JOTUN

SeaLion | REPULSE

Nanorepellent Technology™

SeaLion Repulse
Jotun in-house technology

As one of the global leaders in the marine paint market, Jotun takes a major step with their innovation in the Fouling Release Coatings (FRC) market by introducing the SeaLion Repulse.

Jotun is among one of the world leaders in the marine industry, established in 80 countries around the world with a strong reputation in the marine business segment, supplying the worlds' merchant fleet with high quality coating systems and the world's most advanced antifouling technology. With research and development as a core part of the business, innovation has become a driver for change and new developments, supporting the vision of being perceived as a leading quality supplier of solutions based on customer's needs.

In 2002 Jotun A/S and NKM formalised their co-operation by forming SeaStar Alliance which has more than 22% of the global marine market, providing a presence that ensures that products and services are readily available wherever a ship is being built or drydocked, supported by Coatings Advisors with FROSIO, NACE or similar accreditations.

Sharing of existing and developing technology helps sharpen the competitive edge for the SeaStar Alliance, enabling its partners to maintain their status as leaders in the marine market.

SeaLion Repulse is based on an in-house technology from one of Northern Europe's largest privately owned R&D laboratories. By introducing the Nanorepellent Technology™ with additional features, Jotun is bringing a breakthrough in fouling release coatings technology to the market.

Photo: Courtesy of www.jeffkraus.com

Nanorepellent Technology™

The Jotun in-house Nanorepellent Technology™ has provided SeaLion Repulse with release and repellent properties. Through nanoscale engineering of the coating's surface a repellent layer is created on the silicone surface. The nano structures extend into the water creating a layer that acts as nanoscaled-springs. When the spring-like structures are compressed, a counter force is developed. The nanoscale-springs thereby provide release and repellent properties to prolong the period before settlement of slime and other fouling. This gives a smoother surface than conventional FRCs with a system life up to 10 years under normal conditions.

Jotun Antifouling laboratory

Take fouling control

The non-stick properties of conventional FRC's are based on the properties of silicone, which provides a chemically inert surface. The advancement achieved by introducing Nanorepellent Technology™ is that the film surface has been modified to increase its fouling repellent properties. With the introduction of nanoscaled-springs, the repellent properties are introduced in addition to the release properties. This inhibits adhesion of fouling compared to conventional FRC's on the market.

Scales of fouling

The environmental and economic aim of hull protection is to minimise fuel consumption through a smooth fouling-free surface. This will minimise bunker costs and emission of greenhouse gases to air.

The estimated 4-5000 species of fouling can be classified into three groups based on the fully grown specimen.

ALL FOULING STARTS ON A NANOSCALE LEVEL
The initial stage of fouling on a submerged hull consists of an organic monolayer of glycoproteins and polysaccharides. These nanoscaled substances may be seen indirectly by advanced scientific instruments, and have no direct influence of the frictional resistance (fuel consumption), but rather acts as a primer for fouling organisms. Through the employment of nanoscaled-springs the repellent properties of the Nanorepellent Technology™ inhibit adhesion of fouling. (Figure 1).

MICROSCALED FOULING
The next successive stage of fouling comprises a complex mixture of groups of bacteria and diatoms in drifting plankton. These microbial organisms may be studied through a microscope. Agglomerates of these microbial organisms may be seen by the naked eye as a slime layer, and have a direct impact on the frictional resistance and fuel consumption. (Figure 2).

MACROSCALED FOULING
In the final stage of fouling both animals and plants are included. At this stage the impact on frictional resistance is severe and may give a fuel penalty up to 40%. (Figure 3).

Both micro and macro fouling attach by a complex nano-sized glue mixture. Hence all fouling start on a nanoscale level. The Nanorepellent Technology™ inhibits micro and macro fouling.

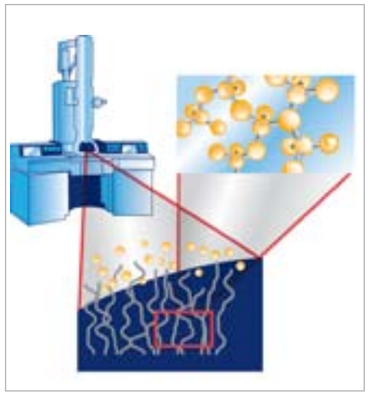


Figure 1

The coating surface has been engineered by introducing spring-like nanoscale structures. One nanometer is one billionth of a meter, and structures of this size can only be evaluated by advanced scientific instruments.

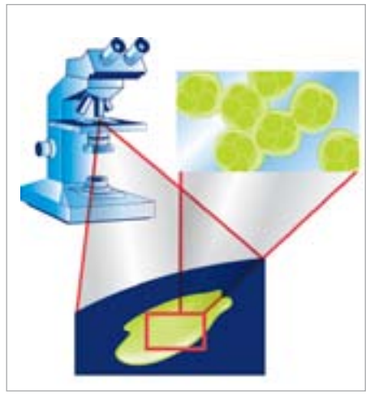


Figure 2

One micrometer is 1.000 nanometers. Micro fouling organisms may be investigated by optical microscopy. Agglomerates of micro fouling organisms are visual to the naked eye.

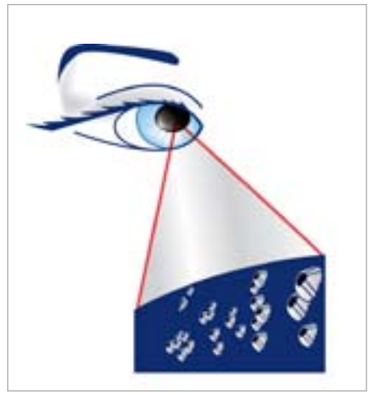


Figure 3

One millimeter is 1.000.000 nanometers. Marco fouling of this size is easily detected by the bare eye.

Repulsion on a nanoscale

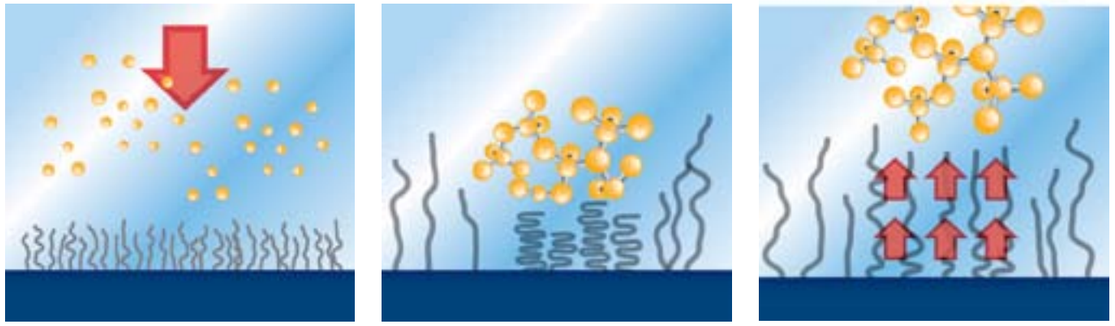
Nano technology has received growing attention in the last decade and has almost become a daily expression. One nanometer is one billionth of a meter. Relating this to the scale of chemistry can be illustrated by; atomic and molecular dimensions in the order of 0.1 nanometer and upwards.

Large molecules organised assemblies of such are in the nanoscale. The concept «nano technology» commonly refers to structures up to 100 nanometers.

Organisms attach themselves to surfaces by exerting biological glues which are molecules that can form chemical bonds to the surface. These are macromolecules with reactive chemical entities. When these are repelled by the nanoscaled-springs, fouling is inhibited.

1) REPELLENT PROPERTIES

Incoming nano-sized glue from micro or macro fouling is repelled by the nano-springs, and hence fouling is inhibited.



2) RELEASE PROPERTIES

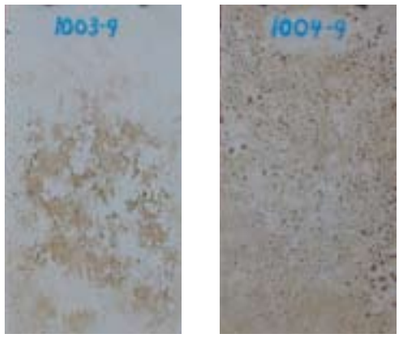
Barnacles can easily be removed from the surface.

Advantages

- Prolongs the time for slime and fouling to settle
- Keeps a smooth surface longer than traditional FRC's
- Less fuel consumption
- Long term investment
- Environmentally sustainable

COMPARISON OF STATIC PERFORMANCE OF SEALION REPULSE VS PREVIOUS SEALION

SeaLion Repulse *SeaLion*



Only some light slime on SeaLion Repulse, whereas SeaLion have barnacle settlements in addition to slime.

Areas of use

TYPE OF VESSELS	HULL	PROPELLER	RUDDER
CONTAINER	Yes	Yes	Yes
LNG	Yes	Yes	Yes
VLCC	Yes	Yes	Yes
BULKER	Yes	Yes	Yes
CRUISE	Yes	Yes	Yes
REEFER	Yes	Yes	Yes
CAR CARRIER	Yes	Yes	Yes

Questions and answers

Q ***What is FRC?***

A FRC is short for Fouling Release Coatings and is a low surface energy coating with a smooth, non-stick, water-repellent surface.

Q ***What is Nanorepellent Technology™?***

A A technology based on specifically designed nanoscale-springs, that are motile when linked to the surface of the coating giving a dynamic surface structure. This provides both release and repellent properties towards slime and other fouling.

Q ***What is the difference between Nanorepellent Technology™ and other FRC-technologies?***

A Conventional FRC technology is based on low surface energy and elastic properties of the film. Nanorepellent Technology™ is an advancement where the film surface has been modified to increase its fouling repellent properties. This is accomplished by introducing specifically designed nanoscale structures that obstruct and diminish the attachment of the fouling.

Q ***Does the nano-springs affect the hull roughness?***

A No. The nano-springs are on a scale order of magnitude smaller than hull roughness and do not influence the coating.

Q ***What are the benefits of SeaLion Repulse?***

A Prolongs the time for slime and fouling to settle. Keeps a smooth surface longer than traditional FRC's. Reduced fuel consumption and environmentally sustainable.

Q ***What are the advantages of SeaLion Repulse compared to standard SeaLion?***

A SeaLion Repulse offers better fouling control and protection through the repellent effect which prolongs the time for slime to settle. Keeps the hull smooth for longer, improved static robustness and reduced fuel consumption compared to standard SeaLion.

Q ***What is the total coating system for using SeaLion Repulse?***

A Anticorrosive primer, Safeguard Universal ES, SeaLion Tiecoat and SeaLion Repulse.

Q ***Is SeaLion Tiecoat an important part of the SeaLion Repulse system?***

A Yes, as it provides an excellent adhesion strength and through this a mechanically more robust system.

Q ***What surface preparation is needed?***

A Full blast is our recommendation. If the coating film has minor damages, a touch-up of the topcoat is recommended.

Q ***Can conventional FRC's be overcoated by SeaLion Repulse?***

A Yes. Contact your local Jotun office for advice and recommendation.

Q ***What is the expected lifetime of the system?***

A Up to 10 years lifetime with a touch-up after 5 years.

Q ***What is minimum speed for SeaLion Repulse?***

A As this depends on vessel type, trade and sailing waters may vary. Contact a Jotun representative for correct specification.

Q ***How smooth is SeaLion Repulse compared to other FRC's in the market?***

A SeaLion Repulse is equally smooth compared to other FRC's in the market and offers in addition the nano-spring repellent properties.

Q ***What is the expected fuel savings with SeaLion Repulse?***

A Major fuel savings can be expected depending on vessel type, trade, weather and sailing pattern.

Q ***Is SeaLion Repulse in compliance with the latest IMO rules?***

A Yes, SeaLion Repulse is in compliance with the latest IMO rules. There are no biocides in the product.

Q ***Is SeaLion Repulse based on a Jotun formulation?***

A Yes, SeaLion Repulse is based on an in-house technology as a result of several years' research, in one of Northern Europe's largest privately owned R&D research laboratories.

Q ***Will slime/algae occur on FRC?***

A Yes. Slime and algae will occur on any FRC in the market regardless of technology. SeaLion Repulse with its Nanorepellent Technology™ gives both repellent and release properties that prolong the period up to settlement of slime and fouling.

Q ***Will mechanical damage occur on SeaLion Repulse?***

A Yes, due to the elastic nature of the film, damage might occur when exposed to mechanical impact.

Q ***Further questions?***

A Please contact a Jotun representative for professional advice.

Team No.1

Jotun Coating Advisors

Uniform Standard of Global Service

Global service

- Highest number of technical personnel in the industry
- Same high standard of trained personnel globally
- Easy to exchange trained technical personnel across national borders and multi-national projects

Standardised

- Same tools, reports, procedures and behaviour worldwide
- Same competence in maintaining company standard procedures
- Recognised globally by their yellow and red boiler suits

Coating Advisor Academy

- Compulsory training for all technical personnel worldwide
- Theoretical and practical training testing and examination
- FROSIO and NACE certification
- First Aid and Fire-Fighting

Trained to Deliver the Ultimate Result

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Allegro Sandefjord

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