NewSkin: Innovation Eco-system to Accelerate the Industrial Uptake of Advanced Surface Nano-Technologies.

Overview of NewSkin Services to the Industry

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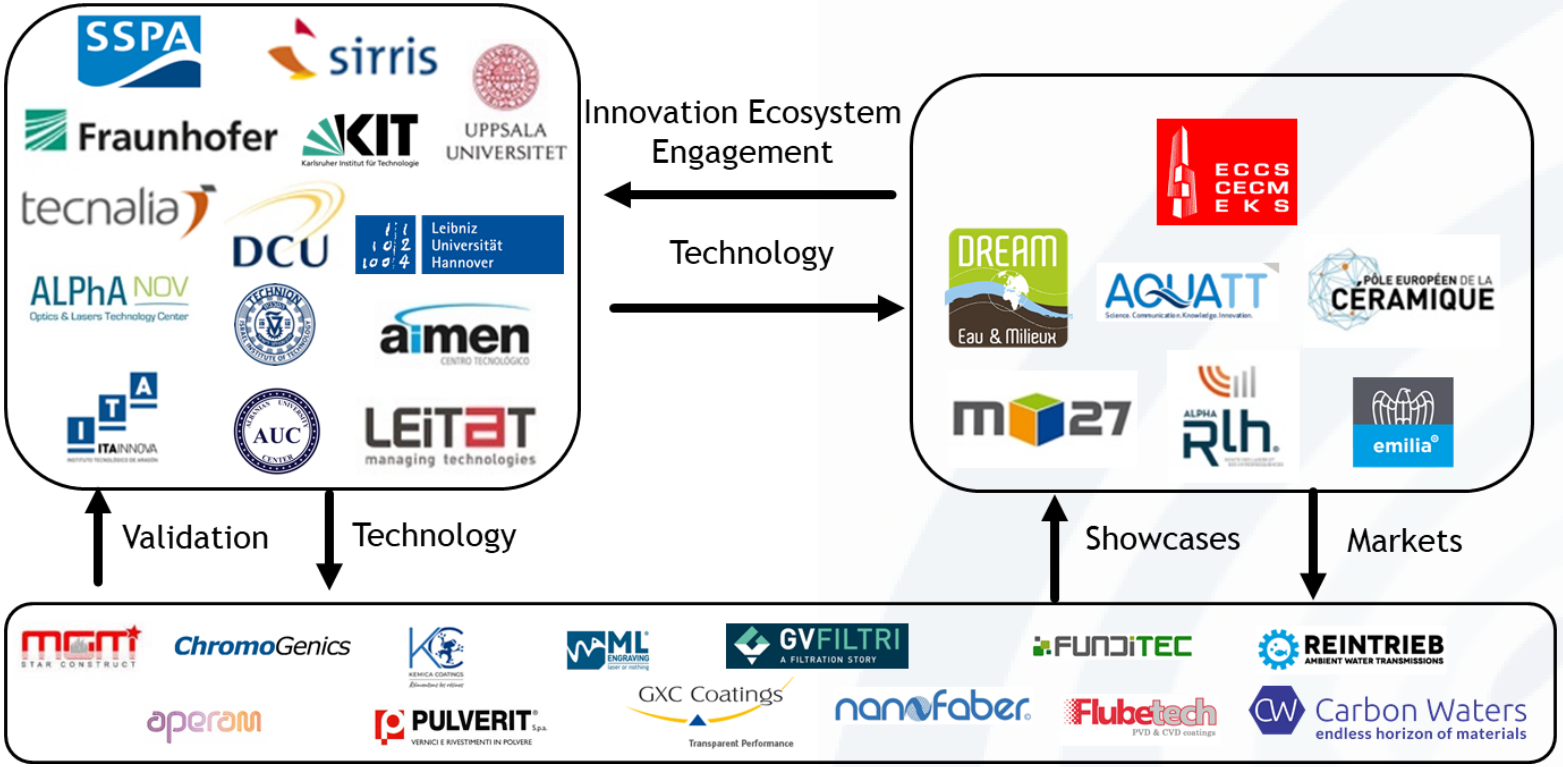
NewSkin OITB

NewSkin provides **open access through a SEP** to innovative manufacturing up-scaling and testing **facilities** as well as route to market **services** for the development and **market uptake** of new advanced surface **nano-technologies** (to TRL7 and higher) to meet the **challenges** of key European Industries and Society. The Consortium is integrated by Research Centers, European Industry representatives and a set of early adopters that will participate in the production of demos to showcase NewSkin Value Propositions



NewSkin OITB

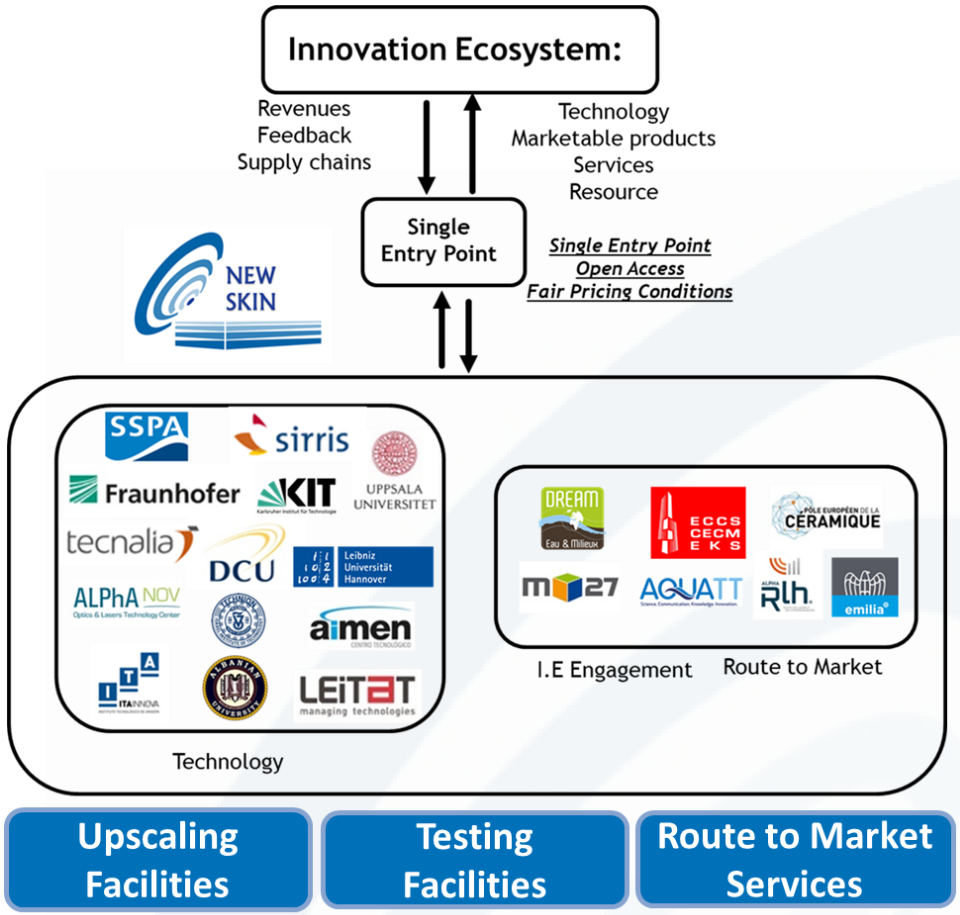
NewSkin provides **open access through a SEP** that will act as an "architect office" and will support clients to contract all the necessary services in a simple process.

The OITB services **access conditions are harmonized** and the SEP will be in charge of coordination of all the necessary interactions to complete contractual processes.

Despite the Consortium complexity, access to services will granted under **transparent and fair access conditions,** including IP aspects, in a simple process .

The OITB will grant access to IP under fair conditions and the customers will keep their IP.

Services will we 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

Contact the Architect Office: **https://www.newskin-oitb.eu/contact-us/**

When to intertact wiht the OITB:

- **The OITB will be available for technology developers willing to scale up:**

Newskin offers upscaling facilities for the foreground developed by research, center, technology developers and others. Contact us and check the suitability of our facilities and how can we help you to impact the market.

- **The OITB will be available for end-users willing to find problems for relevant problems:**

The project partners and the project network will offer specific technologies that will be available for product developers willing to improve their portfolio performance. The range of components includes not only filtering media and membranes but asl components in the pumping systems and mechanical components.

In addition, we are offering services to scout technologies to achieve new levels of performance.

- **The OITB will be available for companies willing to introduce and demonstrate novel technologies in the market:**

NewSkin offer services to validate new technologies and support the route to market by:

- Demonstrating the technologies features in relevant environment environments.
- Supporting you in the creation of supply chains to deploy your solution to the market.
- Networking with the key stake-holders and markets.

- **The OITB will be available for companies willing to be part of our Innovation Ecosystem.**

Participate as end users, supply chain members or stakeholders in the different activities to be provide by the Innovation Ecosystem. Join our platform.

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

NewSkin OITB Added value (I):

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

Commercialisation of nano-enabled industry and consumer products with new functionalities

NEW SKIN

Range of services to be provided

Design of solutions
Technology Transfer
High performance
Added value
Advanced features

Prototyping
Enhanced, continuous mass production processes

Performance evaluation
Replicating highly demanding end use conditions

Benefits quantification
LCA approach
Economic
Social
Environmental
Regulatory

Industrial uptake and route to market support
Value chains
Funding
Networking
Regulatory issues
Nanosafety and security

Commercialisation of nano-enabled consumer products
New functionalities
General industry focus:
Construction
Industrial components
Water treatments
Transport
Renewable energy
Prosthesis
Packaging
Optics & electronics

NewSkin OITB Added value (V):

Horizontal portfolio of showcases (55), easily recognizable its replication in a wide range of potential products: high-performance components in dynamic conditions, tribological and energy efficient components. Optical and functional coatings and surfaces, high performance coatings to protects components working is aggressive operation conditions.

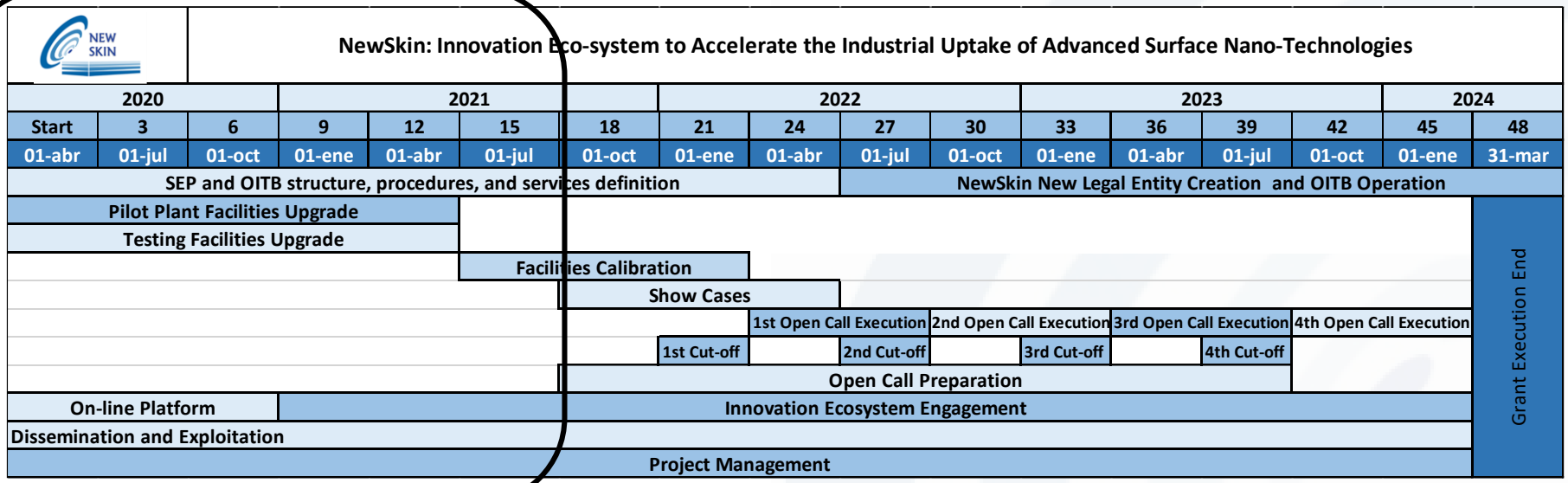
Services portfolio strongly aligned with the main industrial societal European challenges: Circular and Climate Neutral Economy, Energy and Resources Efficiency, Knowledge based Economy, Efficient Construction….

How must apply for services:

- Innovative companies and institutions able to get revenue from the offered technologies.
- Companies with a good understanding of their portfolio able to identify where the application of technologies will bring relevant benefits in terms of performance, durability and energy efficiency.
- Companies that allocate resources and budget to R&D and product development.
- There will be some chances to get access to free of charge services during the project execution to showcase NewSkin services portfolio, but the OITB will operate in the market providing services under fair pricing conditions.
- Open to collaborate and provide details on components to understand NewSkin portfolio suitability.
- Particularly:
  - Entities working in high performance gas and water separation including desalination ,hydrogen related developments.
  - Entities working in components under extreme conditions (vacuum, cryogenic conditions or high P and Tº) which performance increase has a relevant and direct impact on energy efficiency or the overcoming of renewable energy barriers; PV , off-shore and others.
  - Entities working in the development of highly efficient components for transport , energy production and energy intensive industries which performance increase will results into sound advantages.
  - Sustainable constructions
  - Nano-coating surface, developers.
  - Developer of advanced compononets (optics, electronics and others.)

The Project Timing:

- NewSkin is now completing the upgrade of facilities. From April 2021 first tests and specimens are being produced to proceed with the validation and calibration of the up-scaling and testing facilities.
- In October 2021 the Consortium will work for 6 months in the production of 55 demo cases that will showcase the potential of the OITB services.
- In April 2022 Open Calls will be launched every 6 months until the end of the project, and 100 free of charge services will be provided. April 2022, October 2022. April 2023 and October 2024.
- The OITB will be accessible under payment basis from 2021.



Mass production Functional and High Performance Surfaces

Mass production Functional and High Performance Surfaces: R2R processes

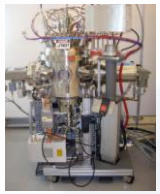
- Nano-conformable, low temperature and functional and high performance metallic, ceramic polymeric and hybrid **nano-coatings** for the **synergistic** combination with **nano and micro-structures** in continuous processes for coils and others. Low temperature deposition and accurate texture and structures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

- **Available technologies:**

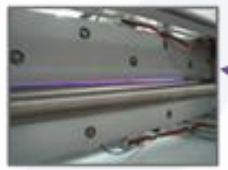
- CVD.




- HiPIMS.

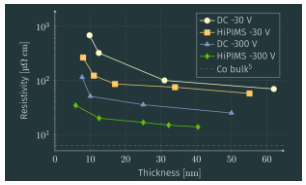
- APGD and Coating.

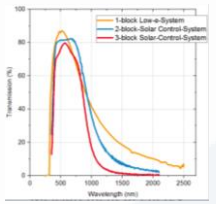



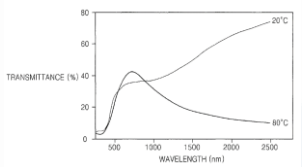

- Laser processes & Thermal Imprinting

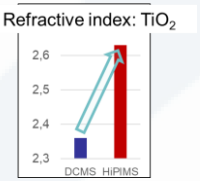
Mass production Functional and High Performance Surfaces: R2R processes

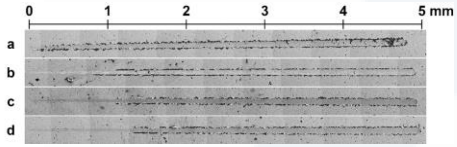
- **High Performance and Functional Layers:**
  - Conversion layers for temporary corrosion protection and improved lacquer adhesion SiOX , AlOX , CrOX.
  - Corrosion resistant coatings Ti, Al, Cr, stainless steel
  - Decorative coatings TiN, Cr, Ti, CrOX
  - Transparent layers for reduced abrasion SiO2 , Al2O3.
  - Layers for solar absorption CrC, a-C:H, C:H-Ti.
  - Production of specially alloyed surfaces Fe, Zn, Mn, Mg, Al.
  - Easy-to-clean / photo catalytic coatings TiO2.
  - Hard coatings & Stable friction coatings TiC, TiN, WC, CrN, Al2O3.
  - Electric isolation layers SiO2
  - 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,
  - Electrochromic and Photochromic layers, NiO , VO2
  - Low & Stable friction coatings CrN, DLC.
  - Barrier coatings Hybrid poymers. Al2O3, SiO2
  - Optical Coatings TiO2, HfO2.
  - Smart Textiles and surface
  - Energy storage, fuel cell and hydrogen applications.



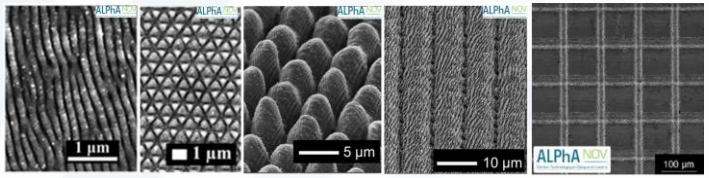






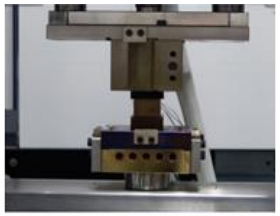


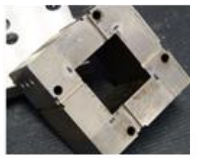
- **Laser processes:**
  - Antibacterial, self cleaning, antifouling.
  - Friction reduction.
  - Improved hydrodynamic performance.
  - Improved heat exchange.
  - Battery electrodes processing.
  - Anti-icing
  - Grip control and vibration damping.



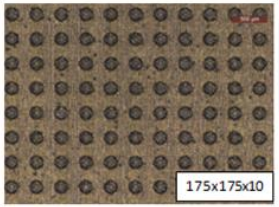
Mass production Functional and High Performance Surfaces: TDM Processes

- Texturing During Molding consist of the transfer of textures to polymeric components during the molding process. The negative pattern is created by laser ablation on the surface of molds.

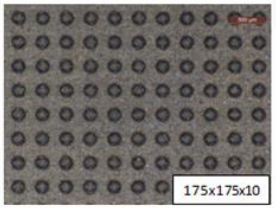





- TDM is a mass production process that has been developed to industrial scale.
- The process is mature enough to be transfer to a wide range of applications.
- Design tools and test rigs have been developed for the design, demolding and manufacturing processes.
- Textures on seals have a strong effect on equipment efficiency reducing lubricant leakages, friction losses and increasing the durability of seals but also components.
- The efficiency of the technology will depend on the contact pressure and the speed.
- The technology is available for both rigid and elastomeric materials.
- The application of the technology involves the use of textured molds and nano-enabled release coating to ensure the proper release of components and reduce maintenance operations.
- Any molded component from seals to gaskets and polymeric gears, pistons bearings, shafts working in dynamic lubricated regimes will be benefitted by the implementation of this technology.
- Pneumatic and hydraulic actuators, compressors, pumps , engines ….



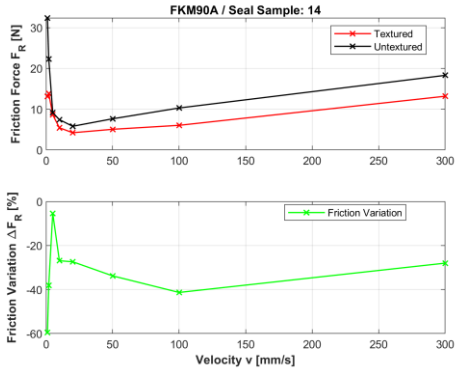
Textured Metal Plate



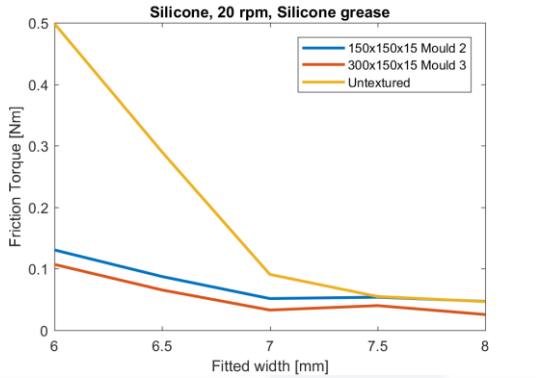
Textured Rubber Sample

Mass production Functional and High Performance Surfaces: TDM Processes

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

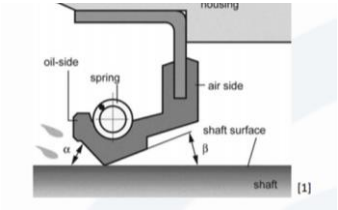


- **Rotating V-Ring seal :**
  - Dimple diameter: 150/300 µm
  - Dimple distance: 150/150 µm
  - Dimple depth: 15/15 µm



Example 9: 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.



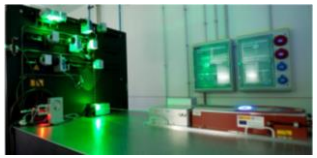
Example 10: Radial Shaft and wipe seal:

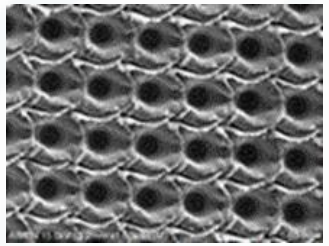
Polypropylene handles and grips for sports equipment and hand tools with antiscratch surface texture. Service life extension >100%.

Direct Texturing & Coating of Components for Automotive and Industrial Components

Direct Texturing of Components for Automotive and Industrial Components:

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





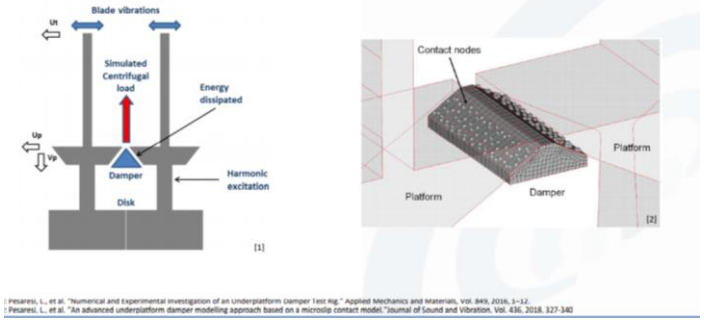
Direct Texturing of Components for Automotive and Industrial Components:

Example 1: Retrofit under platform damper:

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

Component:

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

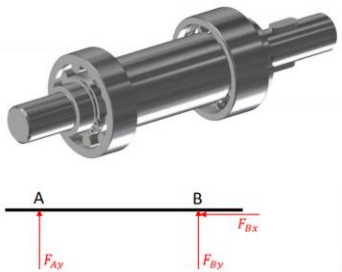


Example 2: Shaft/Bearing in electric cars:

Friction torque reduction of 15%.

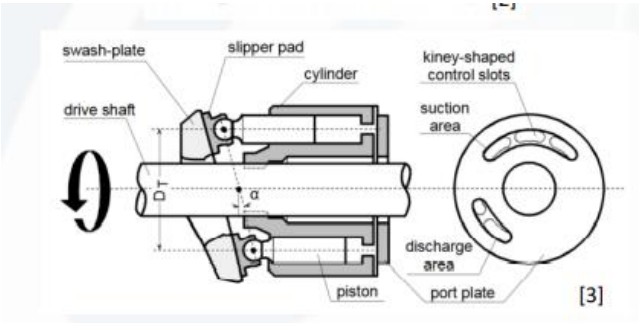
Component:

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



Example 3: Scroll Compressor:

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



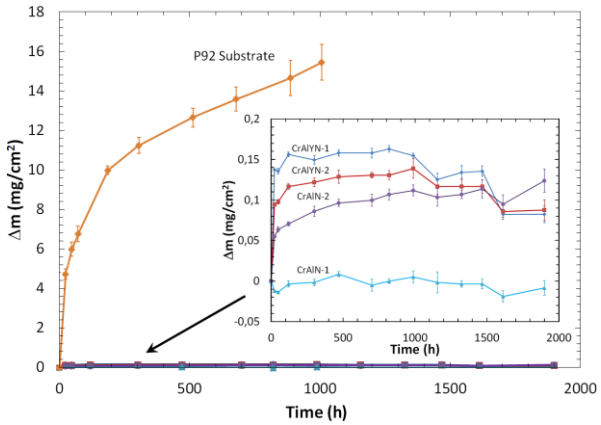
Example 4: Components in maritime engines and centrifugal pumps:

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

High Performance and Functional Coatings and Textures

High Performance Coatings: PVD

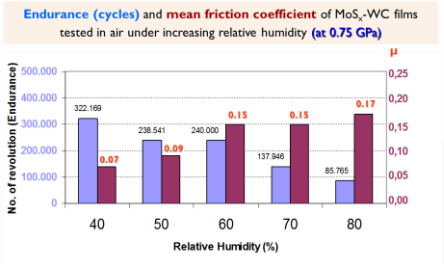
- **CrAlN based coating**, show increase wear resistance as oxidation resistance properties at 650ºC 100% r steam environment and until 850ºC in air

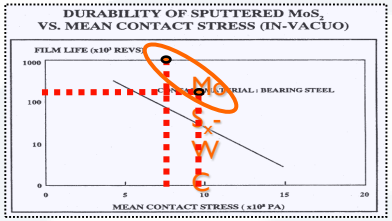


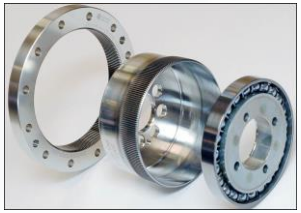
- **DLC-Ti** (Prosthesis)

- **DLC** (low friction)

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

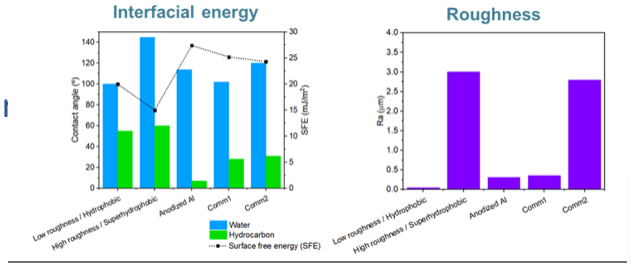




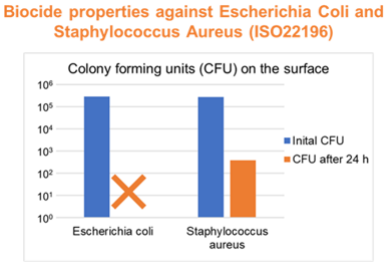


High Performance Coatings: Sol-gel

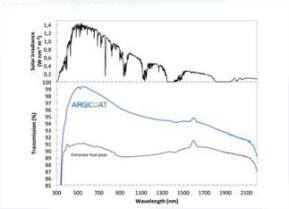
- **Hybrid coating** with low surface free ener



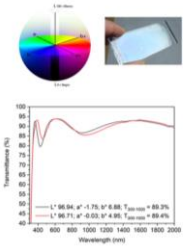
- **Hybrid coating** with antimicrobial properties



- **Antireflective coating:** ARGICOAT



- **Interference coatings** for BIPV



Application and Testing of nano-formulated coatings

Application and Testing of nano-formulated coatings

- **Application facilities:** Equipping robots and systems to check the nano-safety aspects.

  Drying and curing systems to optimize the industrial rates and the coating efficient including proper film formation.

- **Testing facilities** replicating harsh conditions, extreme industrial environments and highly demanding scenarios to demonstrate the **superior performance over the S.o.A:**

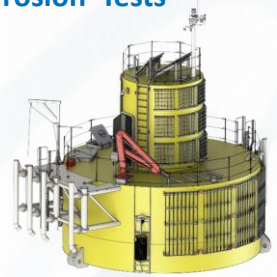
Icing Tests

Fatigue Corrosion Tests

Cavitation Tunnel & Towing Tank

Intumescent Coatings Durability

Harsh Industrial Conditions



Off-shore Conditions

Continuous Production of Monoatomic Graphene Membranes and other advanced functional layers.

Continuous Production of Monoatomic Graphene Membranes

- The unique atomic thickness of graphene open up 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 without appreciable tears and cracks
  - Creation of sub-nanometer pores with a narrow pore size distribution.

- 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.

    - APGD for (< 1 nm pores)

Continuous Production of Graphene, CNT, Graphene Oxide and other nano-particles Membranes.

Continuous Production of Graphene, CNT, Graphene Oxide and other nano-particles coated Membranes, Textiles and Surfaces.

- While mono-atomic graphene layers request the formation of a continuous graphene layer on an active catalyst surface at high temperature in vacuum conditions, a simpler approach to nano-enabled membranes can be achieved by simpler means by stacking high aspect ratio particles on the surface of a porous substrate (membrane or textile). Carbon particles: GNP, CNT, CNF, GO, rGO and other nano-particles not limited to carbon are well-known in the literature.

- Different processes for the staking of nano-particles on surfaces are widely spread at lab scale, mainly:
  - Vacuum filtration.
  - Dip-coating.
  - Spin-coating and drop casting.

- NewSkin offers the following facilities to scale-up the processes for the translation of lab scale processes into industrial processes:

- APGD plasma pre-treatment.

- Surface activation by means of binders: polyimide or a self assembled monolayer (SAM) of 3-aminopropyltriethoxysilane (APTS)

- Nanoparticles finishing processes:
  - Padding.
  - Exhaustion.
  - Spraying.

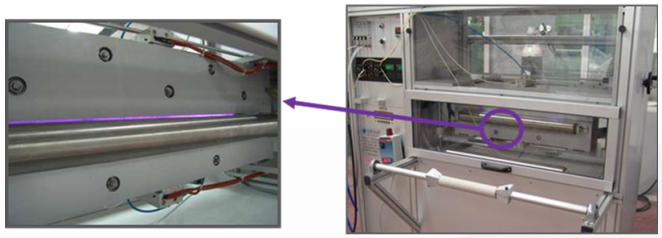
R2R APGD pilot-plant plasma system

R2R surface finishing system

Membranes Texturing and Coating for Improved Selectivity and Fouling Resistance

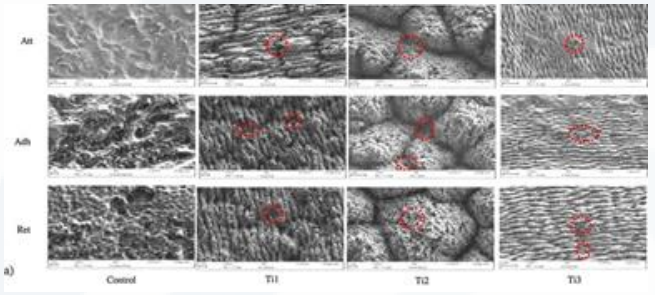
Membranes Texturing and Coating for Improved Selectivity and Fouling Resistance

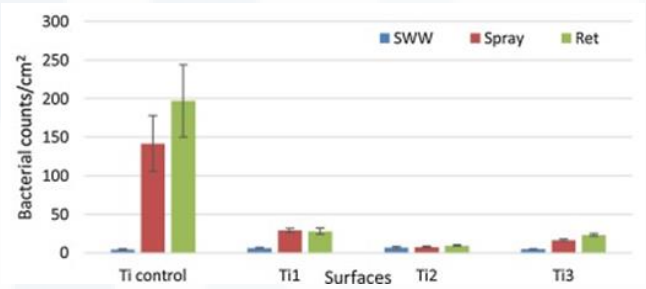
- NewSkin will bring laser processes and APGD processes for membrane surface modification in order to improve selectivity of and fouling resistance of filters and membranes.
- By creating tailored nano-structures on the surface of membranes and filters, microbial and foulant adhesion is prevented.
-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





Thank you!

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