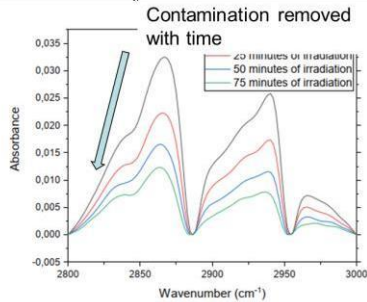


HEMA

- 5 ppm B in seawater, in permeate it has to be < 0.3 ppm
- B removal represents 15-20% of water cost – a significant motivation to enhance B rejection to >95%
- It is proved very hard and mechanism is not clear

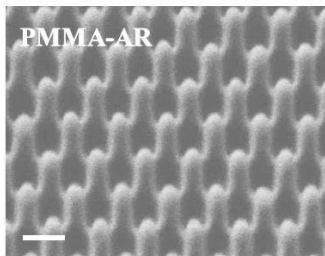
Room Temperature Conformable Ceramic Coatings.

- Self-cleaning Low Temperature TiO₂:

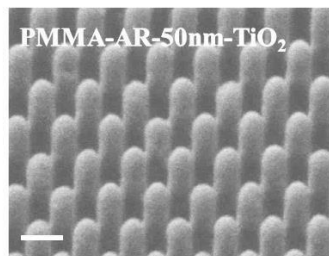


Technique	Temperature	Activity
dcMS	RT	0.2
HiPIMS	RT	0.9
	200°C	2.1

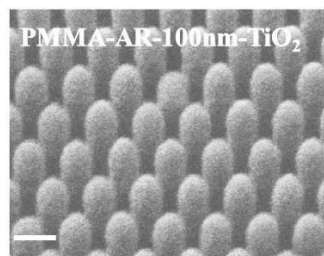
- TiO₂ on nano-structured polymers:



Uncoated



Coated, 50 nm TiO₂



Coated, 100 nm TiO₂

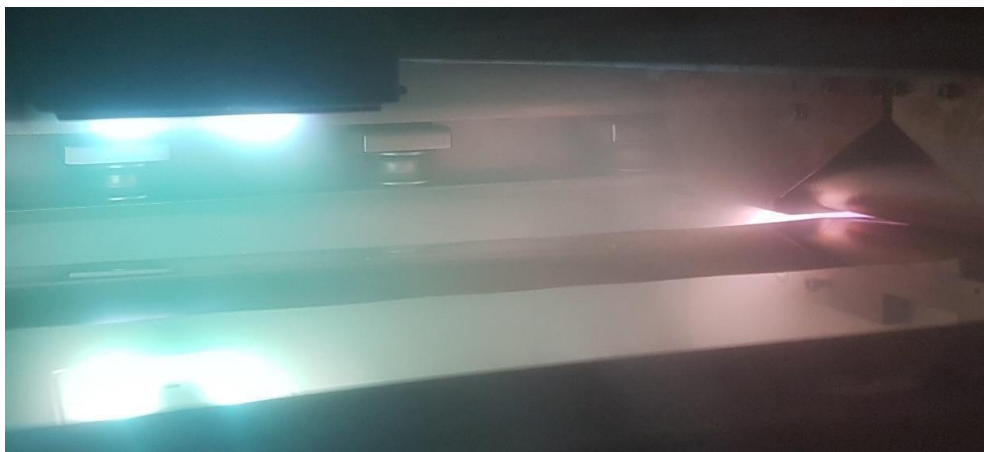
- Easy to deposit photocatalytic TiO₂ at 400°C
- Much higher activity of HiPIMS TiO₂ for room temperature depositions.
- Compatible with heat sensitive substrates.
- Tuneable microstructure and density.
- Nano-conformity
- Stability increase from ~100°C to above 250°C
- Improved scratch resistance
- Enhanced surface hardness
- Superhydrophilic surface after UV illumination. WCA ~4°

Continuous Production of Monoatomic Graphene Membranes

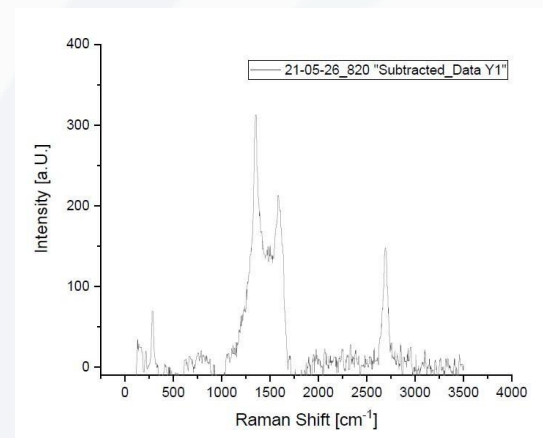
- The **unique atomic thickness of graphene** open a chance to achieve **the highest fluxes in liquid and gases filtration**. The formation of a single-layer graphene membrane typically involves three critical steps:
 - Production of a **homogenous monoatomic graphene surface**.
 - **Transfer of large-area graphene** onto a desired porous substrate.
 - Creation of sub-nanometer **pores**.
- NewSkin brings the necessary facilities for:
 - The **continuous production of monoatomic graphene** on Cu catalyst supported on stainless steels foils. Roll-to-roll vacuum deposition unit MAXI
- The **creation of nano-pores** on the surface of the monoatomic graphene membrane:
 - 4-axis OWS, LIPSS micro- and nanomachining for up to **50 nm nanopores**.
 - OWS, LIPSS Laser system for up to **10 nm nanopore creation**.
 - Continuous laser system for 0,1 aspect ratios.
 - APGD for (**< 1 nm pores**)



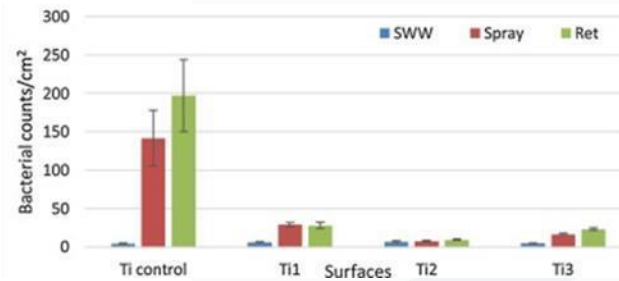
Continuous Graphene deposition:



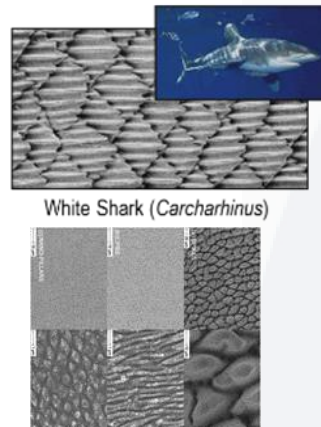
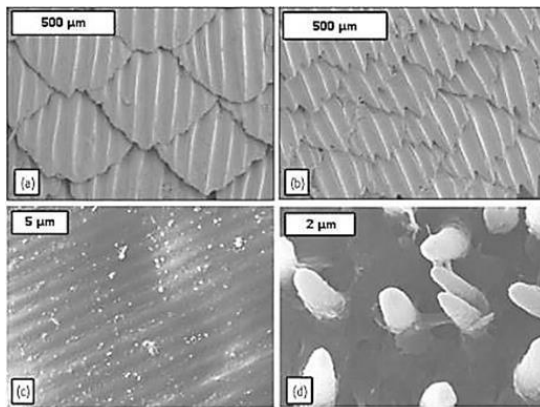
- C-based coatings **PECVD process**:
 - Sputtering of **catalytic Cu-layer**.
 - Magnetic plasma enhanced **PECVD –process + ion beam heating for graphene deposition**.
 - Barrier applications and **membranes for water treatment**.
 - **NF, MD, RO (Controlled Porosity and nano-thickness)**



- Combination of **laser texturing and laser hardening**
 - **Reduced cavitation/bubble generation** of propellers in liquid environments.
 - **Increased part lifetime:** Reduced cavitation damage of propeller blades, bearings and motor components.
 - **Low friction** applications
 - **High wear** resistance
- Benefit for customers:
 - **Lower part maintenance,**
 - **enhanced reliability,**
 - **lower energy requirements**



- **Shark Skin and Crab Shell and other antifouling textures:**

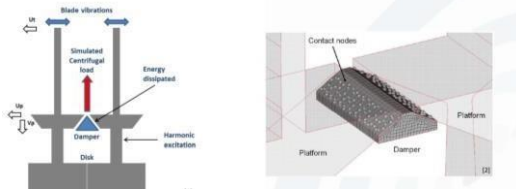


- **Reduced drag.**
- **Reduced fouling.**
- Polymer and chemical free **anti-fouling strategy.**
- Compatible with continuous processes and metal coil manufacturing

Texturing & Coating of Components for pumping and other devices

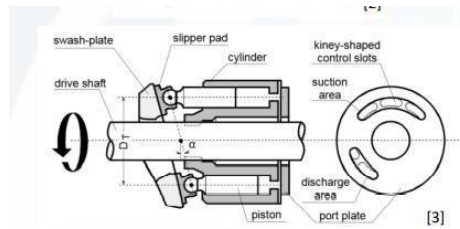
Retrofit under platform damper:

Vibration attenuation leads to an **efficiency gain over 0.25%** in gas and steam turbines.

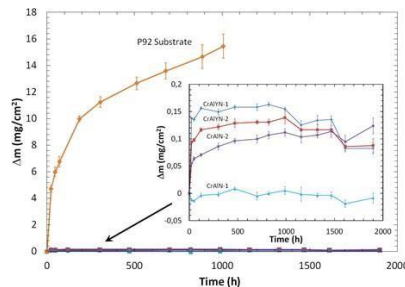


Scroll Compressor:

Friction reduction of 10% and **extended service life of 20%**



CrAIN based coating, show increase wear resistance as oxidation resistance properties at **650°C 100% steam environment** and until **850°C in air**



Shaft/Bearing in electric cars:

Friction torque reduction of 15%.

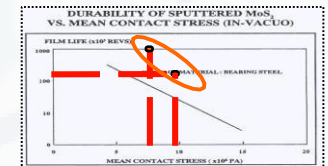
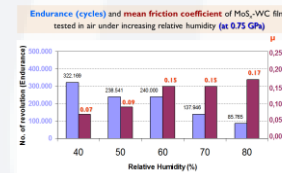


Components in maritime engines and centrifugal pumps:

Propeller and nozzle system: anti-fouling, cavitation prevention and improved drag texture



MoSx-WC based coating, this coating has **low friction coefficient under vacuum**, **cryogenic temperatures** and resistance to humid environment when tested at atmospheric conditions.



Testing of the membranes on real wastewater mimicking streams:

- **Membrane Evaluation:**
 - water flux,
 - Separation efficiency (i.e., solute rejection),
 - and scaling/fouling propensity.
- **Under typical operating:**
 - Pressure,
 - Temperature,
 - Feed flow rate,
 - Feed water quality.
- **Screening, characterization, fouling/scaling experiments.**
- Flat sheet membrane **custom-designed membrane system** for:
 - Microfiltration (**MF**)
 - Ultrafiltration (**UF**)
 - Nanofiltration (**NF**)
 - Reverse osmosis (**RO**) membranes





Application and Testing of nano-formulated coatings



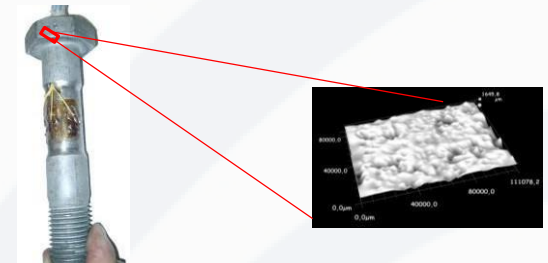
Industry and Society Trends:

- Society and industry are addressing period of changes:
 - **Sustainability, circularity and security** will be the key drivers for the next decade.
 - Materials and energy **efficiency**
 - Removal of potential **toxic substance**
- **Coating production itself.**
 - Environmental concerns on the use **raw materials** (e.g. PFAS),
 - Associated **carbon footprint**
 - **Microplastics** emissions
 - And **solvents removal**
- **Coating performance:** to protect different materials and substrates:
 - **Extending lifespan**
 - **enabling** the use of materials in demanding scenarios,
 - **refurbishment and re-use**
 - **new levels of performance based on more sustainable chemistries.**



Industry and Society Trends:

- **Nano-technologies** are called to play a key role to meet these objectives. Nano-technologies will open that path to highly durable **water-based systems**, overcoming the lack of barrier and mechanical performance associated to water-based binders when compared to solvent borne technologies.
- Nano-technologies will also contribute to **resources efficiency** increasing lifespan and allowing to get same or better performance levels applying thinner coatings.
- Nano-enabled coatings are also enablers for the **use of more environmentally** friendly materials despite its potential lower weathering resistance limitations. In addition, durability will reduce paints micro-plastics emissions.
- Moreover, nano-technologies will allow deployment of **novel functionalities** that will become common practice in the next decades: e.g photocatalysis, heat-reflection and others.



- Fully C5 and CX **water-based corrosion** protection systems.
- **Composites corrosion** in saline water.
- **Complex corrosion mechanism** under cycling loads and harsh environments.
- Long term **durability in Intumescent coating**.
- **Marine environment corrosion and fouling resistance**.
- Cavitation, wear and fouling in **ocean energies**.
- Chemical resistance in **hot liquid storage** tanks and chemical industry.
- Wind turbines **leading edges erosion**.
- Soiling and icing in **photovoltaic systems**.
- **Heat reflective** finishes for highly efficient envelopes.
- Enhanced mechanical **zinc rich primers**.
- **Immersed and buried** components protection.
- High performance **water-borne systems**.
- Thinner protective (solvent and water) to reduce application and **enable assisted drying systems**.
- Oxygen and water vapour **barriers**.
- **Alternative to PFAS** systems.
- **Cu- free antifouling**.
- Increase the competitiveness of painted steel according to life cycle criteria.



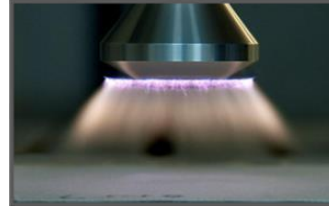
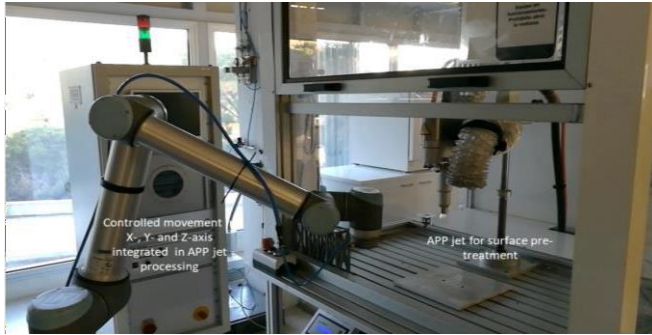


Coating Facilities:



Automatized Controlled Deposition of Nano-Enhanced Coatings:

- Automated APP jet for surface pre-treatment



APP jet for surface pre-treatment

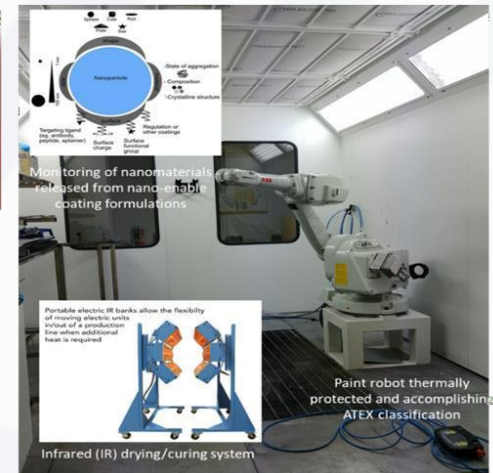
- Rotative nozzle technology
- Low frequency generator: 19-23 kHz
- Adjustable plasma cycles: up to 100%
- Discharge distances: 5-25 mm
- Processing speed: 0,1-37 m/min
- Surface treatment of 2D or 3D materials

- Integrated automatized system with controlled X, Y, Z-axis movement for improving reproducibility of surface pre-treatments and optimize operational parameters before industrial up-scaling
- Liquid paint booth upgraded with an automatized spray, nanosafety assessment and IR dry/curing system**

- Vertical flow 3m x 4m liquid paint booth
- Temperature-time control for paint-drying-cooling steps
- Paint box for preparation of WB, SB, 100% solid paints
- ATEX compliant
- Integrated automatized infrared (IR) system as environmentally friendly alternative to conventional thermal drying/curing systems
- Integrated assessment of nano-safety and nanotoxicology of nano-enable coating processing for potential nanomaterials in the air inside and outside the liquid paint booth.



Liquid paint booth



Powder paint booth upgraded with an automatized spray, nanosafety assessment and IR dry/curing system

- Batch 1,0m x 1,5m powder paint booth
- High voltage generator: 100 kV
- High Density Low Velocity (HDLV) tech.
- 11,3 L powder feed hopper
- Convenient powder recovery
- Application performance at current levels below 5 mA
- ATEX compliant
- Integrated automatized infrared (IR) system as environmentally friendly alternative to conventional thermal drying/curing systems
- Integrated assessment of nanosafety and nanotoxicology of nano-enable coating processing for potential nanomaterials in air inside and outside the powder paint booth.



Powder spray system





Testing facilities



SIRRIS owns one of the largest climatic chambers in Europe (dimensions 10x7x8 m), with a wide temperature range (+60°C to -60°C). With 10 years of activity, it has become a reference for extreme temperatures testing. In addition, the chamber is also equipped for humidity cycles (95%RH) and solar infrared radiation tests (950 W/m²).

- Up to 30m² area coverage
- Simultaneous testing of multiple samples
- Different icing clouds are generated for different icing conditions (glaze ice, rime ice, freezing rain/drizzle)
- Evaluation of the durability of anti-icing coatings by performing icing/de-icing testing
- Ice adhesion testing by shear testing
- Evaluation of reparability of coatings in harsh environments.
- Impact icing by using fan(s).



Icing test	Possibilities to generate different types of ice like rime, glaze and mixed ice. Build up according to standards. 25 controllable nozzles which cover a surface of ±25m ²
Measurements on ice build-up (new)	Adhesion, type and thickness
Extreme temperatures (existing)	-60C to +60C
Humidity (existing)	Up to 95%RH
Solar radiation (existing)	950W/m ² (4x4 m)
Large size objects (existing)	Inner dimensions 10x7x8 m

Corrosion and mechanical performance of large sized bolted connections

Fatigue assessment of preloaded bolts under extreme environmental condition. Influence of alternative coating systems on the fatigue behaviour of bolts. Simulation of the lifespan of bolted connections

Some examples:

- Ring Flange Connections
- Column - Beam Connection
- Girder Joint

Test procedure

1. Surface scan, roughness measurement, coating thickness measurement
2. Climatic chamber: Salt spray test according to ISO 9227 under preload. Including measurement of preload loss for some bolts
3. Fatigue tests incl. evaluation
4. Surface scan and roughness measurement, layer thickness measurement, fracture surface analysis

Applications

- Determination of corrosion fatigue performance
- Evaluation corrosion protection system
- Determination of optimal coatings

Target

- Simulation of long-term product lifetime with short-term test period
- Basic information for approval procedures
- Suitable for series testing

Climate chamber



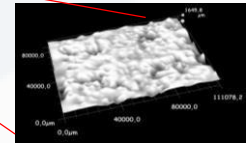
Fatigue test



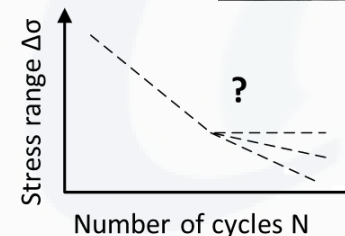
Monitoring



Evaluation

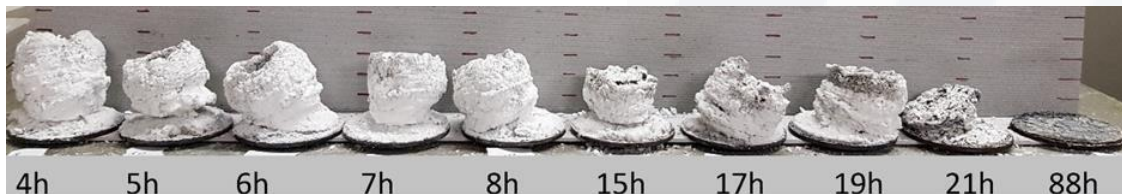


Examples



Corrosion and ageing resistance in aggressive industrial environments:

- Accelerated salt-spray testing by spraying acid solutions.
- Alternate salt spray and acid spray up to 65 °C.
- Updated software it is now possible to program a high variety of combination of cycles and parameters to realize the corrosion tests in harsh and industrial atmosphere.
- The evaluation of the functionality of IC applied on buildings.
- Develop accelerated aging procedures for IC to simulate the degradation resulting from the exposure in the buildings.
- Engineering of a minimal invasive method to evaluate the performance of IC after exposure in real buildings.
- Tailored durability testing procedures to claim over 10 years of durability to EAD 350402-001106 TAB based on existing samples.



degradation of intumescent coating

Combined stresses at extreme P and T conditions. High and low pressure and T^a

- **Testing textures and coatings under a wide variety of harsh conditions:**
 - Design pressure up to 350 bar and temperatures up to 400 °C
 - Non-stirred / stirred autoclave system (50-3000 rpm)
 - Rotating Cage test, simulating the abrasion caused by liquids with suspended solids
 - Simulation of sour/non sour service environments (e.g: CO₂, H₂S, chlorides,...)
 - Rigorous methodologies to ensure the integrity of the tests. E.g. H₂S saturation, temperature, pH, oxygen (ppb level)
 - Corrosion rate determination of coatings under cathodic protection
 - Performance of corrosion inhibitors in service
 - Electrochemical corrosion testing in autoclaves
 - Standards related to coatings chemical resistance testing:
 - ASTM D6943 – Immersion testing of Industrial Protective Coatings and Linings
 - ISO 2812-1 – Determination of resistance of coatings to immersion in liquids other than water
 - NACE TM0174 – Laboratory Methods for the Evaluation of Protective Coatings and Lining Materials on Metallic Substrates in Immersion Service
 - NACE TM0185 – Evaluation of Internal Plastic Coatings for Corrosion Control of Tubular Goods by Autoclave Testing



Evaluation of samples and components in real offshore environment:

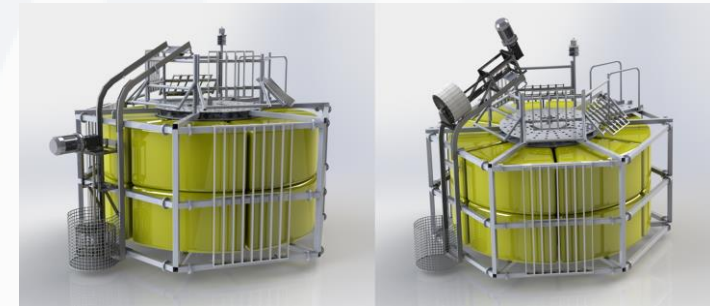
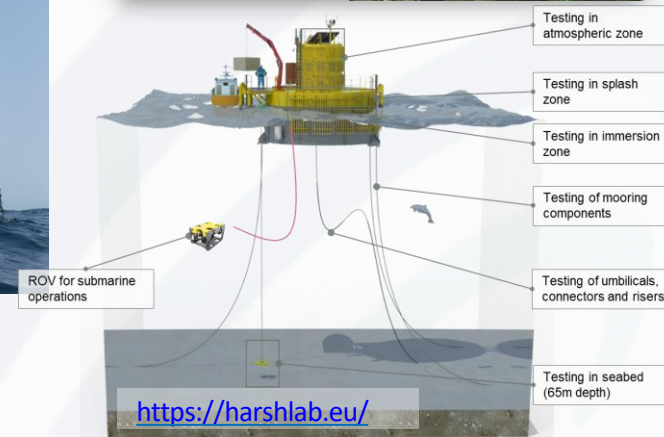
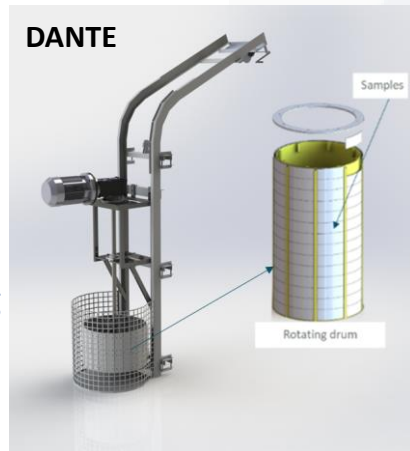
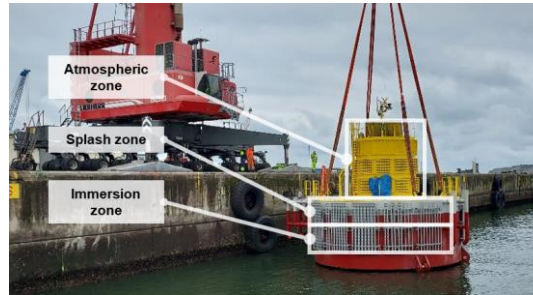
- Up to 2000 samples in atmospheric, splash and immersion zone
- Testing of mooring, umbilical and seabed components.
- Testing anticorrosion and antifouling solutions
- Additional natural marine exposure site in immersion zone at Pasaia's port.

HarshLab equipped with energy supply for equipment connection (autumn'23):

- Maximum power: 160 kVA.
- Maximum voltage: 1 kV.
- Nominal voltage: 690 V
- Power conductors: 3 x 50 mm² (Copper).
- Ancillary conductors: 2 x 6 mm² (Copper).
- Optical fibres: 24.
- Double armour.

Dynamic Antifouling Testing rig (DANTE)

- Rotating drum for antifouling testing under Dynamic conditions (<15knots)
- To be installed in former HarshLab, moored in the Port of Bilbao (Spain)



Towing tank and cavitation tunnel testing on flat plate and propellers

- Towing tank testing of new surfaces and coatings for skin friction and improved drag effects.
- Inclusion of measured surfaces to SSPA skin friction database, to offer an immediate and accurate context of the new surface in relation to surfaces seen on vessels today (new coatings, fouling, aging and damaged surfaces).
- Evaluation of decrease of fuel consumption from Skin Friction Database, or more accurate methods using CFD which will also allow non-uniform distribution of surface topology. LCOE analysis of new surfaces
- Coatings wear and cavitation wear rate.
- Evaluation of cavitation erosion and hydrodynamics effects of nano-enabled hulls, propellers, vessels components and immersed components in hydrodynamic environments.



Towing Tank

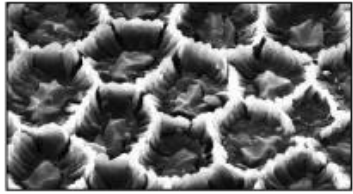


Cavitation tunnel

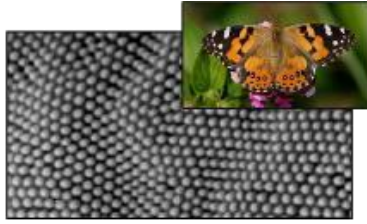


Other High Performance and Functional Surfaces

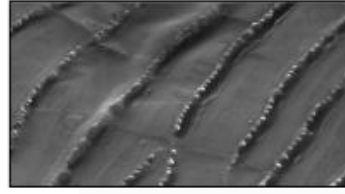




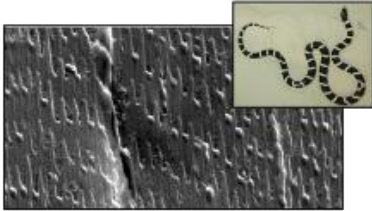
Kongo-Rose Bug (*Pachnoda marginata*)



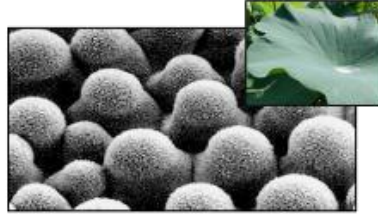
Butterfly (*Vanessa kershawii*)



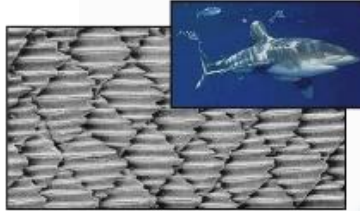
Sandfish (*Scincus scincus*)



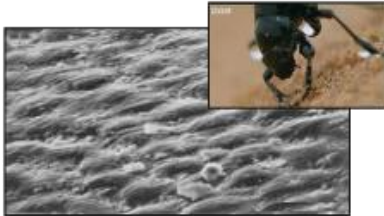
Amumatter (*Elaphe schrenckii schrenckii*)



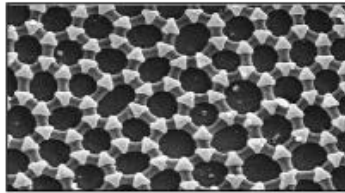
Taro Leaf (*Colocasia esculenta*)



White Shark (*Carcharhinus*)



Dark Bug of Namib (*Stenocara sp.*)



Springtail (*Isotoma saltans*)

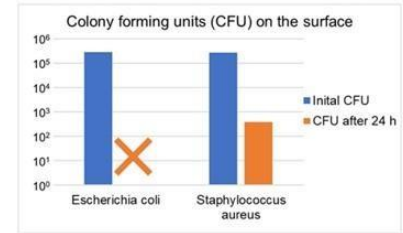


Cicada Wing (*Psaltoda claripennis*)

Super-hydrophobicity
 Super-hydrophilicity
 Antibacterial
 Anti Reflection
 Light Dispersive
 Highly Absorbent

Anti-microbial

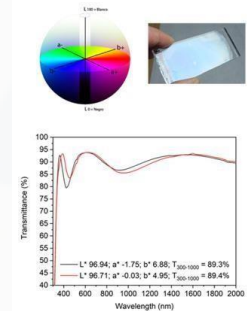
Biocide properties against *Escherichia Coli* and *Staphylococcus Aureus* (ISO22196)



Anti-reflective coating: ARGICOAT



Interference coatings for BIPV





Conclusions



- NewSkin aims to **accelerate the uptake of new advanced surface & membrane nano-technologies** increasing the competitiveness of European businesses and societal benefits
- NewSkin aims to **support industry, especially SMEs, by providing efficient and cost-effective innovative upscaling and testing technologies, resources and services** to manufacture and demonstrate new advanced surface & membrane nano-technologies
- NewSkin offers a **360° portfolio of services - we will tailor to your needs.**
- NewSkin offers a **set of unique interoperable technologies and facilities** for industry as well as knowledge and Route to Market Services.
- NewSkin offers a **complete set of services to accelerate the market uptake of technology.**
- NewSkin services are **available now through Open Calls.**
- Should you be interested in our range of services or want to be part of our community to be updated and participate in our supply chains:
 - Join our platform: <https://platform.newskin-oitb.eu/pages/open-calls>
 - Contact us: info@newskin-oitb.eu
OpenCalls-applications@newskin-oitb.eu



Thank you!

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862100 (NewSkin). The output reflects the views only of the author(s), and the European Commission cannot be held responsible for any use which may be made of the information contained therein.



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