NewSkin introduction

NewSkin: An Open Innovation Test Bed (OITB)

15 countries

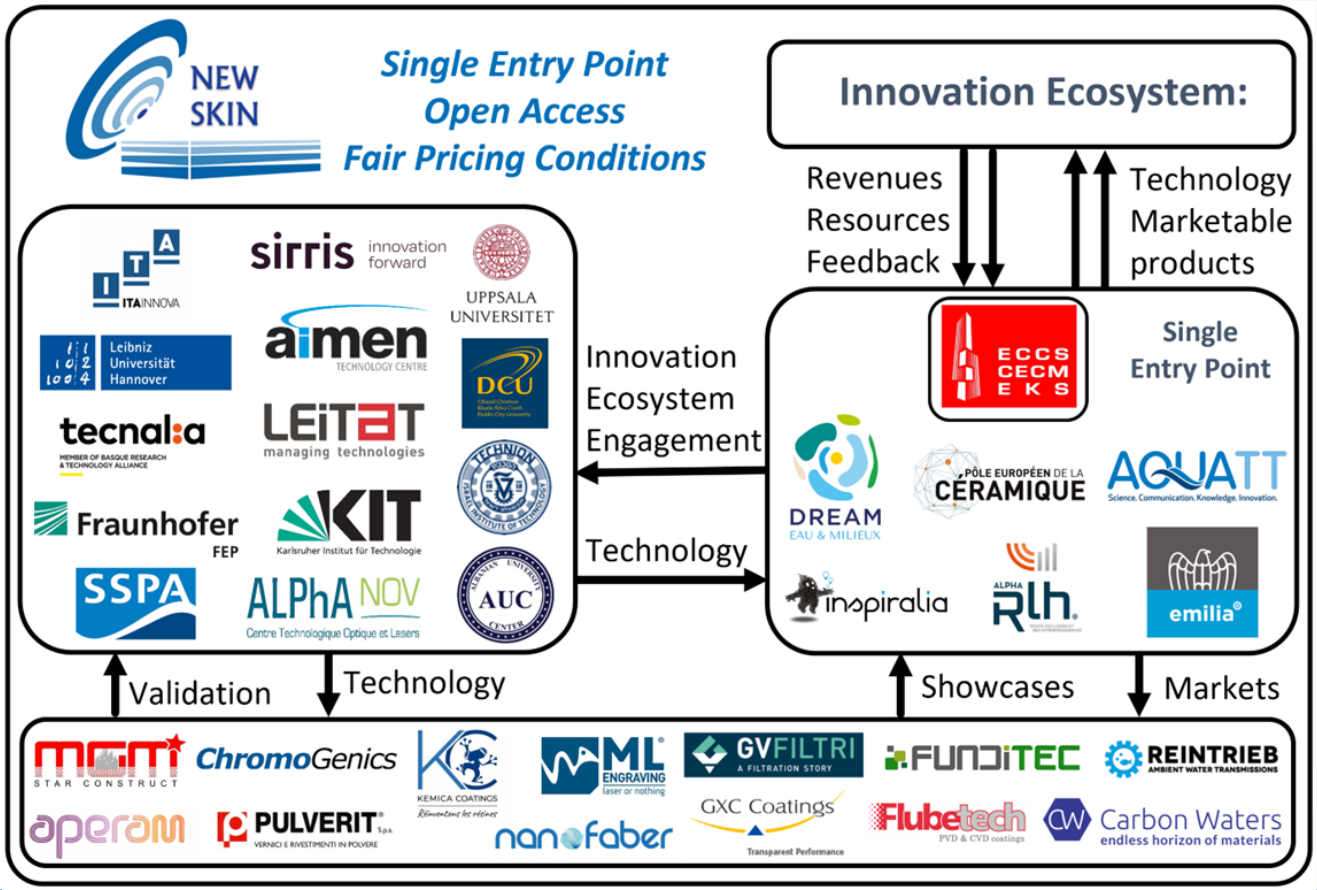
Research

Industry

Innovators

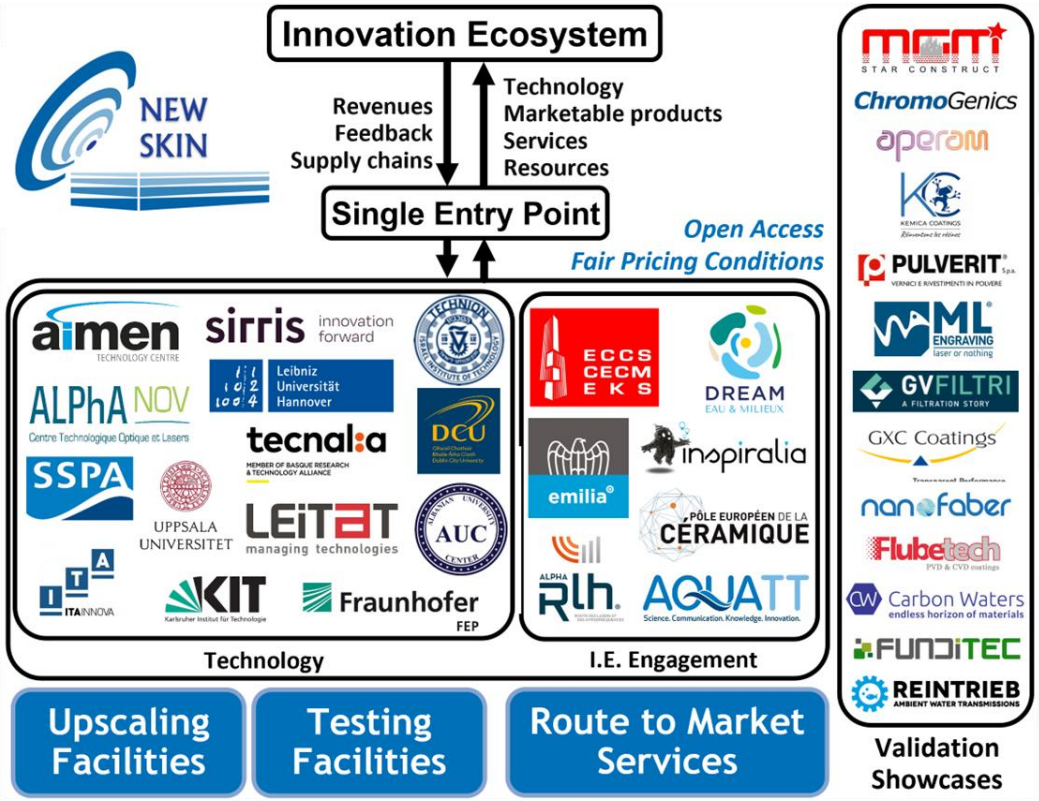
NewSkin OITB

- **Accelerate the market uptake** of new advanced surface nano-technologies
- **Meet key challenges** European Industries and Society.
- Innovative **up-scaling and testing facilities.**
- **Route to market services.** Investment to Supply Chain and Clients management.
- **Coordinated actions** (RTO/AIG´s/early adopters).



NewSkin SEP:

- **Open access through a SEP.**
- Acting as **“architect office”:**
  - support clients to contract all the necessary services in a simple process.
  - Harmonized access conditions. and
  - Coordination of all interactions to complete contractual processes.
- Access to services will granted under **transparent and fair access conditions,** including IP aspects, in a simple process .
- Access to IP under fair conditions.
- Customers will keep their IP.
- **Services are available** free of charge for applicants awarded in the **Open Calls** Process and **subjected to payment** from 01-10-2021.



- Services will be accessible through the NewSkin platform, **https://platform.newskin-oitb.eu/**
- Contact the Architect Office through info@newskin-oitb.eu and OpenCalls-applications@newskin-oitb.eu

NewSkin is part of the H2020 OITBs running:

TEESMAT
Open Innovation Test Bed for Electrochemical Energy Storage Materials

Energy Storage materials design and testing

i-TRIBOMAT
Intelligent Open Test Bed for Materials Tribological Characterisation Services

Tribological Characterization

FORM PLANET

Sheet Metal Testing Forming Hub

Lightme

Light Metal Alloys (Nano)

LIGHTCOCE

Light Ceramics (Nano)

LEE·BED

Flexible Electronics

ASIS

Nano-enhanced composites

INNOMEM

Nano-enabled gas and water membranes

NEW SKIN

Nano-enabled Textures, Coatings and membranes

FLEX FUNCTION 2 SUSTAIN

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

NextGen Microfluidics

Lab on-foil Systems

BIOMAC

BIOMAT

Bionanopolys

INN PRESSME

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

idlimabuilt

meta building labs

WE ARE ALL MEZEROE

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

Services in Detail

NewSkin OITB Added value (II):

Horizontal portfolio of showcases (55), easily recognizable its 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….

Our Offer:

- **The main objective for an OITB it is to support the Innovation Ecosystem to successfully address the industrialization of their nanotechnologies.** To do so we offer:

  - Scale-up and testing,
  - 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:

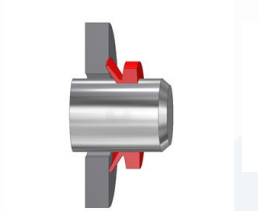
  - the **Sustainable Development Goals,**
  - **Green Deal**
  - and other relevant challenges.

Our Offer:

- NewSkin combines:
  - Unique pilot scale **prototyping facilities** and **testing facilities**,
  - Route to Market Services.

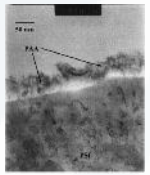
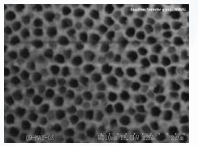
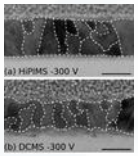
Relevant applications;

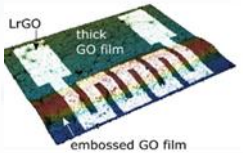
- To reduce **components working in dynamic conditions** friction losses, wear and vibrations.
- For the **mass production of textured and coated elements** (plastic, ceramic, metals) including the continuous **production of advanced surfaces on metal coils**: hard ice, erosion and corrosion strips for wings and blades, textured surfaces for improved hydrodynamics, combination of functional surfaces and large surface area textures for, energy efficiency, energy storage, renewable energy and others.
- **Nano-safe and automated application** facilities for **nano-enabled coatings** including a set of key testing facilities to demonstrate the superior performance of nano-coatings in **extreme conditions**.
- Scaling up and testing facilities for **gas/water permeation media**: improved selectivity, anti-fouling, anti-microbial, mono-atomic graphene membranes, GO including pore and functional layer creation.
- A **miscellaneous of functional layers**; textures and coatings to enhance including, optical, medical, electronics, heat exchange , barrier for packaging and other functional applications.





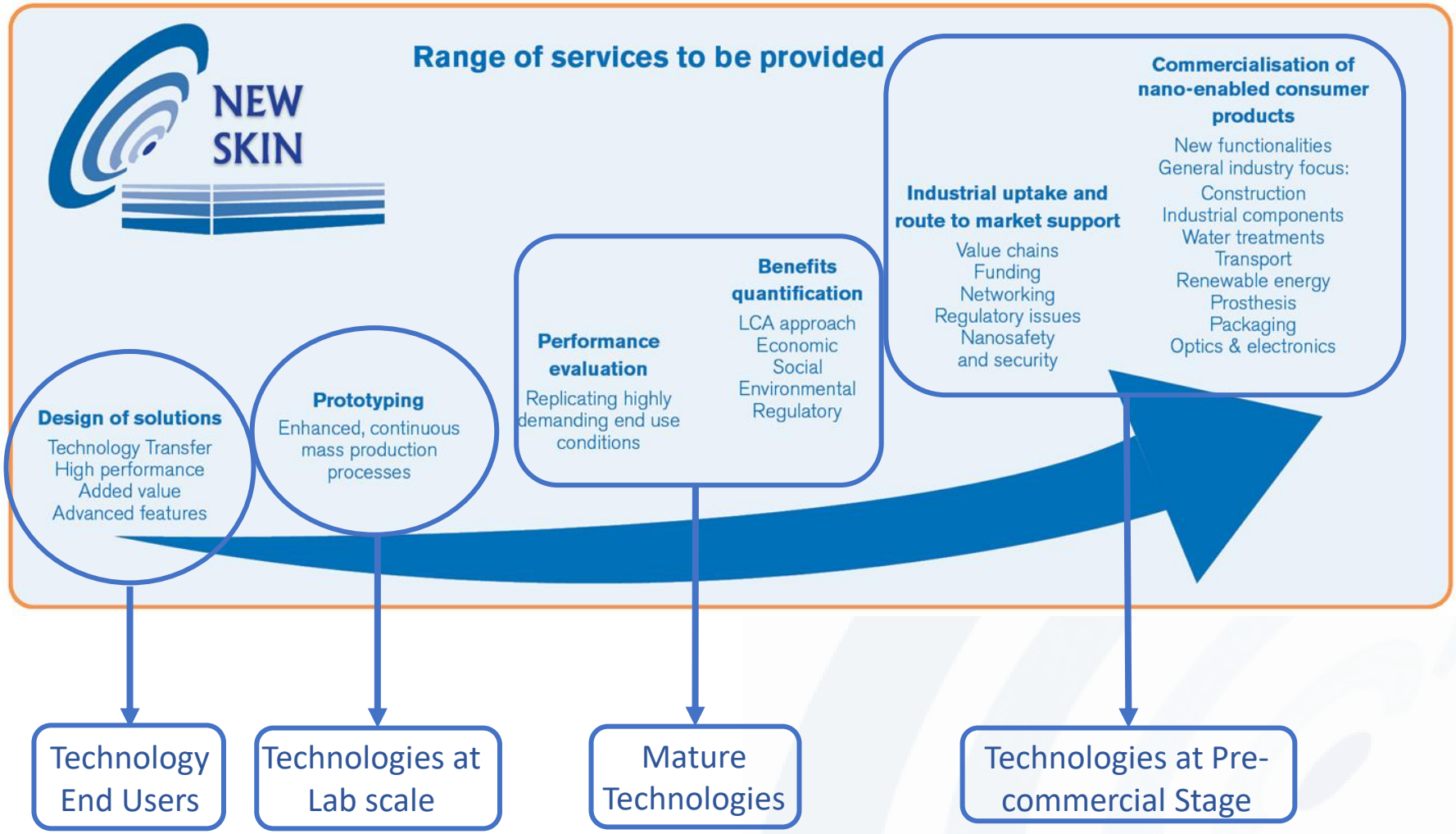




NewSkin OITB Offer

- **NewSkin** offers services a 360º services portfolio to the Innovation Ecosystem.



Facilities and Value Propositions

1. Mass Production of high performance and functional surfaces

Continuous Production advanced functional layers:

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.

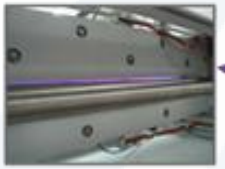
- **Available technologies:**
- CVD.




- HiPIMS.



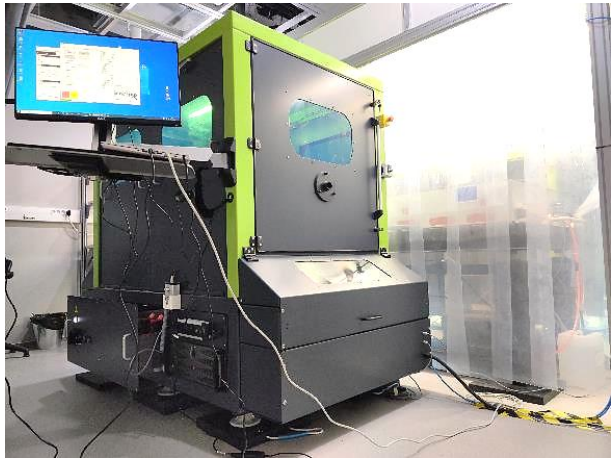
- APGD and Coating.

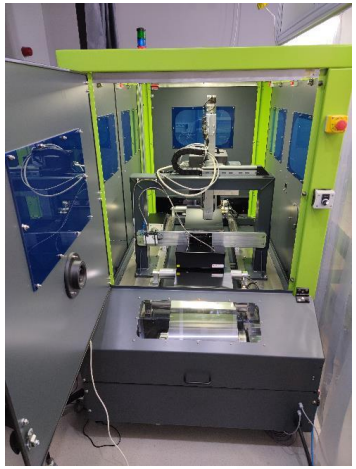



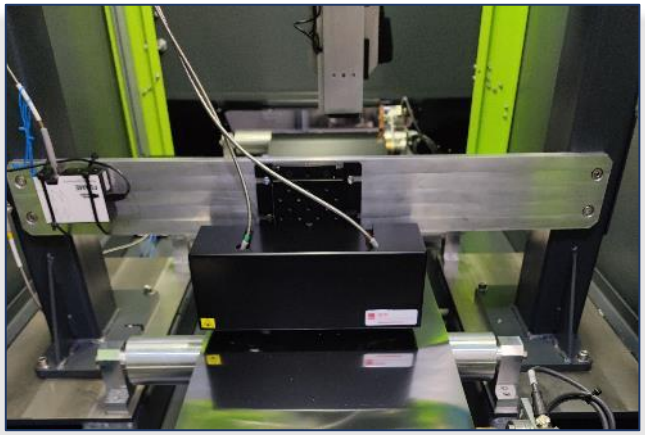

- Laser processes & Thermal Imprinting


R2R Laser Processes

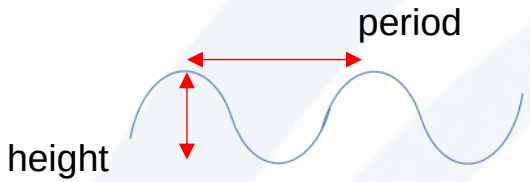
R2R laser Machine:







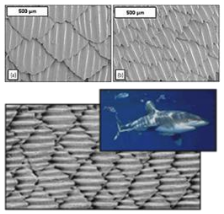
In-line Production monitoring



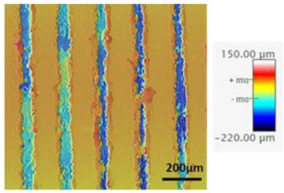
Nano-Ripples

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

R2R Laser Texturing of Components:

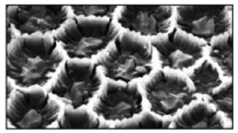


Hydrodynamics

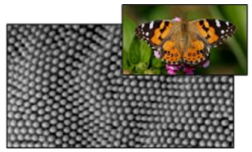


Heat Exchange

Anti-ice

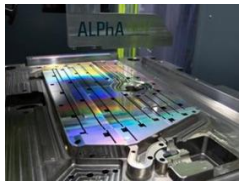


Kongo-Rose Bug (*Pachnoda marginata*)

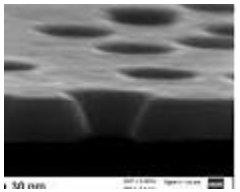


Butterfly(*Vanessa kershawi*)

Biomimetics; optical, antifouling, easy to clean ….



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

HiPMS Available Facilities and Services.

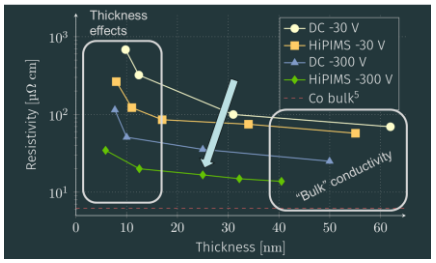
Metal strips and sheets

Roll-to-roll on foils

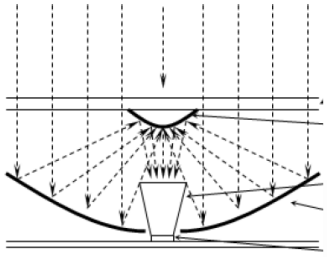
Complex bulky components

- **Hi**gh **P**ower **I**mpulse **M**agnetron **S**puttering **:**
  - PVD Best Available Technology
  - Large fraction of the sputtered material ionized
  - 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 TiO_2 on polymers.
    - Nano-conformable oxides.
    - Highly conductive metal layers.
    - Tribological and wear protection.

Portfolio of Available Coatings.

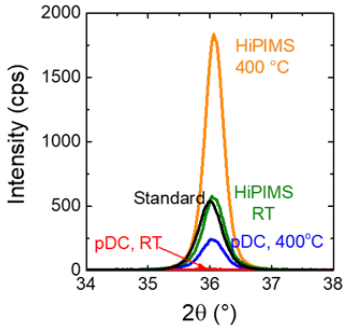


- Resistivity reduced, huge improvement at lower thickness!
- Increases density, grain size and affect nucleation



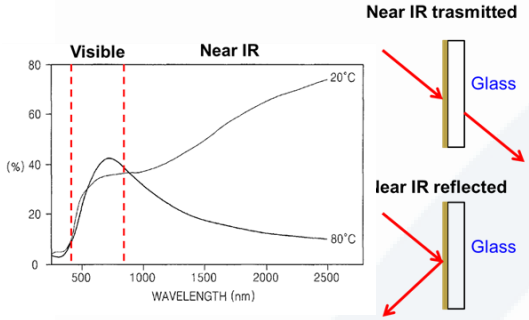
- Primary optics in high concentration photovoltaic (HCPV) systems.

Metallization: Co on SiO2.



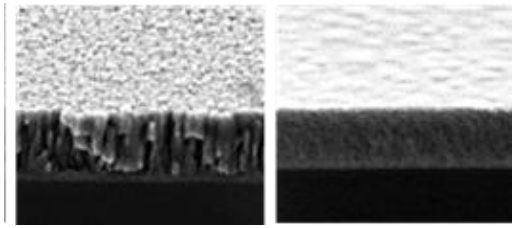
- HiPIMS films at RT comparable with the optimized reference process at 400°C

Reflective Multilayer coatings for Surface mirrors.



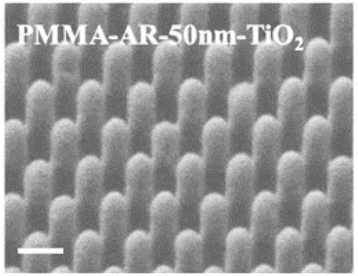
- Low Temperature Synthesis.
- Self-tunable IR filter
- Smart windows and switching applications
- Energy saving.

Piezo-electric AlN coatings



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

Thermochromic VO_2 Thin Films

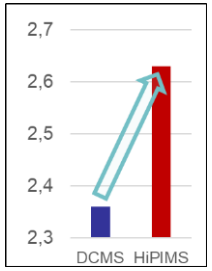


- Antireflective nanosctructure. coated with TiO2
- Stability from ~100°C to 250°C
- Improved scratch resistance and surface hardness
- Superhydrophylic WCA ~4°

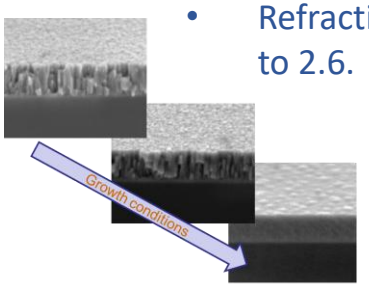
Self-cleaning Low Temperature TiO_2

TiO_2 on nano-structured polymers.

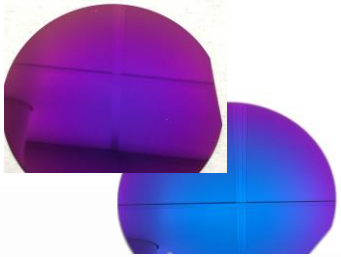
Portfolio of Available Coatings.



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

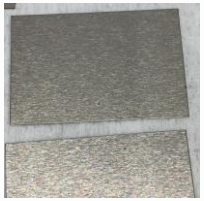


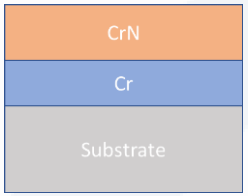
Optical Coating TiO2.



- HfO_2 IR transparent - suitable for IR optics.
- Hydrophobic, hard and transparent.
- Improved transparency and resistance.

HfO_2 for optical elements





- For Al Fuel Cell Plates
- Under development.

Corrosion resistant, electrically conducting CrN:

Others:

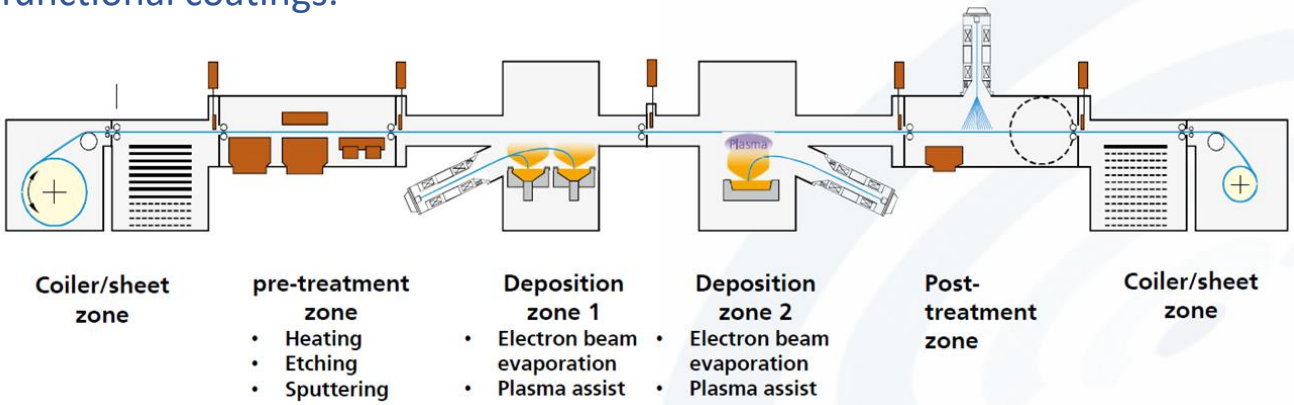
- Layers for solar absorption CrC, a-C:H, C:H-Ti.
- Electric contact layers Cu, Al, Sn, Mo
- High-temperature functional layers YSZ
- Photovoltaic absorption layers CI(G)S, CdTe, Si
- Special functional layers Al, Cu, Sn,
- Transparent conductive oxides: ITO, ZnO, NiO ,

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.

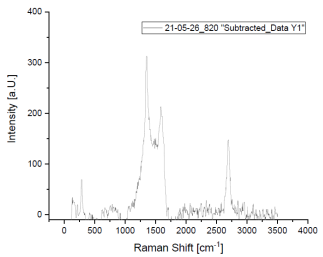
- Cost effective mass
- Production process
- High Production rate



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

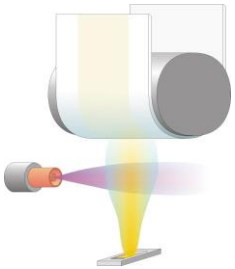
- Double Side coating, 5 coating stations
- Evaporation, sputtering and PECVD
- Packaging bio-based and functional.

Portfolio of Available Coatings.



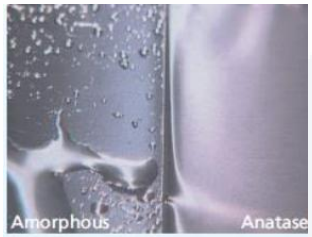
- Filtering media for gas and water.
- Continuous process.
- Later Nano-pore creation

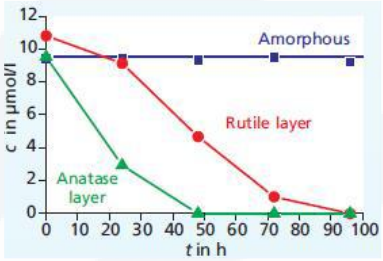
Graphene on Cu continuous process



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

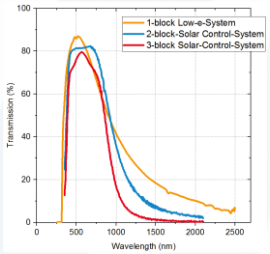
Si-C Coating





Photocatalityc TiO_2 on metal strips

Corrosion protective layers



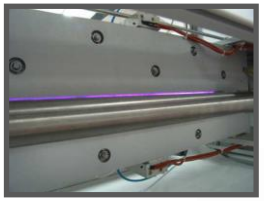
Low-e /solar control coating

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

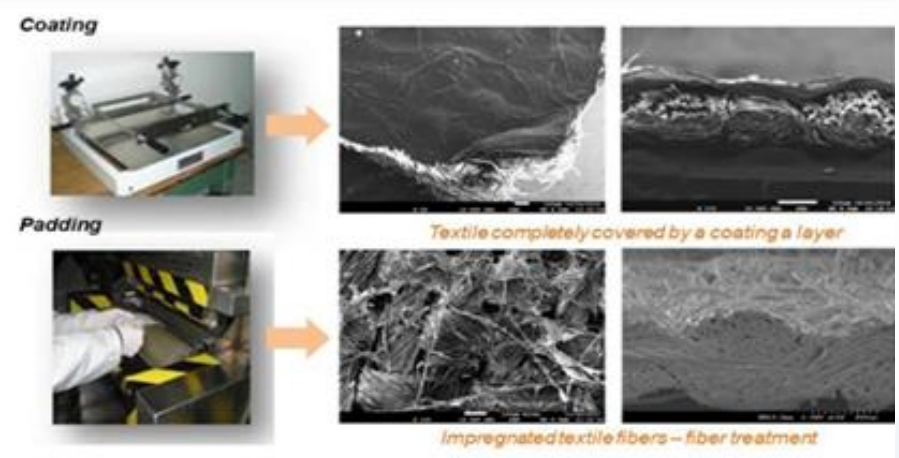
Surface activation

Functionalized surface

Surface grafting induced by plasma
R: functional moiety

Plasma polymerization (PECVD)

Plasma polymerized nanocoating



Finishing

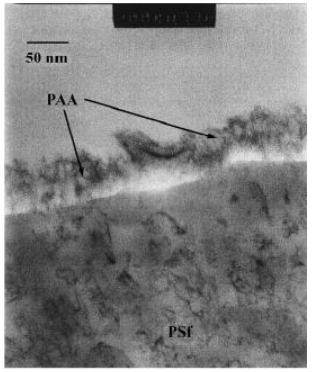
No drying and curing extra processing

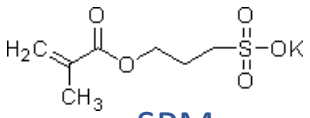
No generation of wastewaters

Very low or null consumption of chemical

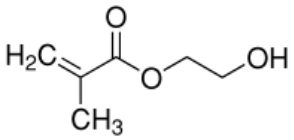
No water consumption

- **Atmospheric Pressure Glow Discharge (APGD) system and surface finishing:**



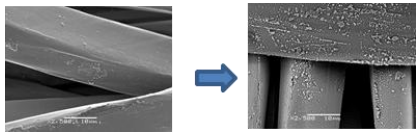


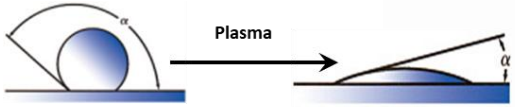
SPM

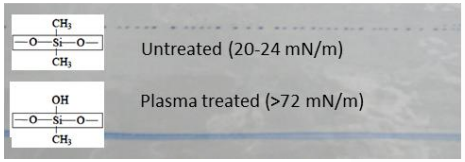


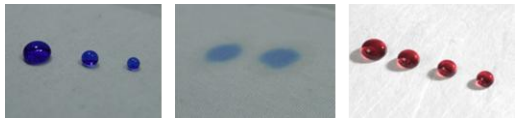
HEMA

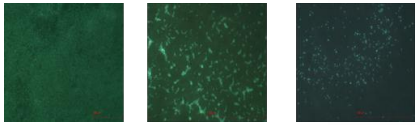
- Membrane finishing to increase:
  - Selectivity
  - Microbial and Fouling resistance.
  - Superhydrophillic and superhydrophobic.



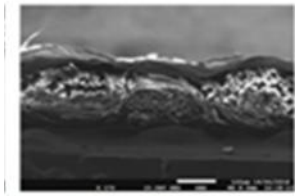


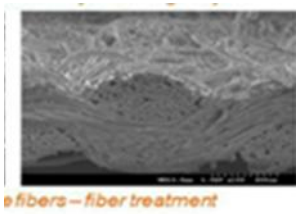


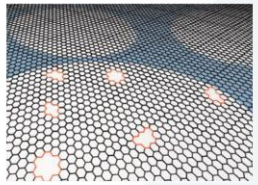




Antimicrobial surfaces



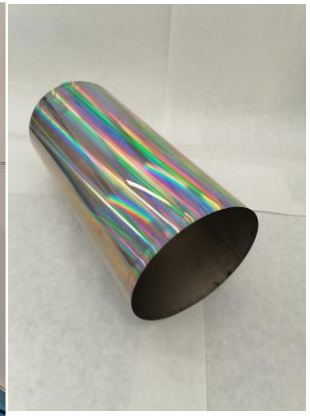


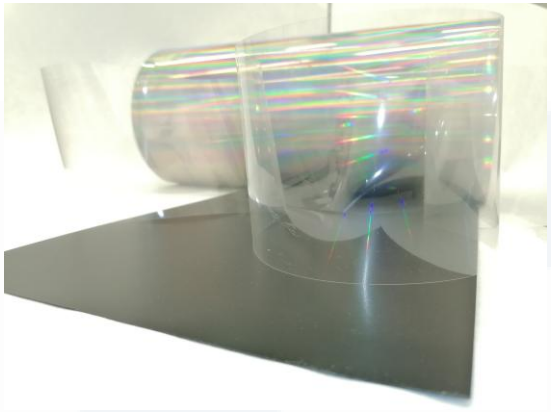


- Improved wear resistance.
- Surface activation for finishing.
- Nano-particles coating;
  - GO.
  - Graphene, CNT
  - Nano SiO_2 and others.
  - Nano-cellulose and others
- Pore creation on graphene.

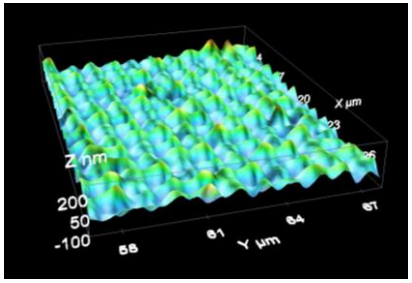
R2R Thermal Imprinting processes.

Upgraded R2R machine with 300 mm rolls

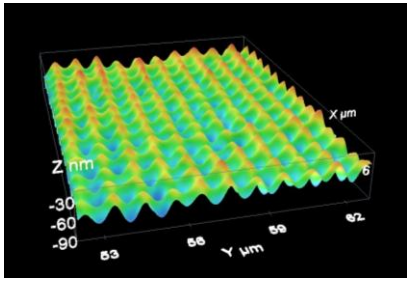




Cylinder texture



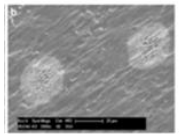
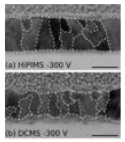
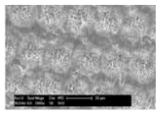
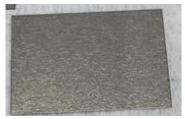
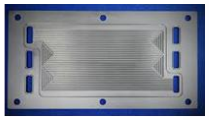
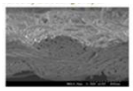
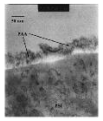
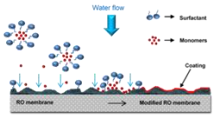
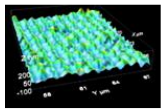
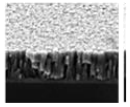
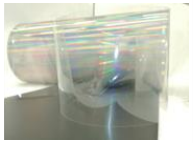
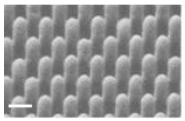
Replica

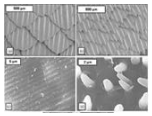
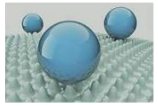
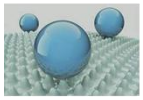
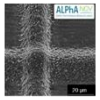
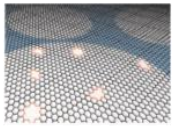
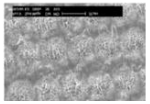
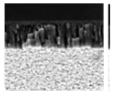
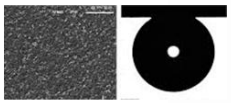
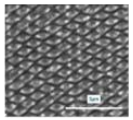
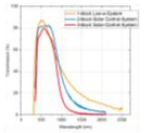


Texture transfer in a roll to roll process by means of a hot cylinder.

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

Inter-operability

  	**Current Collector:** • Wettability + Conductivity. • Reduction of interface resistance. • Increased capacity after cycling
  	**Fuel Cell:** • Improved contact + Conductive Corrosion layer. • Increased corrosion resistance • Increased interface conductivity.
  	**Selective/Antifouling membrane** • Nano structure + Plasma polymerization Increased selectivity for B and others. • Increased resistance to fouiling and aggresive media.
  	**Antibacterial surfaces and packaging:** • Antireflective • Antiviral, bacterial and moulds. • Hydrophillic. • Wear and Tº resistant.
  	**Easy to clean CO2 reducing façade:** • Active Surface + TiO2. • Increased corrosion resistance • Easy to clean • CO2 mitigation

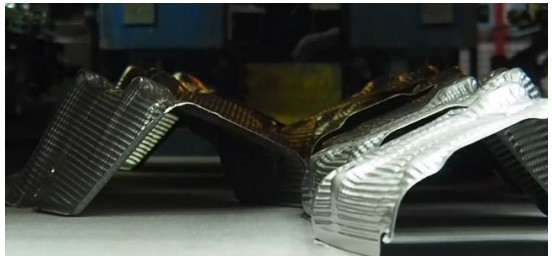
  	**Hulls:** • Drag texturing + Hydrophobic. • Polymer free corrosion resistance. • Improved drag Chemical-free Antifouling
   	**Anti-ice wings and lead erosion resistant blades:** • Anti-ice + Hard Hydrophobic. • Ice prevention on wings. • Cold climate wind energy. • Leading edge erosion resistant • Improved aero dyanamics
  	**High Permeability membrane:** • Graphene layer+ Nanopores. • High permeability media. • Membrane distillation. MF, UF, NF, RO.
  	**Antifouling photocatalytic membrane:** • Active Surface + TiO2. • Self cleaning. • Super-oelophobicity. • Controlled structures.
  	**Energy Efficient Façade:** • Active Surface + e-coating. • Energy efficient envelopes. • Heat reflection properties.

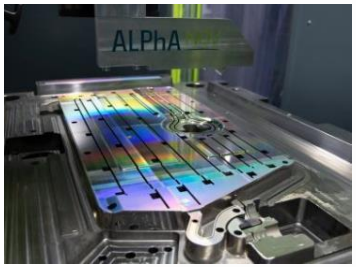
From the coil to a product

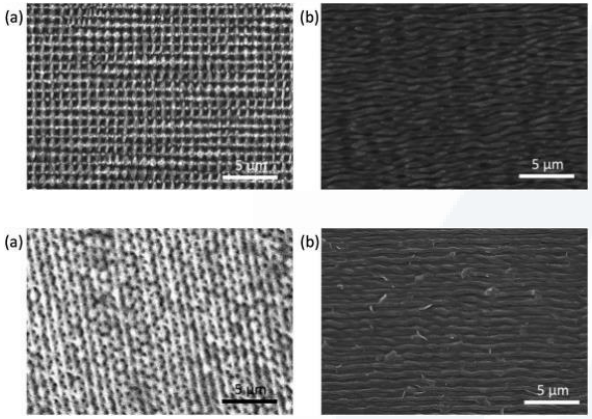
FORMING

MOLDING

LAMINATION



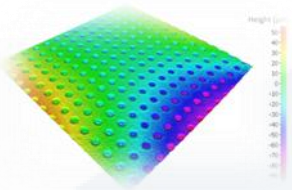




2. High performance functional surfaces and coatings for components.

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 occasioned by vibrations**.

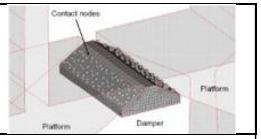
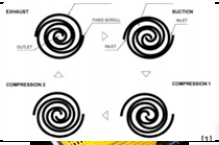
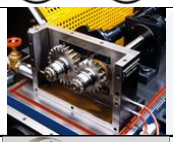
- The range of **coating technologies** includes:
  - Thin film deposition.
  - Sol-gel.
  - Ceramic coatings
  - Polymeric coatings

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.

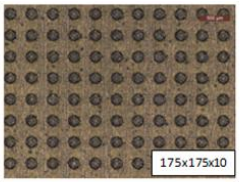
Textures and Coatings in Applications

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 . **Potential extension to other materials**; CIM, MIM and composites.	 

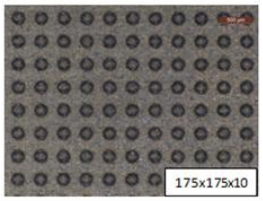
Texturing During Moulding

Texturing During Moulding Processes

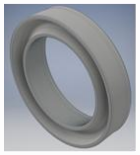
- **Transfer of textures** to polymeric components **during the molding process.**
- **Mass production** process that has been developed to **industrial scale.**
- **Design tools and test rigs** have been developed:
  - Design
  - Demolding
  - Manufacturing processes.
- **Strong effect on equipment efficiency:**
  - Reducing lubricant leakages.
  - Friction losses and
  - 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

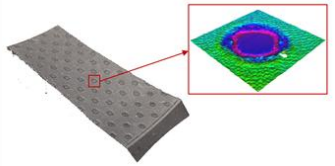


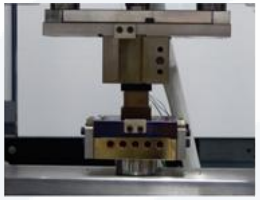
Textured Metal Plate

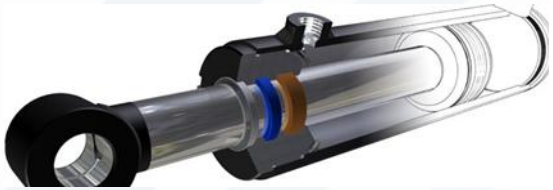


Textured Rubber Sample





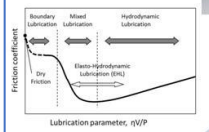


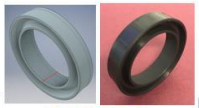


• Holistic Design Software (HDS) for texture patterns for rubber seals

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

Friction modelling → Mouldtex Optimizer





Experiments with real seals

Data obtention

Data analysis

ROM predictive tool

Mouldtex Optimizer → Friction reduction

Simple platform, built in ROMs and optimization algorithms, with user friendly visualization techniques. In terms of friction reduction, it allows the end user to:

- Obtain real-time friction reduction prediction for a given set of parameters.
- Obtain optimum combination of parameters to maximize friction reduction.

Numerical friction models

Data analysis based on **Reduced Order Modelling (ROM)**

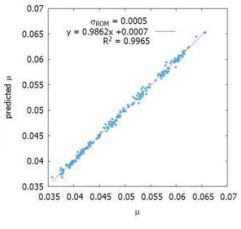
$$F(x_1^{in},\dots,x_n^{in}) = \alpha_1 f_1^1(x_1^{in})\dots f_n^1(x_n^{in}) + \dots + \alpha_m f_1^m(x_1^{in})\dots f_n^m(x_n^{in})$$

Friction specifications and requirements

- Seal application, material, hardness and geometry
- Geometrical parameters: Diameter – Distance – Depth
- Operational conditions: Pressure – Velocity

The main term can be seen as the **first approximation** of the system, being the other ones next **corrective terms** (with lower α coefficients).

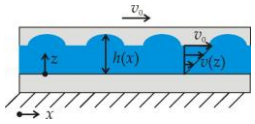
$$F(x) = \sum_{i=1}^{T} \alpha_i \prod_{k=1}^{D} F_i^k(x_k)$$

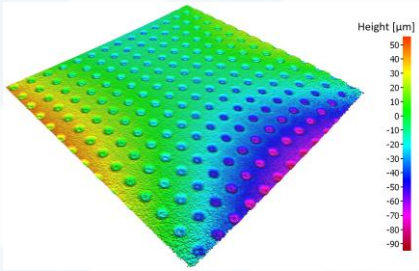


$$\Delta\mu = \alpha_1 f(d) f(\emptyset) + \alpha_2 f(d) f(\emptyset) + \alpha_3 f(d) f(\emptyset) + \alpha_4 f(d) f(\emptyset) + \alpha_5 f(d) f(\emptyset)$$

Effects of surface texturing:

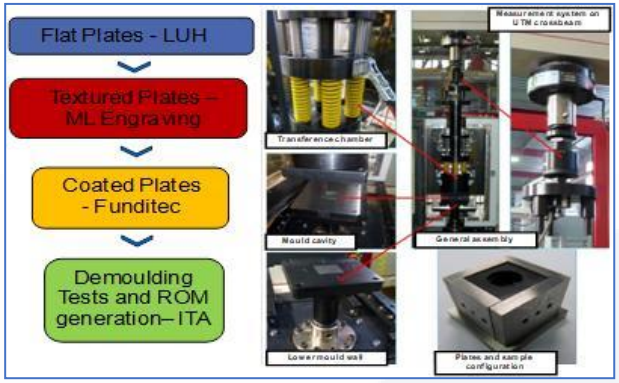
- Contact area reduction
  - Reduction of real contact area → Reduction of dry friction
- Viscous friction reduction
- Friction reduction due to higher fluid film
- Lubricant storage
  - Dimples can store lubricant
- Wear particle storage
  - Dimples can store wear particles

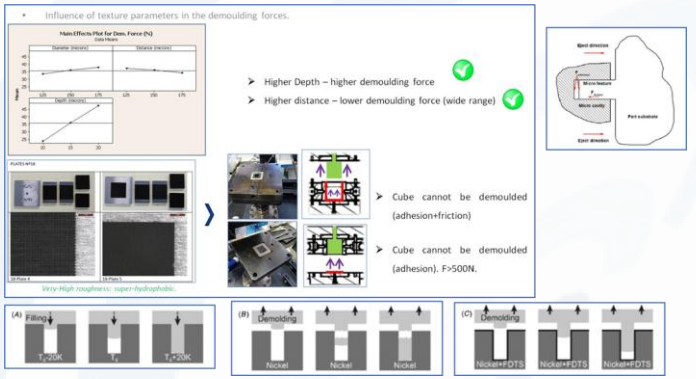




Production of surface textured seals :

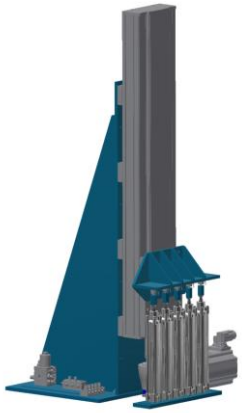
- Texturing during moulding Production → It's necessary to test in the laboratory if there is a correct transfer (small and cheap mould).
- Due to texturing of the metallic mould, demoulding forces always increase due to adhesion + friction (sometimes one order of magnitude depending on the geometry 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 create a super-adhesion between rubber and metal plates.

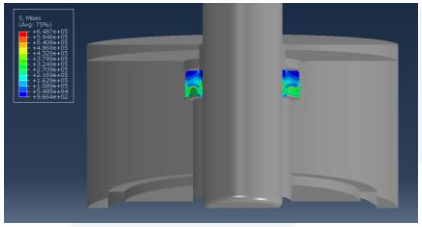




Selection of optimal surface textures:

- 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.





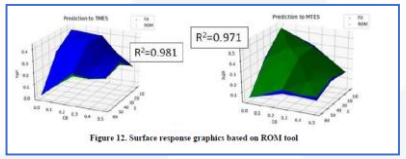
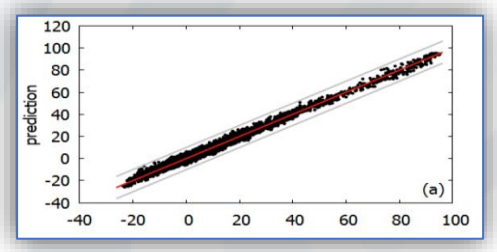
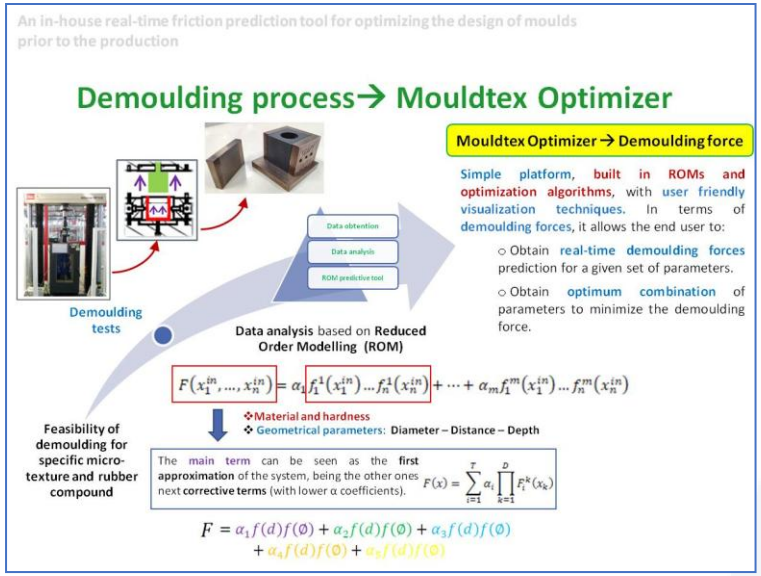


Figure 12. Surface response graphics based on ROM tool

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

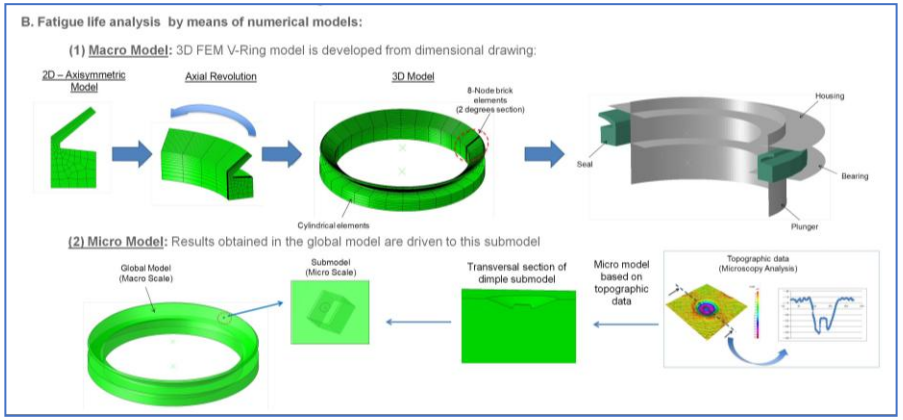
Prediction of demoulding forces.

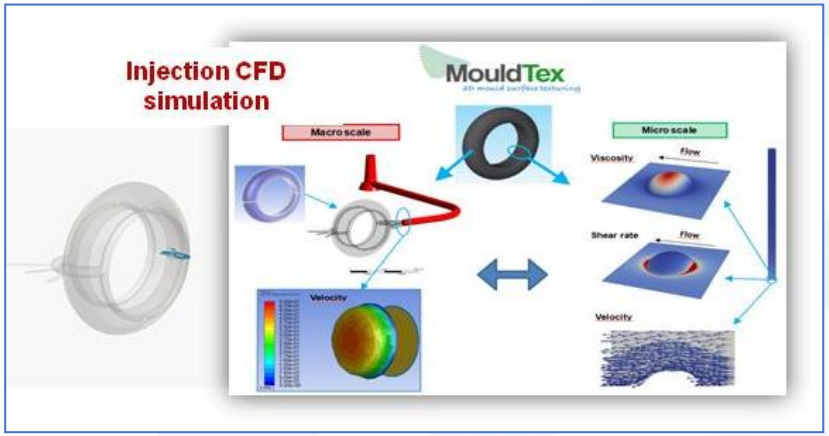


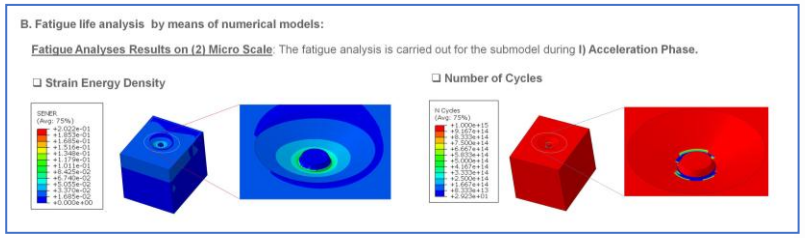


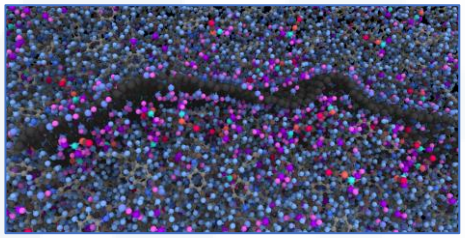
Selection of optimal surface textures:

- 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.





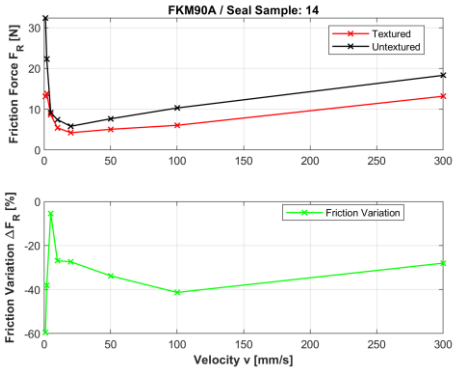




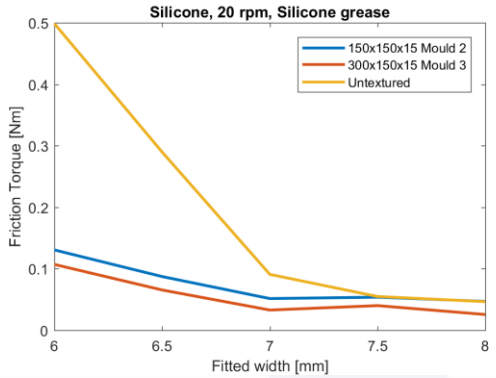
Fatigue estimation of durability (cycles). Analysis of the microtexture (Abaqus).

Mass production Functional and High Performance Surfaces: TDM Processes

- **Reciprocating rod seal:**
  - 60% initial friction reduction
  - 25 to 45% friction reduction depending on dynamics.

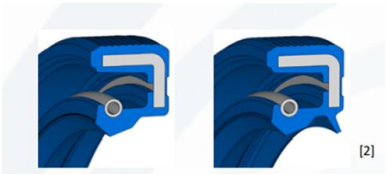


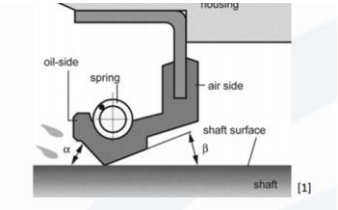
- **Rotating V-Ring seal :**
  - Dimple diameter: 150/300 µm
  - Dimple distance: 150/150 µm
  - Dimple depth: 15/15 µm



- **Radial Shaft and wipe seal:**

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





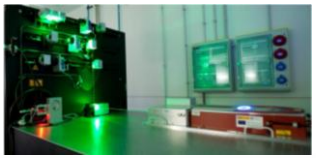
- **Polypropylene Handles and grips:**

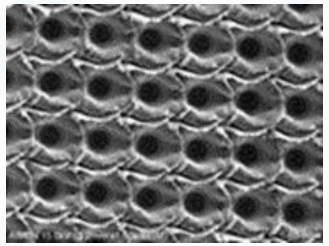
Polypropylene handles and grips for sports equipment and hand tools with antiscratch surface texture. Service life extension >100%.

Direct Laser Texturing

Direct Texturing of Components for Automotive and Industrial Components:

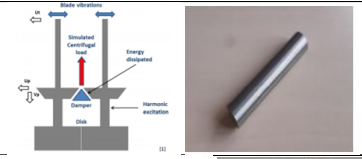
- Textures are directly created on the surfaces by different laser sources in a batch to batch process.
- The selection of laser sources will be conducted according to the following criteria:
  - Component shape and dimensions.
  - Requested precision
  - Textures to be created.
  - Productivity and 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:

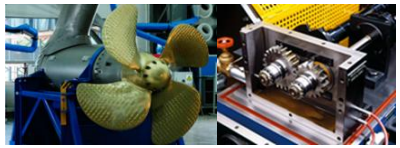
Retrofit under platform damper:
- Vibration attenuation.
- Efficiency gain over 0.25% in gas and steam turbines.



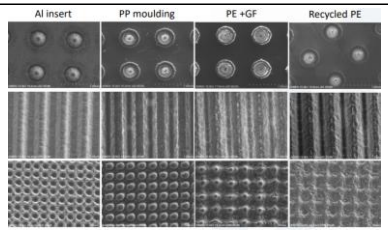
Shaft/Bearing in electric cars:
- Friction torque reduction of 15%.

Piston:
- Compressing gas in air conditioning compressors
- Friction reduction of 10% and extended service life of 20%

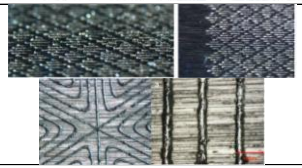
Components in maritime engines and centrifugal pumps:
- Propeller and nozzle system:
  - Anti-fouling,
  - Cavitation prevention
  - Improved drag texture.
  - Improved fuel efficiency.



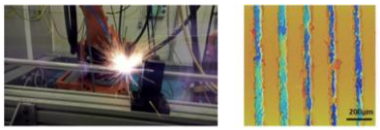
Mould fabrication and Thermal Imprinting cylinders and foils manufacturing:
- Tribological textures.
- Increased hydrodynamic and aerodynamic performance.
- Easy to clean textures.
- Vibrations mitigation.
- Heat transfer.
- Grip surfaces.



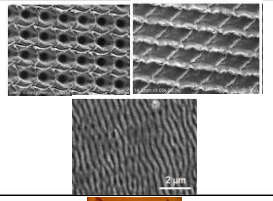
Surface texturing by a laser micro-cladding process:
- Shark-skin textures for transport and hydrodynamics applications.
- Tribological applications.



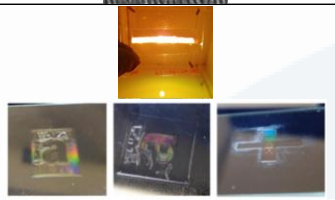
Heat Exchange improving laser induced textured surfaces:
- Patterned structures on the outer surface of pipelines increases the efficiency of heat exchange processes.
- More efficient heat exchange process.
- Up to 2 m long and 25 mm diameter



Bio-compatible laser induced textured surfaces:
- Favour cell growth or osteointegration (prosthetic or dental medical implants).
- Patterning in complex pieces, as implants.
- Antibacterial, osteointegration and low rejection implants

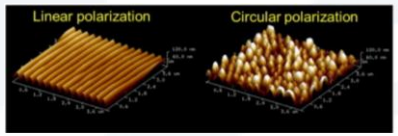


Optical laser induced textured surfaces:
- Laser tailored reflectivity, colour, or transparency
- Gratings, modified reflectivity, transparency, and colour change.
- Food industry (marking), solar cells (absorption and light coupling), lighting and Automotive industry

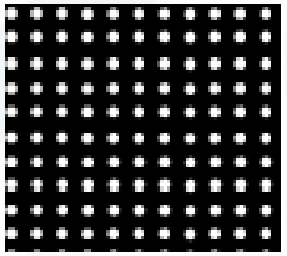


Ultra-short laser processing of graphene oxide:
- Efficient modification its electrical properties
- Alternative for doping processes.
- Fabrication of doped of Graphene oxide
- Sensors and nanoelectronics

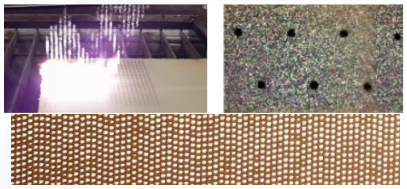
Femtosecond Laser Structuring
- Laser Induced Periodic Surface Structuring (LIPSS). Nanoscale (<1µm)
- Silicon wafers semiconductors and dielectrics
- Ripples/Pillar with high periodicity.



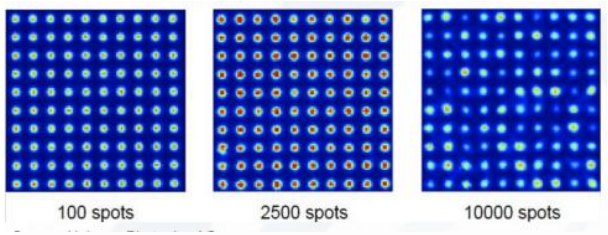
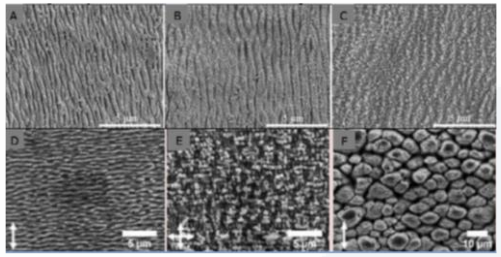
Lightguide 2PP precision fast fabrication (Diffractive Optic Elements):
- Tailored beam distribution intensities DOEs.
- Periodic arrays DOE
- Fabrication area: up to 100x100 mm2, depending on the desired topography.
- Up to 5 cm2 /min depending on the desired topography (>30h with single beam)



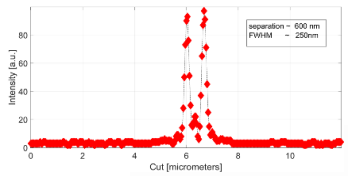
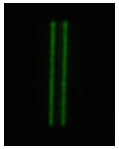
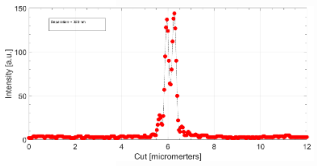
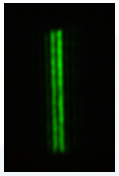
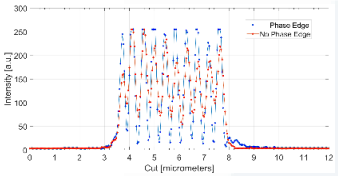
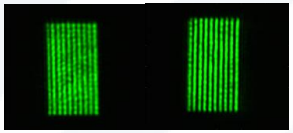
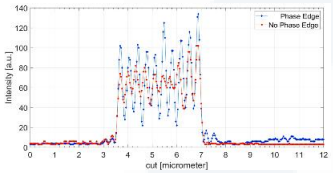
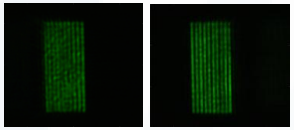
Surfaces Drilling (I):
- High precision drilling of metals, composites, glass, ceramics. Holes and blind holes, controlled depth and diameter (entrance and exit)
- Example1: Mean diameter: 65 microns Metallic sample. 0.8mm thick High productivity – 300 holes per second.



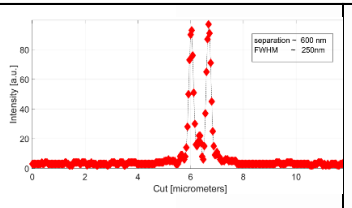
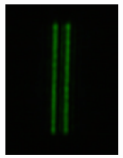
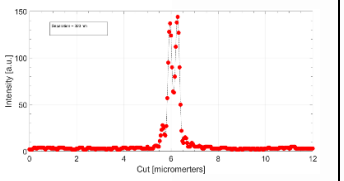
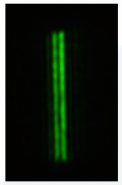
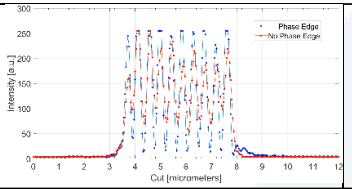
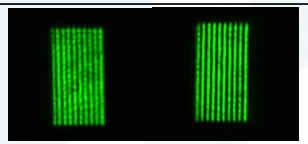
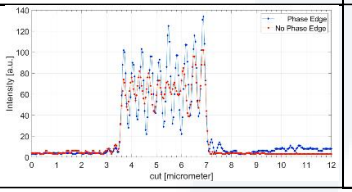
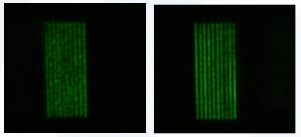
Direct Texturing of Components:

Surfaces Drilling (II): • Parallel processing for rapid large area drilling or surface texturing. • Large-area upscaling using Selective Light Modulation • Resolution: 1920 x 1080 Pixel Pitch: 8.0 µm Fill Factor: 93 %	
Surface Drilling (III): • Nano-channel induction in the 2D materials by mean of LIPSS. • Membrane distillation media. • Micro, nano and ultrafiltration media. • Minimum pressure drop in filtration operations.	

Sub-micrometric patterns::

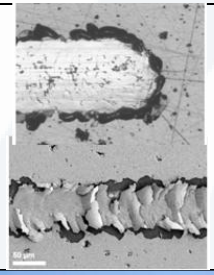
• Direct amplitude projection: 2 lines: width 100nm, separation 600nm • Image size 12 x 12 µm • RESOLUTION: 250 nm • Separation: 600 nm		
• Direct amplitude and phase projection: • 2 lines: width 100nm, separation 320nm, distance 220nm, • PI phase shift among the lines for destructive interference in the overlap • Lines are resolved: distance 220 nm ~ on the limit with 50% contrast		
SLM in the focal plane: 10 lines (effect of the phase edge)		
• 10 lines: width 100nm, separation 450nm • Image size 12 x 12 µm, • Above: No Phase Edge; below: Phase edge		
• 10 lines: separation 350nm (distance 250 nm) • Image size 12 x 12 µm, • Above: No Phase Edge; below: Phase edge.		

Sub-micrometric patterns::

• Direct amplitude and phase generation with relevance • Image size ~ 23 x 27 µm • Dots, squares, lines.		
• Direct amplitude projection: 2 lines: width 100nm, separation 600nm • Image size 12 x 12 µm • RESOLUTION: 250 nm • Separation: 600 nm		
• Direct amplitude and phase projection: • 2 lines: width 100nm, separation 320nm, distance 220nm, • PI phase shift among the lines for destructive interference in the overlap • Lines are resolved: distance 220 nm ~ on the limit with 50% contrast		
SLM in the focal plane: 10 lines (effect of the phase edge)		
• 10 lines: width 100nm, separation 450nm • Image size 12 x 12 µm, • Above: No Phase Edge; below: Phase edge		
• 10 lines: separation 350nm (distance 250 nm) • Image size 12 x 12 µm, • Above: No Phase Edge; below: Phase edge.		

Coatings

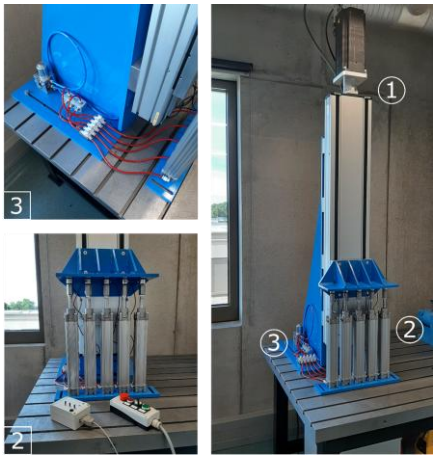
Portfolio of Available Coatings.

DLC-Cr coating deposited by PVD: • Tribological applications • Substrate materials: metals, alloys, ceramics… Target end-users: automotive components, cutting tools…	
CrAlN based coating: • Increased wear resistance • Oxidation resistance: • 650ºC 100% steam • Up to 850ºC in air.	 
MoSx-WC based coating: • Low friction coefficient at vacuum and cryogenic conditions. • 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.	

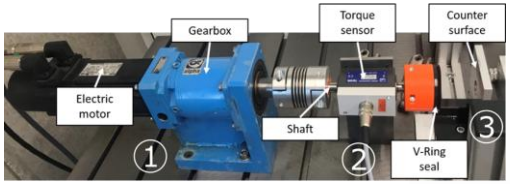
Testing Facilities

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

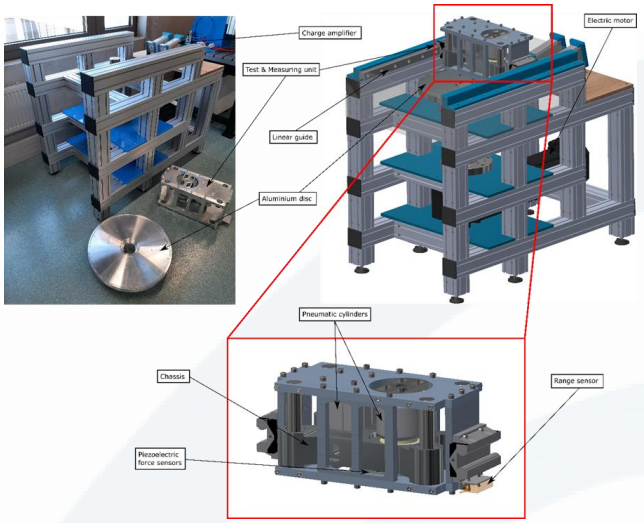
- **Longitudinal test-rig:**



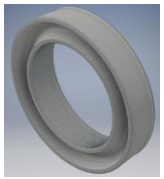
- **Rotational test-rig**



- **Test rig for the evaluation of contact surfaces in general**

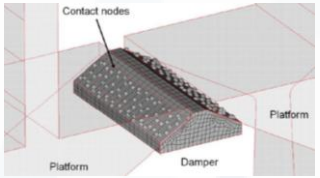


- Pneumatic seals
- Hydraulic seals
- Pistons



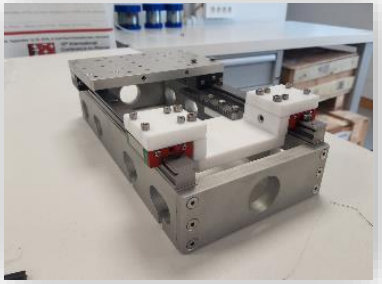
- Roller bearings.
- Radial shaft seals.
- V-Ring seals.

- Under platform damper



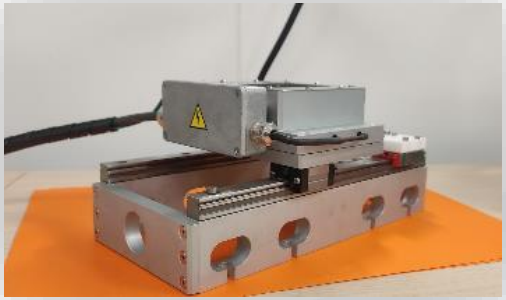
High and low Temperature and Pressure and Tribometer:

A.Wear Measurement



B. Static COF

C. Plane vs plane contact mode



D. Tribo-tests at high temperature in the reciprocating configuration

MICROTEST tribometer, capable to perform test under different configurations (pin-on-disc, reciprocating) under different atmospheres (controlled humidity, vacuum), in lubricating conditions and under temperature up to 650ºC (on the contact).

- Atmosphere: the tribometer has humidity control, making it possible to carry out the tests at a relative humidity of between 10 and 90%HR.
- Configuration: it is possible to modify the relative movement type between sample and counterpart and perform the tests in two configurations: pin-on-disc and reciprocating.
- Contact modes: ball-on-plate, plate-on-plate, cylinder-on-plate and cylinder-on-cylinder.
- Counterparts: at all the contact modes, different counterparts available: e.g balls or pin (6 mm, 10 mm, others).
- Load: the load applied during the tests can be up to 60N.
- Speed: the maximum speed of the tribo-tests is 500 rpm.
- Temperature: the temperature of the tests can be modified from RT to 850ºC environment (650ºC on contact).
- Lubrication: it is possible to perform test with sprayed lubrication or immersed.
- Parameters recorded: Dynamic friction coefficient (COF), and electrical contact resistance (ECR) during the tests.
- Wear on specimens is measured by optical microscopy and contact profilometry after the tests are performed.

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)

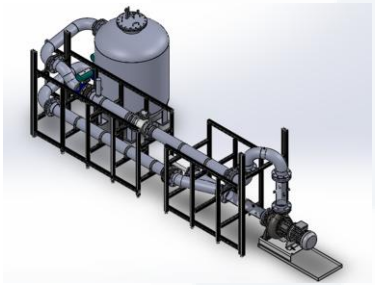
(d)

(c)

(e)

(f)

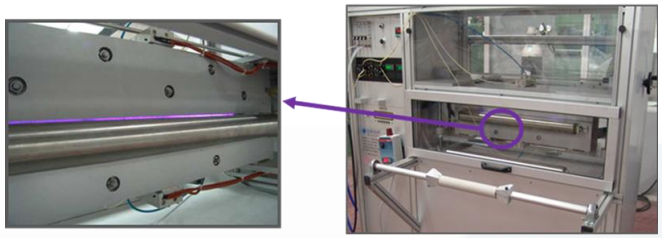
(g)



3. Nano-enabled Surfaces and Membranes for the Water Treatment Industry

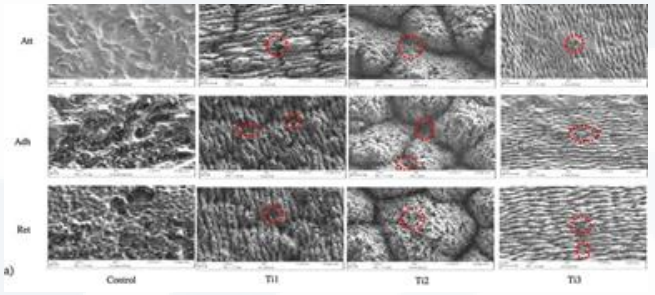
Membranes Texturing and Coating for Improved Selectivity and Fouling Resistance

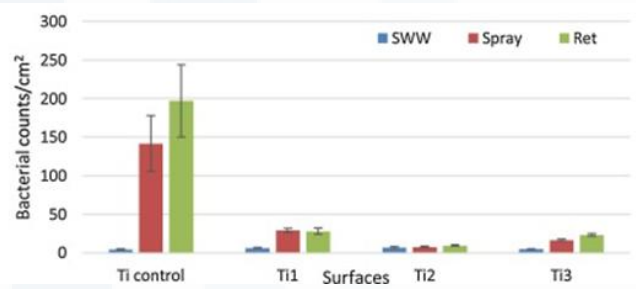
- NewSkin will bring laser processes and APGD processes for membrane surface modification in order to improve selectivity of and fouling resistance of filters and membranes.
- By creating tailored nano-structures on the surface of membranes and filters, microbial and foulant adhesion is prevented.
- 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.



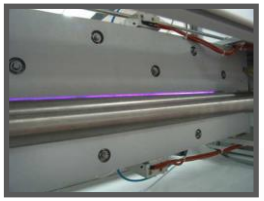
R2R APGD pilot-plant plasma system

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

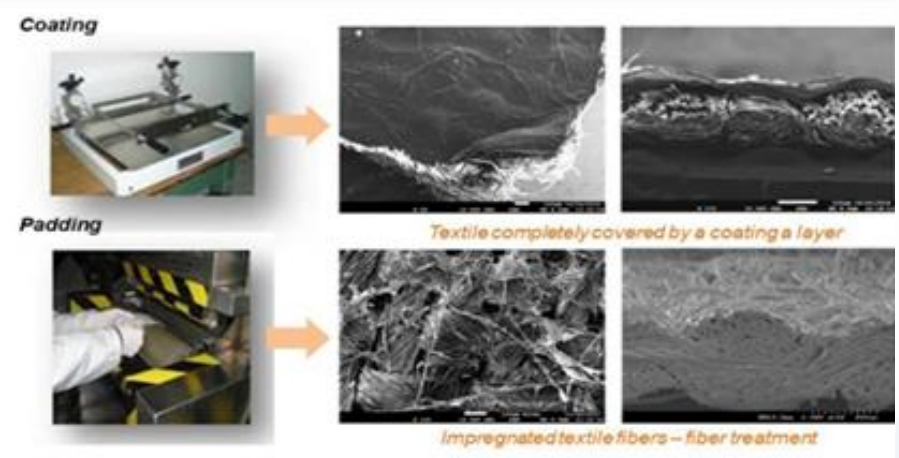
Surface activation

Functionalized surface

Surface grafting induced by plasma
R: functional moiety

Plasma polymerization (PECVD)

Plasma polymerized nanocoating



Finishing

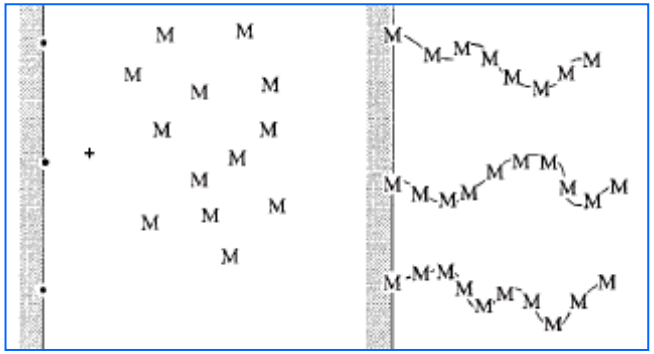
No drying and curing extra processing

No generation of wastewaters

Very low or null consumption of chemical

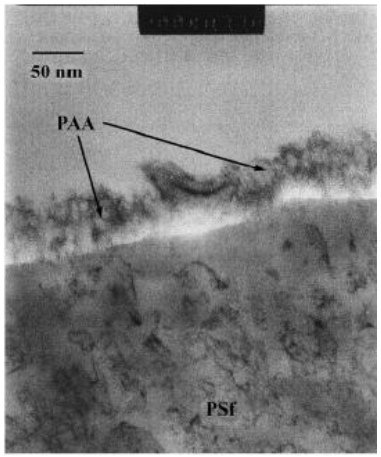
No water consumption

Grafting of polymers on RO membranes to increase selectivity.



$$S_2O_8^{-2} + S_2O_5^{-2} \rightarrow SO_4^{-\bullet} + SO_4^{-2} + S_2O_5^{-\bullet}$$

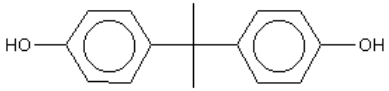
$$SO_4^{-\bullet} + H_2O \rightarrow HSO_4^{-} + HO^{\bullet}$$

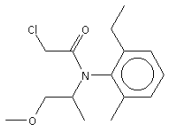


Ben-David et al. *JMS*, 2010

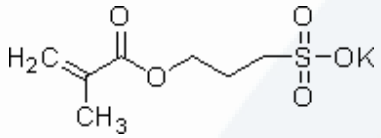
- Fouling mitigation - minimal grafting required
- Tuning selectivity - grafting optimization required

Model Contaminants

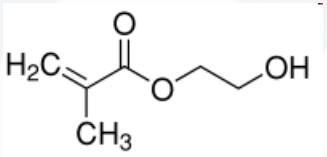




Hydrophilic Monomers



SPM

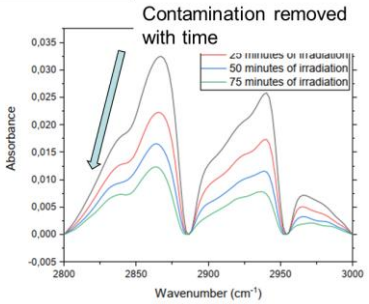


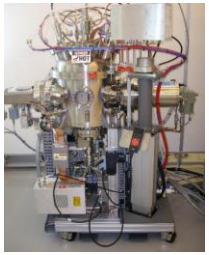
HEMA

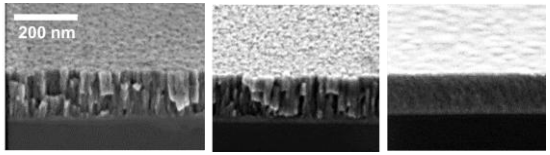
- 5 ppm B in seawater, in permeate it has to be < 0.3 ppm
- B removal represents 15-20% of water cost – a significant motivation to enhance B rejection to >95%
- It is proved very hard and mechanism is not clear

Room Temperature Conformable Ceramic Coatings.

- **Self-cleaning Low Temperature TiO_2:**



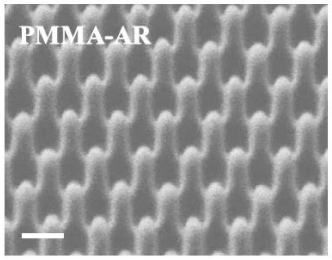




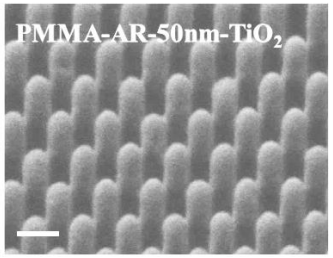
Technique	Temperature	Activity
dcMS	RT	0.2
HiPIMS	RT	0.9
	200°C	2.1

- 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.

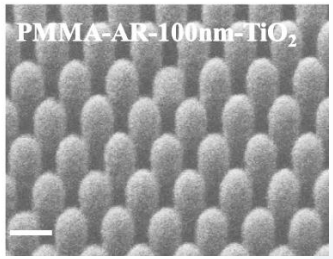
- **TiO_2 on nano-structured polymers:**



Uncoated



Coated, 50 nm TiO_2



Coated, 100 nm TiO_2

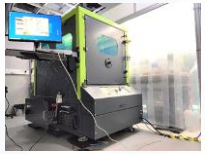
- Nano-conformity
- Stability increase from ~100°C to above 250°C
- Improved scratch resistance
- Enhanced surface hardness
- Superhydrophylic surface after UV illumination. WCA ~4°

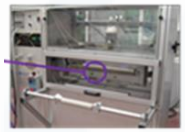
Continuous Production of Monoatomic Graphene Membranes

- 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.**

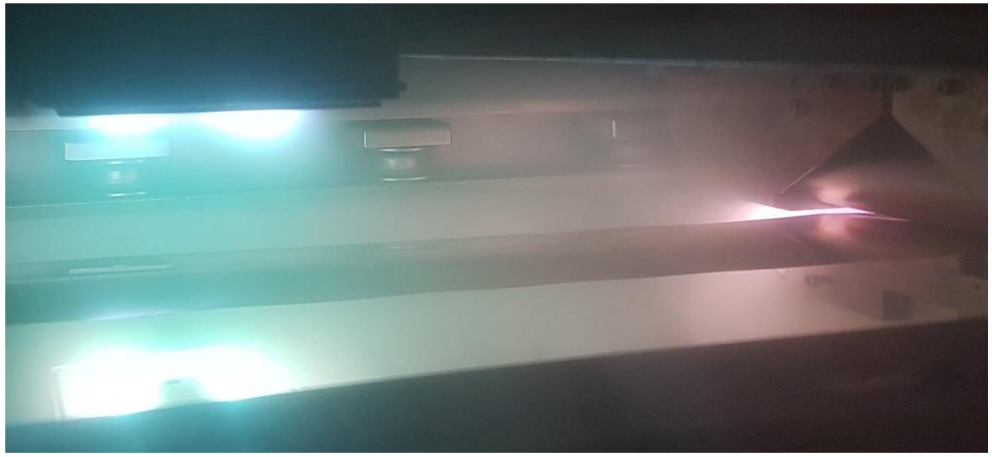
- NewSkin brings the necessary facilities for:
  - The **continuous production of monoatomic graphene** on Cu catalyst supported on stainless steels foils. roll-to-roll vacuum deposition unit MAXI,

  - 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**)

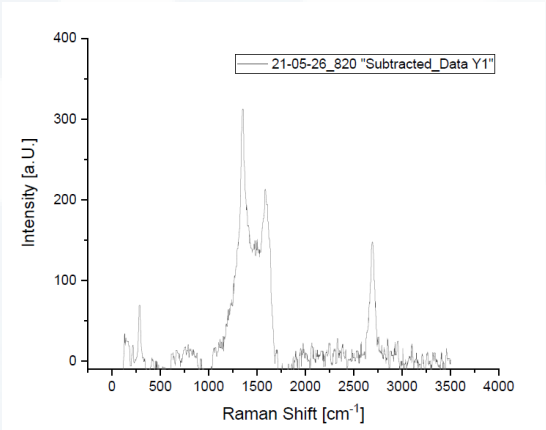




- **Continuous Graphene deposition:**

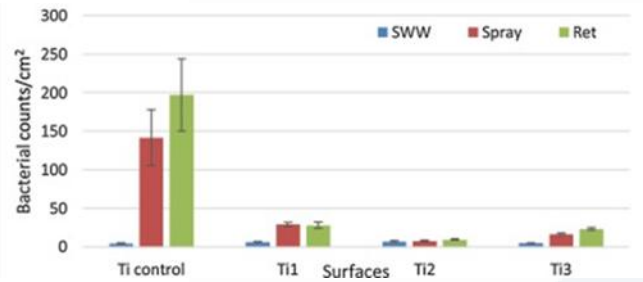


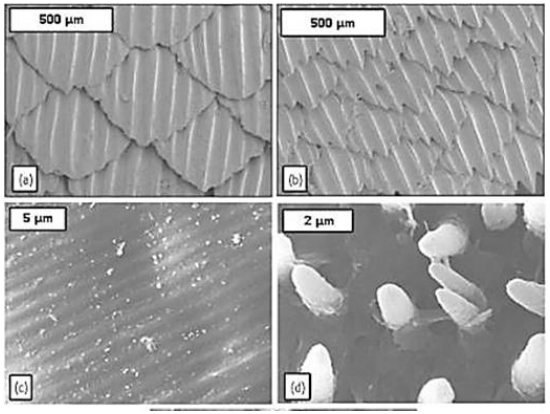
- C-based coatings **PECVD process**:
  - Sputtering of **catalytic Cu-layer**.
  - Magnetic plasma enhanced **PECVD –process + ion beam heating for graphene deposition**.
  - Barrier applications and **membranes for water treatment.**
  - **NF, MD, RO (Controlled Porosity and nano-thickness)**

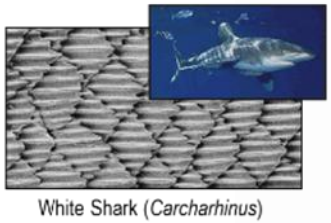


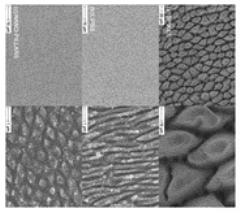
Laser hardening and texturing for performance improvement

- 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**






White Shark (*Carcharhinus*)

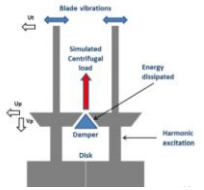


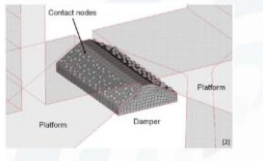
- **Reduced drag.**
- **Reduced fouling.**
- Polymer and chemical free **anti-fouling strategy.**
- Compatible with continuous processes and metal coil manufacturing

Texturing & Coating of Components for pumping and other devices

Retrofit under platform damper:

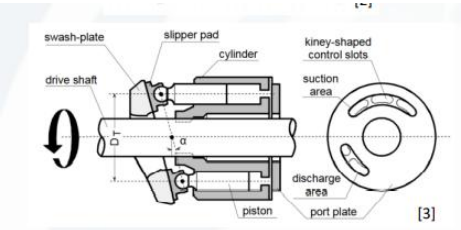
Vibration attenuation leads to an **efficiency gain over 0.25%** in gas and steam turbines.



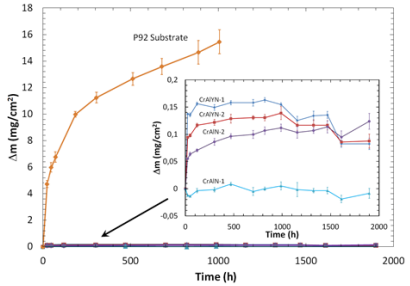


Scroll Compressor:

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



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



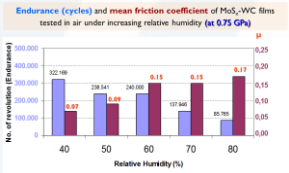
Shaft/Bearing in electric cars:

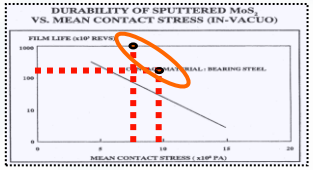
Friction torque reduction of 15%.

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.

4. 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
  - Environmental concerns on the use **raw materials** (e.g. PFAS),
  - associated **carbon footprint,**
  - **microplastics** emission
  - and **solvents removal**

- **Coating performance**: to `protect different materials and substrates.:
  - **Extending lifespan,**
  - **enabling** the use of materials in demanding scenarios, **r**
  - **Refurbishment and re-use**
  - **new levels of performance based on more sustainable chemistries.**

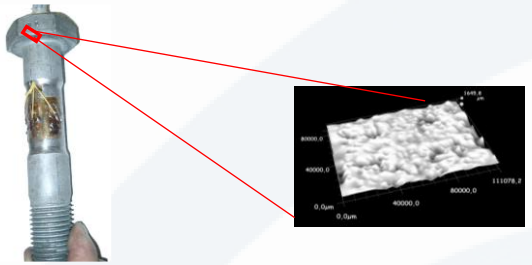
Industry and Society Trends:

- **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 to deploy **novel functionalities** that will became a common practice in the next decades: e.g photocatalysis , heat-reflection and others.



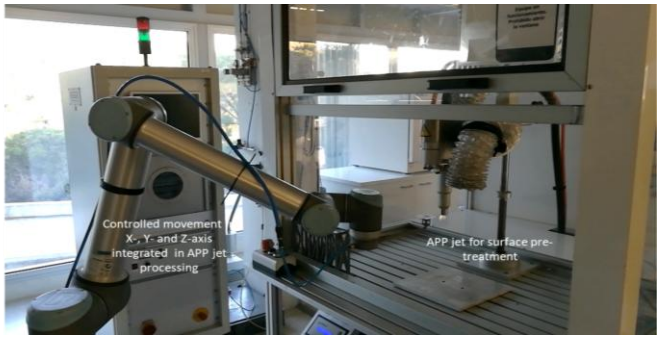
Some Challenges and synergies:

- 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 an 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**



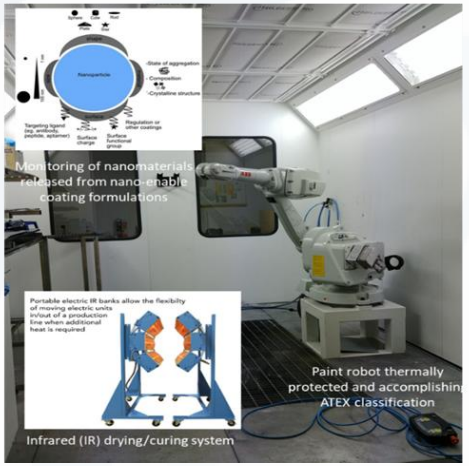
APP jet for surface pre-treatment

- 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 nanosafety and nanotoxicology of nano-enable coating processing for potential nanomaterials in air inside and outside the liquid paint booth.

Liquid paint booth



Automatized Controlled Deposition of Nano-Enhanced Coatings:

- **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

Powder spray system

- 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.

IR dry/curing system:

An IR system with integraded AI tool for the evaluation of drying time with IR drying/curing setup is available for all painting systems This system includes IR and Monitoring set-up

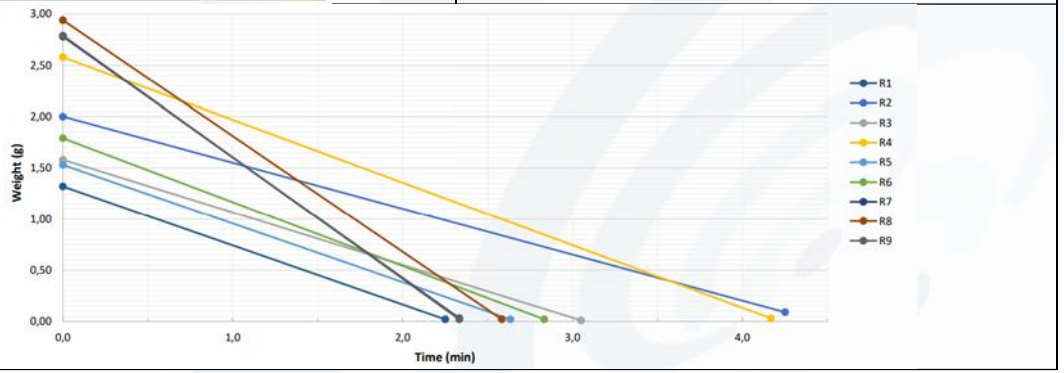
Set-up:

- Automated control of IR-sample's distance
- Optimization of the IR irradiation reflections on the: Sample's plane IR's plane
- Optimization of the camera's FOV regarding different IR-sample's distances

Monitoring

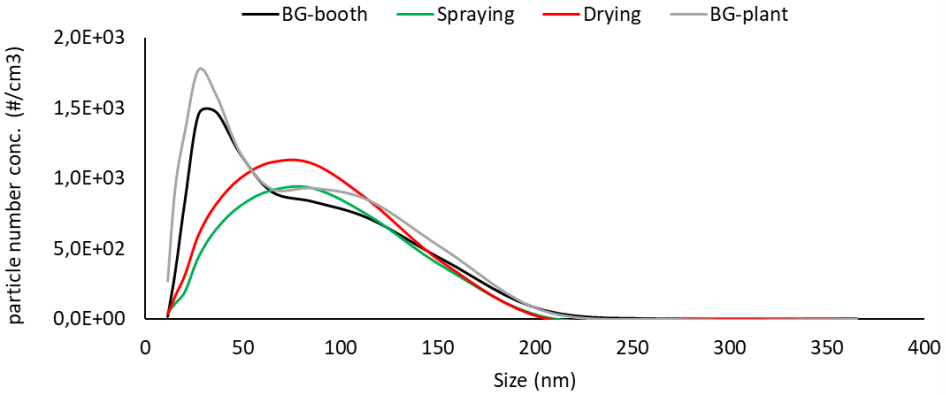
- Feeding the monitoring system with dried/not-dried conditions according to conventional characterization tools
- Image identification of final drying of nano-enable paints

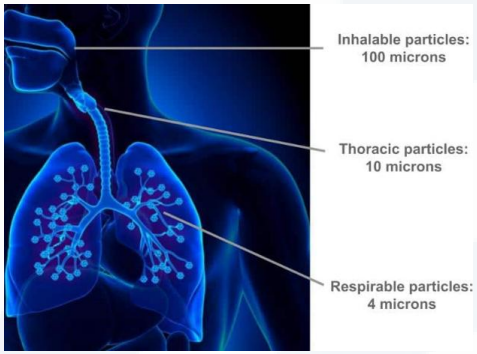
	**Initial state assessment.**
	**Intermediate state assessment**
	**Final state assessment**

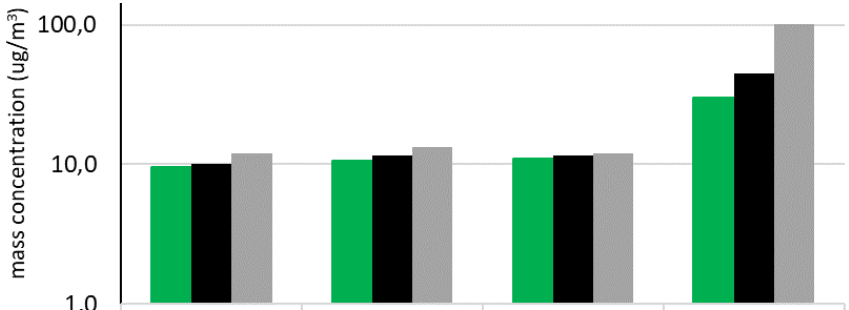


Nanosafety assessment (coatings):

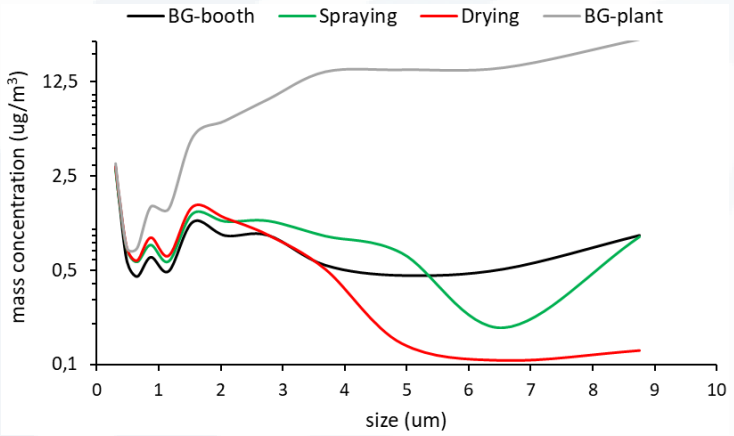
The safety in terms of aerosol emissions and their potential impact on inhalation exposure was assessed during the processes related to the present activity. Emissions in terms of particle number concentration, particles size distribution, segregated mass concentration, and mass distribution have been monitored in the size range of 10 nm to 10 µm.







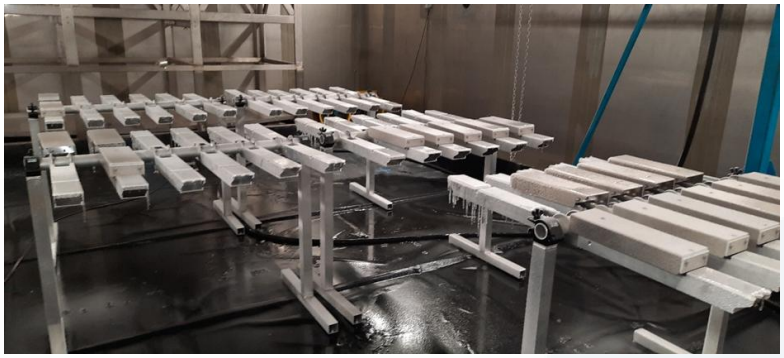
	BG-booth	Spraying	Drying	BG-plant
PM2.5	9,6	10,7	11,1	29,8
PM4	10,2	11,6	11,6	44,6
PM10	12,0	13,3	11,9	101,4



Testing facilities

Large Scale Icing Testing Capability (SIRRIS)

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).

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

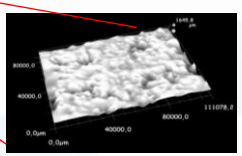
- Simulation of long-term product lifetime with short-term test period
- Basic information for approval procedures
- Suitable for series testing

Climate chamber

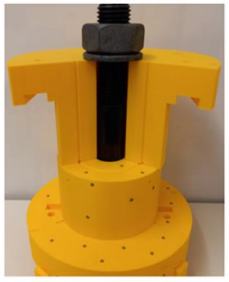
Fatigue test

Monitoring

Evaluation



Examples

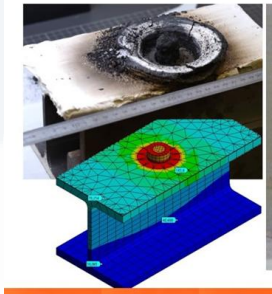


Corrosion and ageing resistance in aggressive industrial environments:

- 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.

salt spray chamber

Delaminator



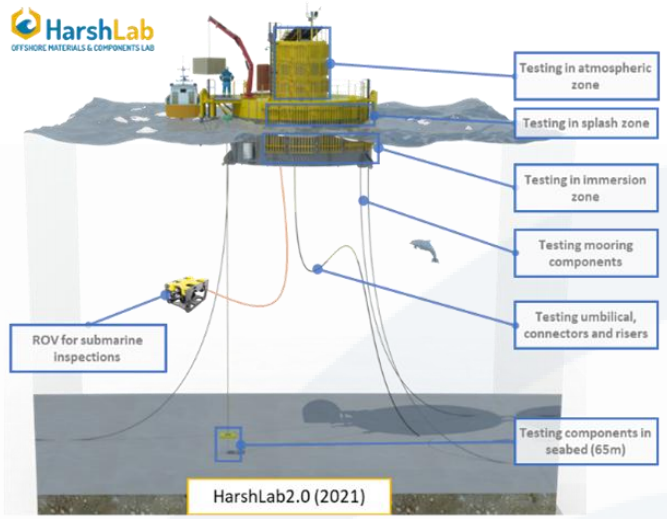
Combined stresses at extreme P and T conditions. High and low pressure and Tª

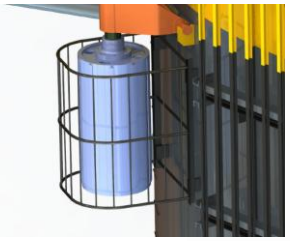
- **Testing textures and coatings under a wide variety of harsh conditions**:
  - Design pressure up to 350 bar and temperatures up to 400 °C
  - Non-stirred / stirred autoclave system (50-3000 rpm)
  - Rotating Cage test, simulating the abrasion caused by liquids with suspended solids
  - Simulation 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

Component Corrosion Test Platform (HarshLab)

Evaluation of standardized probes and other components in real offshore environment

- Up to 765 probes (125 samples in atmospheric, 320 in splash and 320 in immersion zone)
- Additional natural marine exposure site in immersion zone at Pasaia's port.
- Testing of mooring , umbilical and seabed components.
- Quantification of the corrosion rate under an artificially made scribe alternative to ISO 12944-6: 2018 (A2).





Dynamic Antifouling Testing rig (DANTE)

- Max capacity: around 120 samples
- Max testing speed: Up to 20 knots

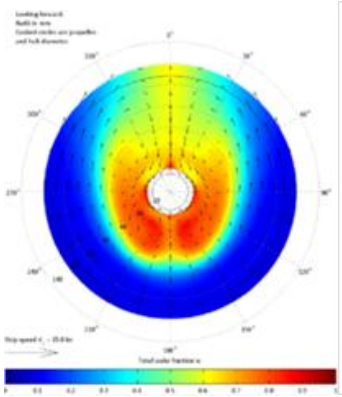
Energy supply for equipment connection:

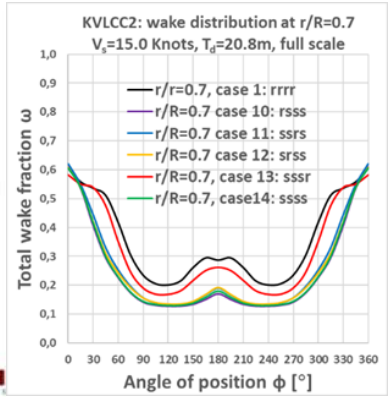
- Maximum power: 160 kVA.
- Maximum voltage (withstand by the material): 1 kV.
- Nominal voltage: 690 V.
- Power conductors: 3 x 50 mm² (Copper).
- Ancillary conductors: 2 x 6 mm² (Copper).
- Optical fibres: 24.
- Double armour.

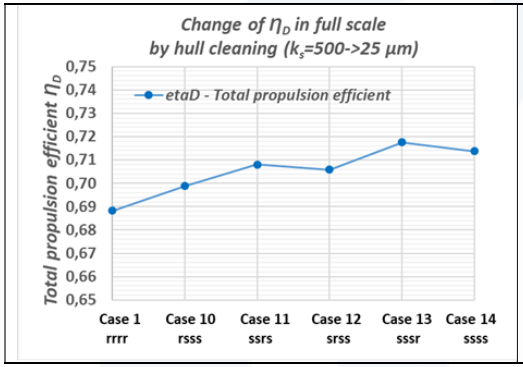
https://harshlab.eu/

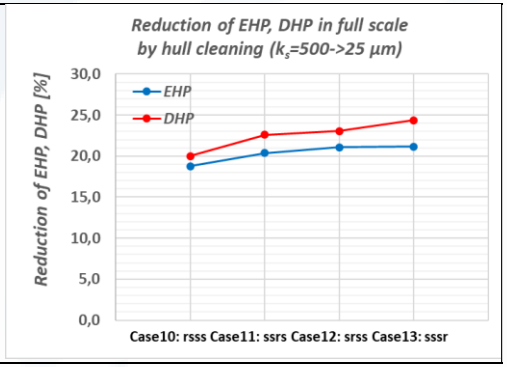
Towing tank and cavitation tunnel testing on flat plate and propellers

- 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.









Conclusions

Highlights:

- NewSkin aims to transfer technology to the industry.
- We offer a 360º portfolio of services we will tailor to your needs.
- We are bringing a set of unique interoperable technologies and facilities for the general industry as well as knowledge and Route to Market Services.
- We offer a complete set of services to accelerate the market uptake of technology.
- Our services are temporally available 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

NEW SKIN

Thank you!

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