GRAPHENE-ENHANCED PLASTICIZERS

"REDEFINING PERFORMANCE IN CEMENT & POLYMER SYSTEMS"

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REWRITING MARINE COATING STANDARDS

- Traditional coatings fail fast and cost high.
- Downtime, dry-docking, frequent repainting, and material degradation are destroying long-term ROI.
- Enter: Graphene & Advanced 2D Materials
  - Exceptional barrier strength
  - High-temperature durability
  - Corrosion and chemical resistance
  - Biomimic antifouling capacity
- RI deliver industry-ready smart coatings, tested across marine conditions.

PERFORMANCE MEETS REGULATION.
TOMORROW'S ANSWER? GRAPHENE.

CORE MARINE CHALLENGES

Problem	Impact	Traditional Response	Gap
Corrosion	Hull & metal fatigue	Barrier or cathodic paints	Short service cycles, poor repairability
Saltwater Oxidation	Chemical degradation	Zinc & epoxy layers	Reapplication, high VOC
Oil & Chemical Spillage	Structural & coating damage	Polyurethane topcoats	Insufficient for oil tankers & rigs
Boiler-Area Heat	Paint bubbling/cracking	Ceramic or dual coat	Adds weight, lacks thermal resilience
VOCs in Paint	Worker health & compliance risk	No alternative	Non-green, regulatory pressure

GRAPHENE-BASED MARINE COATING SOLUTIONS

1. Anti-Corrosion & Salt Protection

rGO integrated coatings = near **zero water and oxygen permeability**

4× longer lifespan than epoxy

2. Oil & Chemical Spillage Resistance

Superhydrophobic surfaces repel organic chemicals

Graphene acts as **nano-barrier** to aromatic hydrocarbons

3. Thermal Resistance for Boilers & Hot Zones

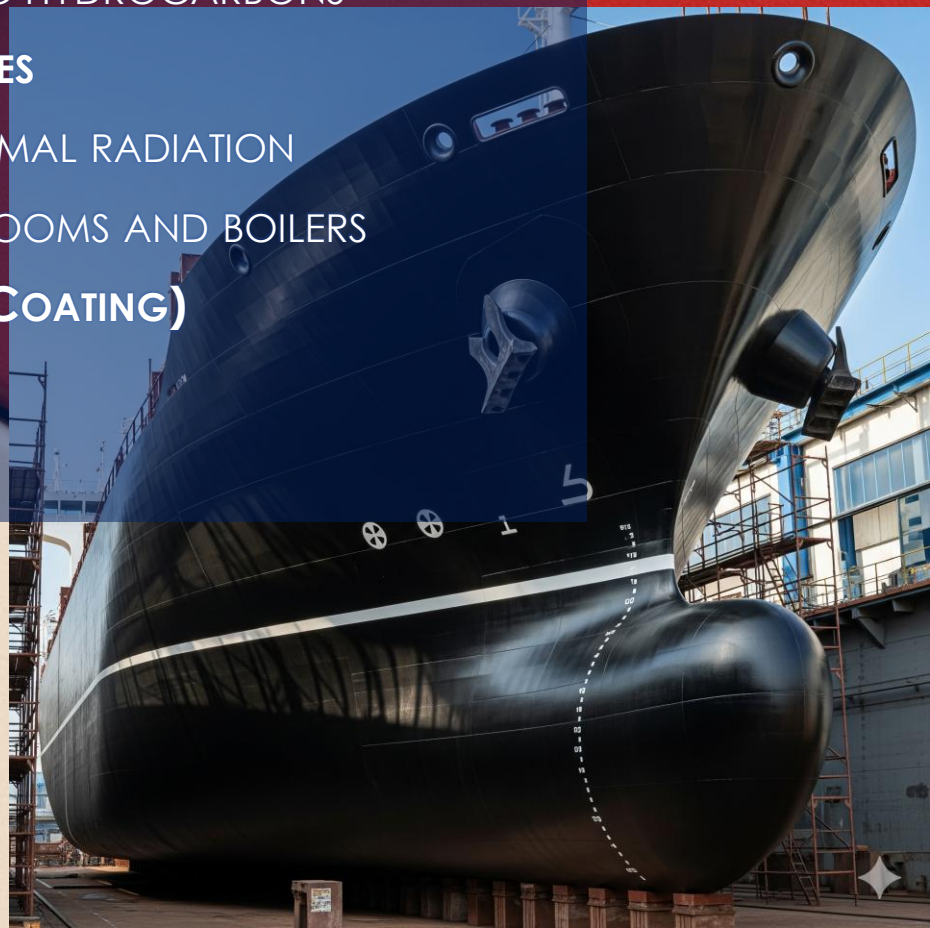
Stable beyond **400°C**, withstands direct thermal radiation

Avoids cracking or bubbling near engine rooms and boilers

4. Fouling Resistance (Biomimic Shark Skin Coating)

Textured surfaces reduce drag

No toxic biocides – green compliance



STRATEGIC INSIGHTS & VALUE ANALYSIS

COST STRUCTURE, ENVIRONMENTAL FOOTPRINT, AND REGULATORY POSITIONING

Metric	Conventional Paint	Graphene Paint
Application Cost	₹150–200/m²	₹250–300/m²
Dry Docking Frequency	Every 2 years	5+ years
Worker Time	8–10 days prep	2–3 days
VOC Emissions	High	Reduced by >80%
Paint Quantity	3–5 coats	1–2 coats
Total Lifecycle Cost	₹600/m²	₹400/m²

NET SAVINGS: ~₹200/M² + BRAND VALUE

COST-TO-VALUE PROPOSITION

OPERATIONAL BENEFITS

REAL-LIFE ADVANTAGES TO SHIPYARDS & OWNERS

Feature	Impact
Worker Efficiency	Fewer coats, lower labor = ₹30–40/m² savings
Surface Flexibility	Applies over composite, steel, aluminum
Life Extension	Extends steel life by 2–3×
Green Certification	Eligible for sustainability ratings & carbon credit schemes
Fuel Savings	5–7% fuel savings via reduced hull drag

MARKET SCALE-UP READINESS

Industrial Trials
Tankers, small naval vessels

Lab Tested
1000+ hour salt spray resistance

Technology Licensing
Available for paint manufacturers

Compatible
With all primer/topcoat

Local Manufacturing
Built for scale with low transport cost

TECHNOLOGY READINESS & BUSINESS COLLABORATION PATH

Application Focus Area	Technology Readiness Level (TRL)	Status	Business Model
1. Anti-Corrosion & Salt Protection	✅ TRL 8–9	*Commercial Grade Paint Ready*	⚙️ **Direct Supply** or 🏷️ **Private Label Licensing**
2. Oil & Chemical Spillage Resistance	🧪 TRL 5–6	*Lab Scale Validated, Field Trials Needed*	🤝 **Joint Pilot Projects with Ship Operators**
3. High-Temperature Resistance (Boilers, Engine Rooms)	✅ TRL 7–8	*Tested & Available for Industrial Use*	📦 **Bulk Supply** or 🔧 **Customized Paint Solutions**
4. Biomimic Shark Skin Antifouling Coating	🧬 TRL 3–4	*Conceptual Design & Prototype Studies Completed*	🧠 **R&D Collaboration with Paint Manufacturers**

RI : END-TO-END MARINE INNOVATION

🔬 RI GROUP: SCALABLE GRAPHENE DERIVATIVES FOR COATINGS (POWDER, DISPERSION, PASTE)

📦 OFF-THE-SHELF + CUSTOM PAINTS FOR:

HULLS
BALLAST TANKS
DECKS
UNDERWATER ZONES
THERMAL CONTROL AREAS

What We Offer	How You Benefit
Tailored graphene formulations	No change to production sequence
Pilot trial support	Test and scale confidently
Multi-grade graphene	Pre-validated for cement and polymers different grades
Mass-production ready	>5 tons/month available on order

📞 CONNECT FOR PILOT DEMOS, COMPATIBILITY MAPPING, OR COLLABORATION 📧

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