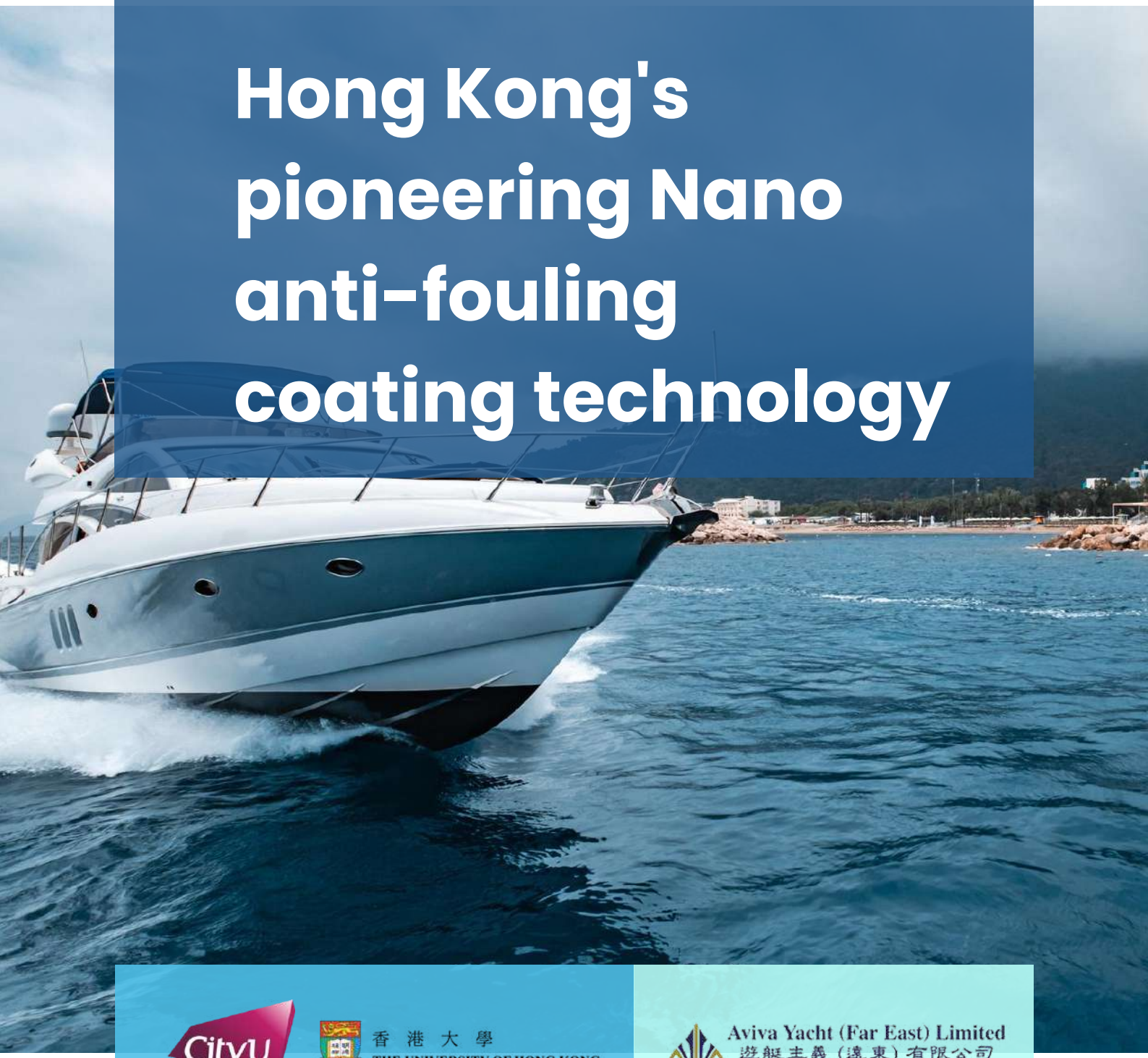
Hong Kong's pioneering Nano anti-fouling coating technology



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

About Aviva Yacht

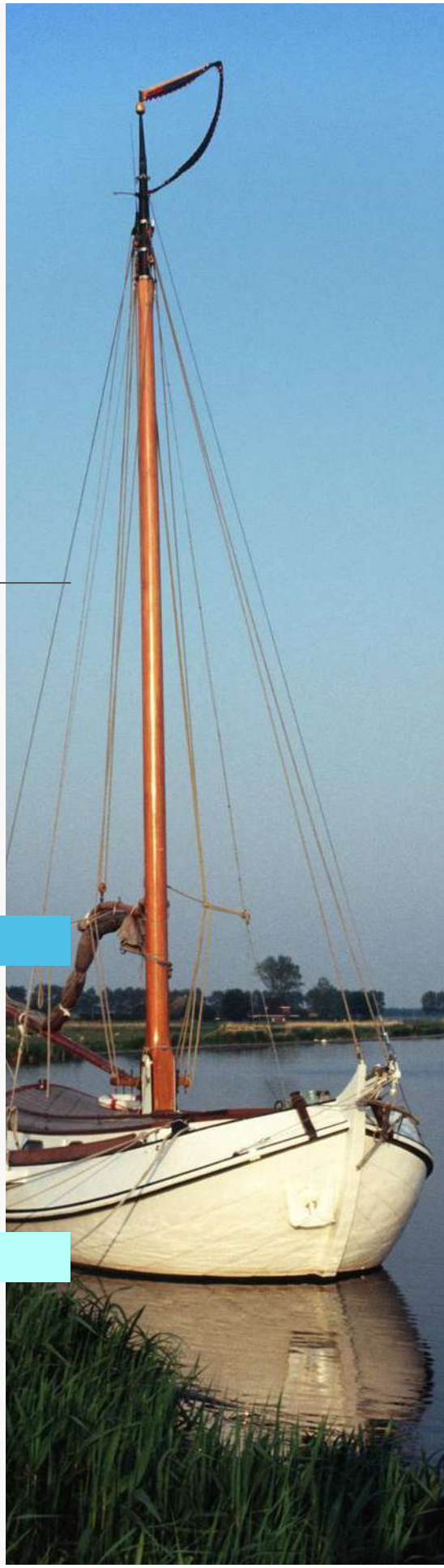
AVIVA YACHT GROUP established in 2015, the founders of the company are a group of yacht owners who enjoy yachting very much.

Learning from the past experience and encountering the reality of all sorts of boating situations, concerns have been raised towards the under development and deficiency of the yachting industry in Hong Kong.

Aviva Yacht Group aims to create a Yachting Society for premier luxury yacht owners in Hong Kong. We target to provide a bespoke precise maintenance service to preserve and even add value to their investment from time to time.

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 Group, we aim to provide non-ordinary yacht antifouling service to yacht owners.



Nano-photocatalytic marine antifouling paint (Nano-MAP)

01 Innovation

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

02 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.

03 Environment

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

04 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

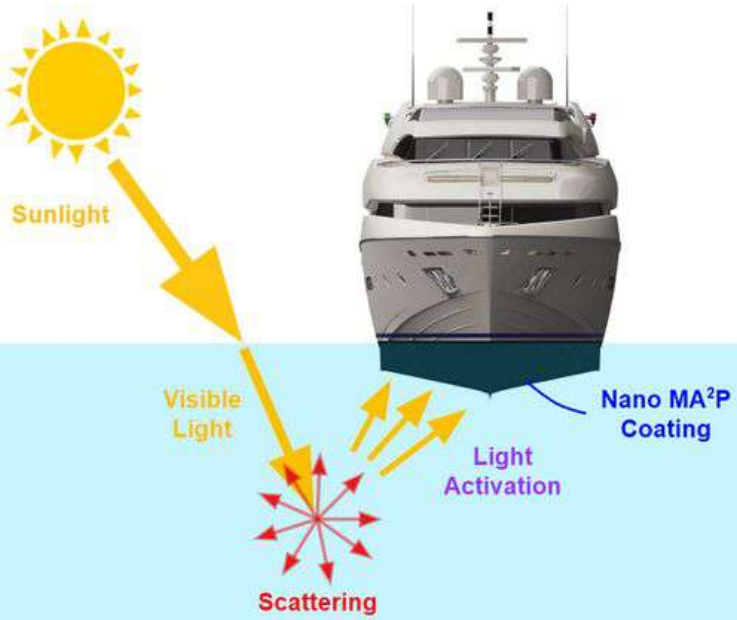
Many marine antifouling and anti corrosion paints in the market have huge drawbacks, including limited effectiveness, environmental pollution and ecological impact.

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

What is Nano-MAP

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-MAP 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-MAP is a photocatalytic additive. It is designed to replace traditional heavy metal-based antifouling paints to protect the environment.

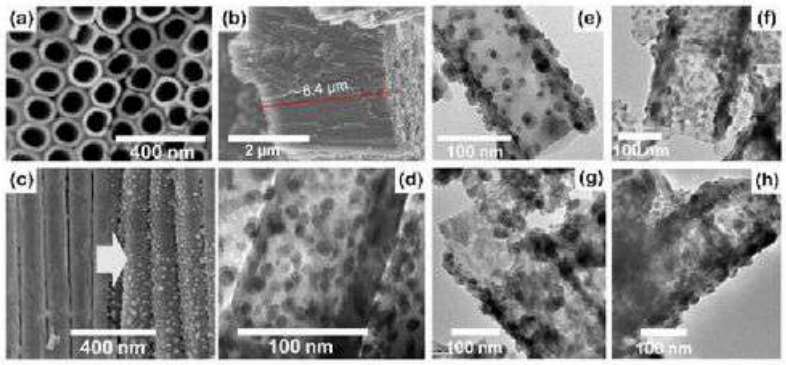
Extensive experiments and field tests of Nano-MAP have been conducted and the results have clearly shown the effectiveness on antifouling of fiberglass yacht hull and metal vessel hill.

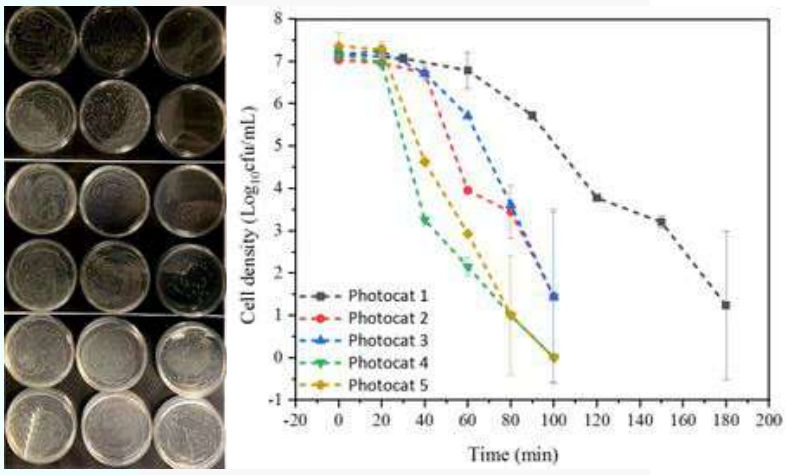
Careful coating design

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 prepared in this project, 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.



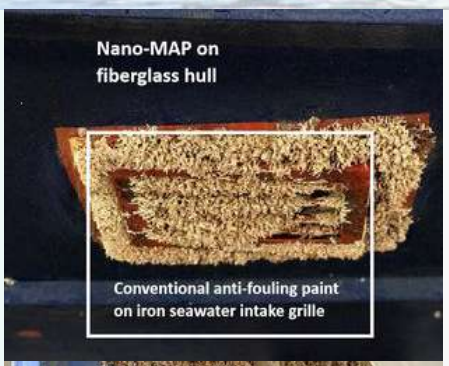


Cultivation of E. coli inactivated by photocatalysts and photocatalytic degradation of E. coli

Specific Nano-MAP formulations have been developed with anticorrosion effect and durability

For metal hull, additional anticorrosion 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-MAP 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-MAP

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

Sanding the Bottom of the Boat

Grind the hull bottom to make it smoother.

Step 3

Remove oysters/pink

Eradicate micro-organisms grown on the hull bottom. Clean water inlet & outlet, propeller, rudder, bow thruster and swimming platform thoroughly.

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

Photocatalytic Nano Antifouling Coating

Apply the 1st Layer of Nano-MAP on the metal parts. Loosen the second layer of Nano-MAP coating after drying.

Step 6

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.

Nano-MAP 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-MAP 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-MAP is more stable with additional water purification function by photocatalytic performance.

Become our happy customer

BEFORE

AFTER

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, Mainland, Republic of China (Taiwan).

Awards

International Award ICAN 2022 Gold Award
2021 Hong Kong Green Innovations Award
2018 & 2019 Hong Kong Awards for Industries
Hanson I&T Outstanding Awards
Energy Saving Championship 2018

Our Super Team

Professor Michael Leung is a Charitable Foundation Professor of Energy and Environment 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.

Michael Leung

Professor

Dennis Leung

Professor

Frank Liang

Consultant

Thank You

In Aviva Yacht Group,

this is a place for all yacht owners to ensure that their valuable investment is properly cared for and maintained. We promise bespoke yacht service.

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