New product highlight

**NEW** Paint for Vessels

**Ultra low Friction Anti-fouling**

**SEAFLO NEO Z**

**SEAFLO NEO SL Z**

**Advanced Fuel-Saving Performance**

New products that are eco-friendly hydrolysis-type anti-fouling ship bottom paints, SEAFLO NEO Z and SEAFLO NEO SL Z were released in September 2013 and April 2014, respectively. Since its release in 2010, the frictional resistance-reducing anti-fouling paint series SEAFLO NEO has been applied to more than 200 large vessels in about 3 years. SEAFLO NEO has received the Minister of Land, Infrastructure, Transport and Tourism Award and also the Minister of the Environment Award for its eco-friendliness. SEAFLO NEO Z and SEAFLO NEO SL Z are new additions to the SEAFLO series, with further advanced fuel-saving performance. SEAFLO NEO Z and SEAFLO NEO SL Z are anti-fouling ship bottom paints that realize ultimately smooth coatings by combining the development philosophy of the SEAFLO NEO series and ultra-smooth anti-corrosion undercoats. Their superb anti-fouling performance has enabled further advanced and longer-lasting fuel-saving performance.

**SEAFLO NEO Z**  
**Innovated Polyester Type**

SEAFLO NEO Z maintains a low-frictional resistance ultra-smooth coating surface for a long time, contributing to reducing the quantity of fuel spent in ship operations. It also has achieved the lowest VOC level in the industry.

**SEAFLO NEO SL Z**  
**Advanced Silyl Type**

SEAFLO NEO SL Z maintains a smooth coating surface through advanced silyl technology and perfect pigment combination. Even smaller amounts of application can enable superb anti-fouling performance for a long time.

The maximum performance is achieved by selecting an appropriate paint according to the vessel type.

<table>
<thead>
<tr>
<th>VLCC</th>
<th>Gas Carrier</th>
<th>SEAFLO NEO SL Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Carrier</td>
<td>PCC</td>
<td>SEAFLO NEO SL Z</td>
</tr>
<tr>
<td>Product Carrier</td>
<td>Chemical Carrier</td>
<td>SEAFLO NEO Z</td>
</tr>
<tr>
<td>Bulk Carrier</td>
<td>General Cargo</td>
<td>SEAFLO NEO Z</td>
</tr>
</tbody>
</table>

3D images of the roughness of coating surfaces analyzed by a laser

**Ultra low FIR anti-corrosive coating**

<table>
<thead>
<tr>
<th><strong>SEAFLO NEO Z</strong></th>
<th><strong>SEAFLO NEO SL Z</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rz: 42μm RSm: 3980μm</td>
<td>Rz: 46μm RSm: 3665μm</td>
</tr>
<tr>
<td><strong>FIR : 1.2%</strong></td>
<td><strong>FIR : 1.5%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current AC + Current AF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rz: 111μm RSm: 3024μm</td>
</tr>
<tr>
<td><strong>FIR : 10.7%</strong></td>
</tr>
</tbody>
</table>

Usually, the coating of ship bottoms is conducted by applying a primer which enhances adhesiveness to the steel surface, followed by an anti-corrosion undercoat to prevent rusting, and then finally anti-fouling ship bottom paint. SEAFLO NEO Z and SEAFLO NEO SL Z enable further advanced fuel-saving performance when used along with CMP’s ultra-smooth anti-corrosion undercoats.
It is said that about 60-80% of the resistance on vessels during operation is attributed to frictional resistance at the hull. Therefore, reducing the frictional resistance greatly contributes to improving the fuel efficiency. Compared with conventional hydrolysis-type paints, the ultra-smooth coating surface of the SEAFLO NEO Z series reduces fuel consumption by up to 8%, which translates into fuel cost savings of several hundred thousand U.S. dollars per paint cycle for a large ship (the value varies depending on the vessel type, size, and operating speed). Needless to say, fuel savings directly translate into conservation of energy resources and reduction of CO₂ emissions proportional to the amount of fuel saved, contributing to the prevention of global warming and to helping to conserve the environment.

**More accurate evaluation of fuel-saving effects**

Frictional resistance is mainly attributed to the roughness (peak height) and wavelength (distance between peaks) of coating surfaces (see the illustration below). Based on numerous experiments and evaluations, CMP has established the FIR theory that calculates frictional resistance from the roughness and wavelength.

The FIR values of CMP’s anti-fouling ship bottom paints shows the increased rates of underwater frictional resistance (i.e., fuel-saving effects).

Through joint research with Tokyo University of Science, Tokyo University of Agriculture and Technology and National Maritime Research Institute, CMP has established the FIR theory that estimates frictional resistance through measurement and evaluation of the roughness and wavelength of coating surfaces. Using this theory, CMP is conducting highly accurate verification of fuel-saving effects.

\[
\text{FIR}(\%) = 2.62 \times \frac{R_z^2}{R_{Sm}}
\]

* With low friction AC

The newly released products SEAFLO NEO Z, SEAFLO NEO SL Z and CMP BIOCLEAN PLUS exhibit extremely low FIR values, indicating promising fuel-saving performance.
New product highlight

Secured the Minister of the Environment Award at the 13th GSC Awards

In May 2014, CMP received the Minister of the Environment Award from the Japan Association for Chemical Innovation at the 13th GSC (Green and Sustainable Chemistry) Awards. The research theme was “Development and practical use of a new paint which enables reduction of VOCs and ship hull friction,” an industry-academia-government collaboration project (Hitachi Chemical Co., Ltd., National Maritime Research Institute, the Cooperative Association of Japan Shipbuilders and Yuge National College of Maritime Technology). The subject of the award was CMP’s fuel efficient anti-fouling paint for the underwater area of ship’s hulls, SEAFLO NEO. SEAFLO NEO was appraised as eco-friendly paint for its performance in significantly reducing VOC (volatile organic compound) levels compared with conventional products and reducing hull friction, which resulted in the award.

This award received for the theme above was the second one following the Minister of Land, Infrastructure, Transport and Tourism Award received in September 2012. Taking the opportunity of the award, CMP will endeavor to further promote its products, and will make every effort to contribute to improving fuel efficiency and assist in preserving the global environment in the marine industry.

NEW Paints for pleasure boats and yachts
Silyl-resin anti-fouling ship bottom paints

Trustable anti-fouling performance backed by substantial past records of application to large ships

SEAJET 039 was added to the SEAJET series of specialized paints for pleasure boats and yachts. SEAJET 039 is a silyl-resin anti-fouling paint that is new to the series. SEAJET 039 is the top-grade anti-fouling paint customized to pleasure boats and yachts, taking advantage of the superior characteristics of silyl resins that are highly valued for use on large merchant vessels and super yachts in Europe.

Silyl-resin anti-fouling ship bottom paints

Silyl resin used in SEAFLO NEO SL Z and SEAJET 039 is a hydrolysis-type resin that has stable physical properties and enables the long-term sustained release of anti-fouling component. CMP’s conventional silyl-resin anti-fouling ship bottom paints such as SEA GRANDPRIX 1000L and SEAFLO NEO SL are regarded as top-grade products by users all over the world.
NEW Paint for Vessels
Silicone foul-release coating

CMP BIOCLEAN PLUS

Top performance anti-fouling paints

CMP BIOCLEAN PLUS is a next-generation silicone elastomer anti-fouling paint that adopts the new technology called PLUS Technology. Coating surfaces that are resistant to the adhesion of slimes and are amenable to the ready washout of such slimes by water flow have been successfully formulated by utilizing the rubber elasticity and water resistance of silicone films (suppresses adhesion of undersea organisms) and a newly developed special polymer that has a protein adsorption inhibition function and a surface activation function. Additionally, the special formulation used for the product enables the effective sustained release of an anti-fouling activator incorporated into the film by a small amount, achieving long-term and stable top-quality anti-fouling performance against various kinds of undersea organisms. Furthermore, the exceptionally smooth surface, characteristic of silicone films, further improves fuel efficiency.

Dynamic monitoring for 28 months (15knots/85%activity)

A seawater immersion test was conducted for test boards under the same conditions as those that sailing ships experience. It can be observed that BIOCLEAN PLUS has high anti-fouling performance against slimes compared with conventional silicone anti-fouling paints. Slimes are slippery substances originating from microorganisms such as algae and fungi. These undersea organisms adhere to and grow on ship bottoms, and interfere with the sailing of ships.

Silicone resin anti-fouling ship bottom paints

There are two major types of anti-fouling mechanisms used in anti-fouling ship bottom paints. One is the hydrolysis (chemical means) type, represented by SEAFLO NEO, where the coating surface slowly dissolves into the seawater along with the anti-fouling ingredient. Another is the silicone-resin (physical means) type, represented by CMP BIOCLEAN PLUS. Silicone resin has a characteristic of repelling the adhesion of substances, due to its rubber-like elasticity and water-repelling function. Silicone resin anti-fouling ship bottom paints are developed by applying various anti-fouling ship bottom paint technologies, such as adhesiveness to anti-corrosion undercoats, applicability and durability, to such silicone resins.

Anti-fouling mechanism of silicone resin anti-fouling ship bottom paints

Even if barnacles adhere to the ship bottom, they will be easily removed by the gravity and the resistance force of the seawater generated by the travel of the ship because the elastic paint film surface does not provide firm footholds for them.