

POLYFLAKE® LLC

MARINE
CORROSION
ENGINEERING

HULL COATING POLYFLAKE® & POLYGLIDE® Underwater Hard-Coating Systems

High performance long term
corrosion protection of
submerged areas



POLYFLAKE® and POLYGLIDE® Underwater Hard-Coating Systems

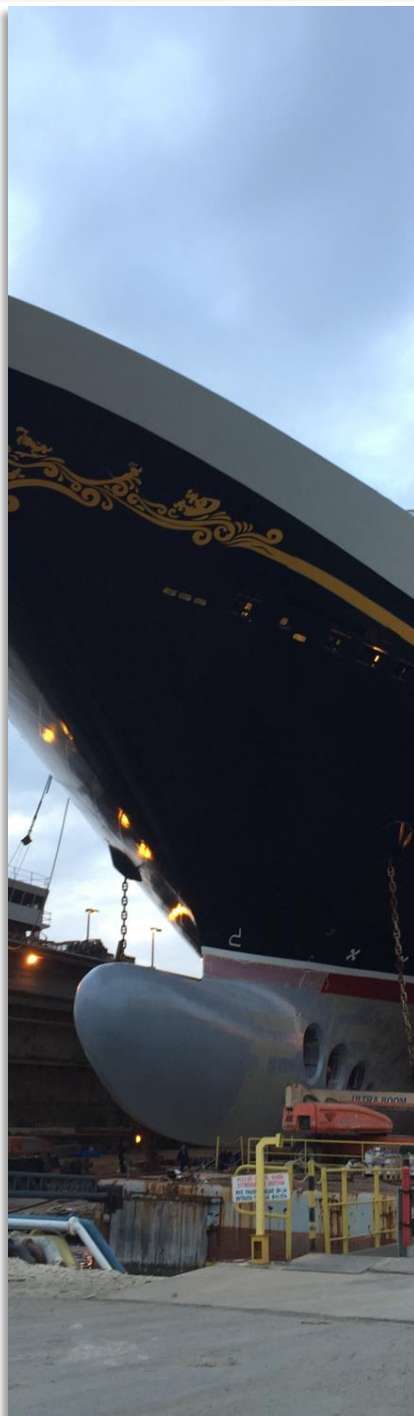
POLYFLAKE® & POLYGLIDE® Underwater Hard-Coating Systems are a technological breakthrough in the corrosion protection of hull submerged areas.

Life expectancy in seawater of the POLYFLAKE® resins has a proven track record that is well over 25 years in continuous cycle 24h / 365 days year without intermediate maintenance⁽¹⁾.

Originally developed for the protection and reconstruction of equipment like pumps, condenser, heat exchangers and evaporators, the POLYFLAKE® Resin Systems has widened the range of applications to critical parts of ships like:

- Crossover pipes
- Tanks
- OVBD and Piping for gas scrubbers
- Rudder, Kort nozzles
- Thruster tunnels
- and all other applications that require effective and long-term protection from seawater, acids, alkalis, and severe problems with cavitation, erosion, and corrosion

NOTE*1: BC-Hydro - Burrard Thermal Power Station seawater cooling system



Key advantages

Operational

- Excellent friction factor, minimal drag
- Long life in seawater
- The bio-fouling takes a longer time to grow in respect to competitor coatings
- Barnacles, mussels and other biotypes don't damage the surface; moreover, their adherence to POLYFLAKE's Hard Coating is minimal, easing the periodical hull cleaning.
- The coating is repairable after years of service minimizing the maintenance cost
- The rapidity of curing minimizes the downtime; the inter coat time is 2 to 3 hours
- Seawater can be applied 24 hours after the last coat.
- In standing water can be applied a sacrificial top layer of antifouling product.

Environmental

- The coating is inert, doesn't release any harmful substance to the ambient
- Minimizes the production of noxious or hazardous waste reducing the disposal cost

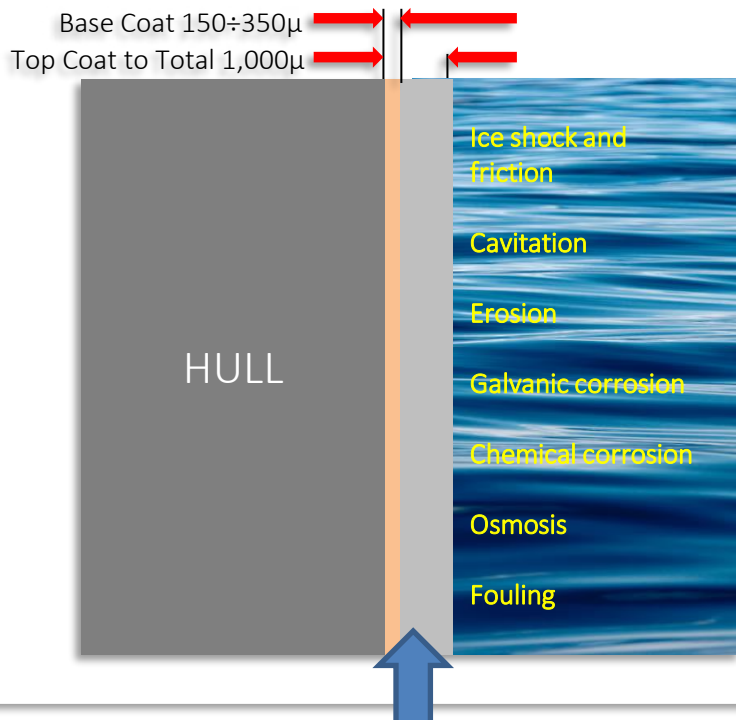
Physical

- Extremely high undercutting and permeation resistance
- Very high electric insulation stops the galvanic corrosion



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Case History



POLYFLAKE® and POLYGLIDE®

The first application of POLYFLAKE® Hard-Coat on the submerged hull, dated 2008, has permitted to repair large areas of the original coating on cruise vessels Disney Magic and Dream.

- During the periodical hull cleaning, the POLYFLAKE® & POLYGLIDE® Underwater Hard-Coating Systems shown, in respect to the original coating, a lower biological growth, a glossy efficient surface, easy to clean and resistant to the cleaning action without damages, no blisters, and a perfect adhesion to the hull. Savings on fuel has also been reported.
- The areas of application have been then extended to the whole hull and rudders.





POLYFLAKE® and POLYGLIDE® Underwater Hard-Coating Systems

POLYFLAKE® & POLYGLIDE® Coating Systems are a long term investment that reduces the maintenance cost of any structure in contact with sea water.

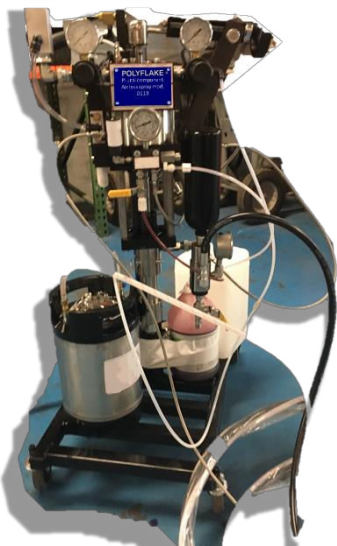
The advantages are:

Low operational cost; repairs are limited to damaged areas by mechanical shock or wear.

The entire surface can be renewed with the application of a new coat on top of the original coat.

Environmentally friendly, no waste to dispose at repairs, the original coat remain in place; definitely less expensive.

POLYFLAKE® Plural-component Airless Spray System



Resins Quality

The core of the POLYFLAKE® & POLYGLIDE® Hard-Coating Systems technology is the quality of the base resin, a bis-phenolic vinyl ester.

POLYFLAKE® C-glass flakes

The 110 and 1110 base coat resins are charged with C-glass short flakes that dispose themselves in a random pattern providing strong equal mechanical properties reacting in all directions.

POLYGLIDE®

The top resins **110T** and the **NO-VOC 1110T** top coats with the new proprietary formulation assures an exceptional low friction factor while the Vinyl Ester based resin grants the well known mechanical and chemical performances of the coating.

Osmosis Barrier

The glass flakes, finely dispersed, constitute a labyrinth that provides an extremely strong barrier to the osmotic permeability; water and oxygen cannot anymore enter in contact with the surface that is fully protected.

Undercutting resistance

The undercutting resistance, given by the extremely high adhesiveness, guarantees that in case of mechanical damage the corrosion is limited only to the affected area and will not propagate anymore.

Reparability

The resin is reversible, therefore the top coat, as the base coat, can be repaired or renewed with a perfect bonding to the surrounding resin also after years in opera.

Extremely long operational life

This means that no complete removal is required of the existing coating back to the metal surface; only the repair of small spots and, in extreme case the cleaning, light sanding and the application of a new top layer of the coating is required limited to the worn areas.

Application method

The coating can be applied by airless spray, brush, roll, and in continuous with the **POLYFLAKE® Plural-component Airless Spray System**;



POLYFLAKE® & POLYGLIDE® Underwater Hard-Coating Systems

Submerged Hull Hard Coatings Suggested best application practices

Can apply on

- Bare metal

After a compatibility and
adhesiveness check:

- On primer
- On existing coating

Surface Preparation

On existing coating:

- Remove blisters, and damaged coating.
- Clean the surface with high pressure water.
- Sweep blast or sand the existing coating found acceptable.

On bare metal:

- Grit-blast SA 2.5 Swedish Standard
- Surface profile 2.5 to 3.0 mils (75 microns).

Surface and ambient conditions

- Apply on dry surface.
- T_{amb} : 3÷5°C above Dew Point
- $T_{surface}$: ≥50°F (10°C)

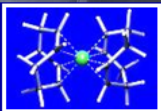


Typical; Physical Properties 100' and 1000' families

Property	Value	Unit	Method
Specific Gravity	1.10 ÷ 1.30	Kg/dm ³	-
	62.43 ÷ 81.2	lb/ft ³	-
Tensile strength	68.95 ÷ 75.84	N/mm ²	-
	10,000 ÷ 11,000	psi	-
Tensile Elongation	0.8 ÷ 1	%	ASTM D.638
Flexural Strength	16,000 ÷ 18,000	psi	-
Flexural Modules	0.03	N/mm ²	-
	4.4	psi	-
Thermal expansion coeff.	6 x 10 ⁻⁵	per °C	-
Heat Distortion	79.5 ÷ 154	°C	-
	175÷310	F	-
Barcoll Hardness	45 ÷ 66	-	Model 934
Abrasion Resistance	0.2772	g/1000 cycles	ASTM E.96
Water Vapor Transmission (Specific Permeability)	0.08 mm/1000 cycles 0.1-0.3		ASTM E.96 ASTM D.967
Salt Spray	No effect	20,000hours	ASTM B1117-5
Thermal shock	No effect	-	-
Tenny Cabin test	300. urs	-82°C	
Adhesive strength VOCs	Nil	-	ASTM D5087-91
Adhesive Strength:			
Carbon Steel	100	Kg/cm ²	
	> 1,500	psi	ASTM D1002
Aluminum	67.9	Kg/cm ²	
	970	psi	

Typical Electrical Properties 100' and 1000' families

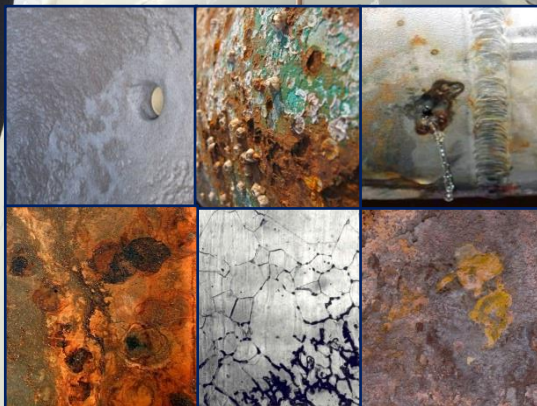
Property	Value	Method
Dielectric Strength	625 V/mils	ASTM D.149
	45 sec (r. surface)	
Arc Resistance	62 sec. (s. surface)	ASTM D.495.58T
Volume Resistivity	30x10 MOhm-Ohm	ASTM D.257.58T
Dielectric Constant	K + 3.64	G. R. Air Cap.



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