

Hong Kong's pioneering Nano anti-fouling coating technology



Research partners:



**Solar Nano-photocatalytic coating –
the cost-effective solution to ship hull fouling problems**

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A single source solution to fouling and corrosion

The new technology and product is developed based on a joint collaboration City University of Hong Kong and The University of Hong Kong, Here at Aviva Yacht, we aim to provide non-ordinary yacht antifouling service to yacht owners.

Nano-photocatalytic marine antifouling additive (Nano-AM)

Innovation

Solar photocatalysis can function effectively under seawater to perform antifouling. Nano-AM adopts solar photocatalysis to prevent unwanted growth of microorganisms onto coated surfaces in seawater.

Economics

The excellent performance of Nano-MAP reduces 30-40% of fuel consumption and reduce maintenance services. The payback period is typically shorter than one year.

Environment

Our paint can fully replace heavy metal based antifouling paints, of which has adverse effects on the marine ecology and contaminated seafood.

Safety

The main ingredients of the paint are the photocatalyst additives. It is commonly used in many consumer products therefore very safe to use.



We understand biofouling

Conventional heavy-metal based antifouling paints are ineffective to mitigate the maritime vehicles and facilities biofouling and corrosion problems but seriously harm the marine ecology.



Bio-fouling

Fouling on hulls and propellers result in lower full speed and poor fuel efficiency. For severe biofouling conditions, an average length container ship can see +55% in GHG emissions*.



Corrosion

Corrosion causes material failure and shortens the service life of metal parts operating under seawater.



Ineffective Paints

Many marine antifouling and anti corrosion paints in the market have huge drawbacks, including limited effectiveness, environmental pollution and ecological impact.

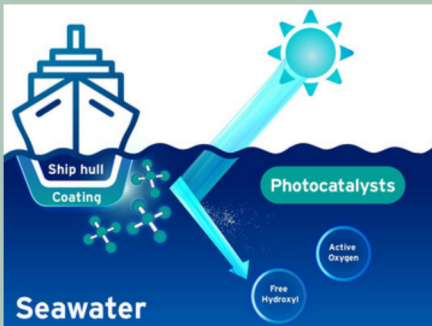


Impact of Ships' Biofouling on Greenhouse Gas Emission. Published by GloFouling Partnerships. London, 2021

What is Nano-AM?

Innovative dual functions and high performance marine coating

The product contains carbon co-doped Titania and composite. We take into account the intensity of solar radiation in seawater, to produce photocatalytic oxidation and super hydrophobicity that can prevent unwanted growth of microorganisms onto the ship hull.



Anti-fouling and anti-corrosion in one paint

A single protective coating can perform dual functions, i.e. antifouling and anticorrosion.



Reduce maintenance cost

The excellent performance of Nano-AM helps to save fuel consumption and subsequent maintenance costs. There is no need to repaint every year.



Protect marine ecosystem

The main component of Nano-AM is a photocatalytic additive. It is designed to replace traditional heavy metal-based antifouling paints to protect the environment.



Over 20 years of R&D

Extensive experiments and field tests of Nano-AM have been conducted and the results have clearly shown the effectiveness on antifouling of fiberglass yacht hull and metal vessel hull.

Careful coating design



Our research team fabricated and analyzed photocatalysts made of different chemicals and formed in various nanostructures. And conducted experimental studies to develop new photocatalysts that can be activated by sunlight under seawater.

Quantitative analyses



We collected results of simulated seawater environment test on different Nano-photocatalytic paints, including (a) number of barnacles, (b) DNA damage assay of E.coli and (c) live/dead imaging of E.coli, under different temperature and light intensity using either artificial seawater and real seawater retrieved from the harbor.



Nano-AM has received certification from the China Classification Society (CCS), showed that the antifouling performance is 70% better than the heavy metal biocide.

Specific Nano-AM formulations have been developed with anti-corrosion effect and durability

For metal hull, additional anti-corrosion protection is required. Metal and metal oxide doped photocatalysts can perform photocathodic protection against corrosion. The metal/ metal oxide doping can also enhance the photocatalytic antifouling effect as the bandgap energy is reduced resulting in solar activation with wider spectrum.



Evaluation of coating durability of the nano-photocatalytic antifouling paints on fiberglass and metal surfaces under different conditions (Fig. top left and right), including (a) single-layer painting, (b) multi-step painting techniques, (c) accelerated cycles of simulated seawater temperature variation, and (d) accelerated cycles of simulated solar radiation variation.

Another promising application of Nano-AM is to protect stationary marine facilities. We conducted field tests of Nano-MAP on the grilles of seawater cooling systems (Fig. bottom left)

Application of Nano-AM



Step 1

Gondola/ Dry Dock Mooring

Move the yacht from seawater by professional travel lift and place it securely to the dry dock.

Step 2

Remove oysters/pink

Remove organisms grown on the hull bottom. Clean the water inlet & outlet, propeller, rudder, bow thruster thoroughly.

Step 3

Sanding the Bottom of the Boat

Grind the hull bottom to make it smoother.

Step 4

Wash the Bottom of the Boat

Clean the hull bottom by high-pressure jet water. Then use alkaline cleaners to make it oily-free.

Step 5

Application of primer

After air drying, apply a layer of special FRP/metal primer.

Step 6

Photocatalytic Nano Antifouling Coating

Apply the 1st Layer of Nano-AM on the metal parts.

Step 7

Loosen the second layer of Nano-AM coating after drying. (a minimum of 3 hours)

Step 8

Quality Management

To achieve the best result, it should be left thoroughly dry (minimum 6-12 hours) before putting the yacht back to the sea.

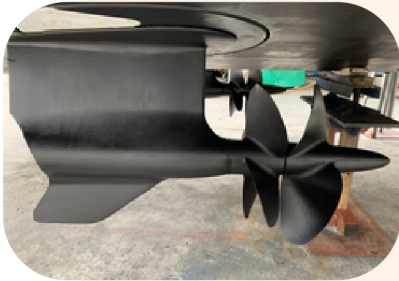
To ensure that the hull has been coated with two layers of paint, the first and second layer are distinguished by different color.

Nano-AM vs. conventional paint



Reinventing the toxic marine coating

Most of the conventional anti-fouling paints contain heavy metal ion components. Not only of its high toxicity, the toxic metal ions will be dissolved from the coating. Which means, conventional ship bottom paints prevent fouling for only a limited time (an average effectiveness of 3 to 6 months under subtropical fouling conditions)



Fuel Consumption

↓ 30-40%



Paint Durability

> 12 months

Nano-AM is non-toxic to marine ecology. Since the photocatalyst catalyzes the generation of reactive oxide species for disinfection, it won't be exhausted. Thus, the anti-fouling effect can last much longer to 1 year and even longer. Nano-AM is more stable with additional water purification function by photocatalytic performance.



Before and After



Customer reviews



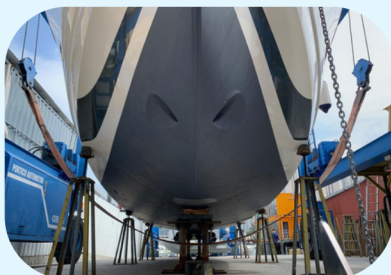
The maintenance of a yacht involves more than just visible cleaning of the hull. It is important to keep the yacht hull clean and smooth. If there is a lot of tubeworms growing, it can clog the machine's intake and discharge ports, causing serious consequences. Since using bottom paint infused with nanotechnology, during each annual check-up, the bottom of my boat has been as shiny as new, giving me confidence when I go boating.

Yacht Owner, Mr. Sam Keung

I always know about the problem of barnacles on the bottom of boats, but for many years, the shipyards responsible for maintenance have claimed that re-growth is inevitable. Even when talking with friends who own yachts, we all believed that there was no solution until recently when I came across a three-year antifouling guarantee offered by Aviva Yacht. I was interested because their work seemed more meticulous than other shipyards, and they offer free inspections every few months. Most importantly, the cost isn't much higher than other options, and if it truly prevents barnacles, it's well worth the investment.



Yacht Owner, Mr. Jiang Shaohui



I often see antifouling nanotechnology being introduced in TV programs. I know that the ship hull can quickly become covered in marine microorganisms. After being recommended by a friend, I chose to use a nano-photocatalytic coating from Aviva Yacht. It comes with a guarantee, and I have become a long-term customer. I feel that Aviva Yacht is a well-managed shipyard.

Yacht Owner, Mr. Au Qixin



SM Pro 1 is designed to lubricate screws, threaded joints, and hard-to-reach crevices. It not only provides lubrication but also penetrates and cleans by removing surface oil, dirt, and grime. With SM Pro 1, you get the benefits of rust prevention and removal. It slows down metal oxidation, ensuring quieter operation of moving parts. It quickly loosens rusted connections, providing long-lasting effects in normal indoor environments for months.

Perfect for lubricating household items such as keyholes, furniture hinges, sliding tracks, aluminum window supports, and even computer chair pneumatic rods. Powered by MA2P nanophotocatalysts, SM Pro 1 easily penetrates intricate components, effectively cleaning away dust and impurities while forming a protective lubricating layer on the surface. Additionally, SM Pro 1 is environmentally friendly as it reduces the amount of lubricant consumed each year.



SM Pro 2 Nano-penetrating gel spray

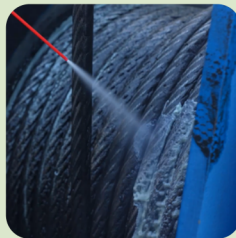
INDUSTRIAL USE

SM Pro 2 revolutionizes outdoor metal equipment protection. This advanced nano-penetrating gel spray combines cutting-edge nano-materials with a liquid lithium-based lubricating grease, creating a formidable barrier against the elements.

Unlike conventional solutions, SM Pro 2 is specially formulated to resist the relentless forces of nature. Rain and sunlight are no match for its long-lasting formula, ensuring that your outdoor metal machinery remains rust-free and well-maintained for an extended period.

SM Pro 2 isn't limited to the easy-to-reach areas; it excels in tackling the most challenging spots on cranes and machinery, such as large screws, gears, steel cables, and motor bearings. SM Pro 2 can be directed into the heart of your outdoor metal machinery, guaranteeing enduring rust protection.

For optimum performance, consider a two-step approach. Begin by applying SM Pro 2, and then complement it with a coating of our marine-grade SM Pro 3 spray. This dynamic combination ensures that your machinery operates smoothly, with long-lasting lubrication that keeps your equipment in peak condition.



SM Pro 3 Nano-grease spray

MARINE USE

SM Pro 3, the ultimate lubrication solution that makes tough tasks a breeze. This spray-on lubricant is waterproof, heat-resistant, and resistant to seawater corrosion. It adheres better to metal surfaces, ensuring superior lubrication. The SM Pro 3 is specially designed for lubricating and maintaining ship components such as cabin machinery, outboard engines, steel cables, and gears. It eliminates noise, enabling smoother operation and extending the lifespan of your equipment.

Marine-specific grease spray combines the power of Nano-AM photocatalysts with butter-like ingredients. The Nano-AM photocatalysts are activated by sunlight and UVC, creating an exceptional lubricating state that doesn't harden due to sunlight or high temperatures. Moreover, when used on outdoor machinery for rust protection, SM Pro 3 forms a friction film on metal surfaces, enhancing the wear resistance of your lubricating oil. It deeply protects the core of objects, creating a sealing effect. SM Pro 3 quickly penetrates every part of your chains, forming a durable protective layer that resists oil stains and dust, ultimately extending the lifespan of your chains.

Forms a thick protective layer to withstand extreme maritime climates



About Aviva Yacht (Far East)

AVIVA YACHT (FAR EAST) LIMITED established in 2015, founders are a group of yacht owners who cares about the development and deficiency of the yachting industry in Hong Kong.

The company is committed to the development and adoption of scientific research to develop a diversified enterprise. Earlier this year, the company obtained an exclusive application and marketing license for Nano-AM, a nano-photocatalytic antifouling coating co-developed by the University of Hong Kong and City University with funding from the Innovation and Technology Commission. It is widely used on yacht hull and other marine facilities. The technology has been a resounding success, winning invention awards in Hong Kong, Switzerland, Canada and Shanghai.

Worldwide service network

Our worldwide network of sales and service centers can provide immediate advice and assistance on the complete range of Aviva Yacht products. Our service network include: Hong Kong, China, and Taiwan.

Awards



International Award ICAN 2022 Gold Award
2021 Hong Kong Green Innovations Award
2018 & 2019 Hong Kong Awards for Industries
The Geneva International Exhibition of Inventions Silver Award
Energy Saving Championship 2018

Our super team



Professor Michael Leung is the Associate Provost (Academic Affairs) at City University of Hong Kong. His main research interests include solar photocatalysis, fuel cell, hydrogen power, advanced refrigeration/air-conditioning and carbon management. He is listed on Clarivate Analytics' Highly Cited Researchers 2018, which recognizes top researchers selected for outstanding research performance.

Professor Dennis Leung is the Chief and Professor of Mechanical Engineering at the University of Hong Kong. As of 2010, he is one of the world's most cited 1% scientists on energy (Essential Science Indicators). In 2008, Professor Leung was awarded the Outstanding Earth Champion Hong Kong Award for his contributions to environmental protection.

Frank Liang has over 50 years of industry experience in building technology. He lead evaporative air-conditioning and instant heat pump refrigeration water heater technologies are especially successful. Liang also has valuable entrepreneurial experience in driving business growth from entrepreneurship to publicly traded companies.



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valuable investment is properly cared for and
maintained. We promise bespoke yacht services.**



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