

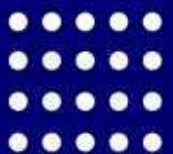
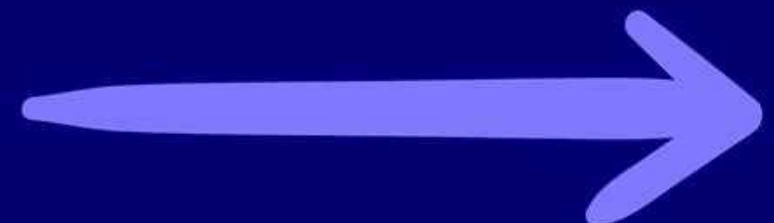
TECHNICAL REVIEW

GELCOATS

The Protective Shield of Composite Surfaces



Prepared by Polres Polyester • 2026



WHAT IS GELCOAT?

Gelcoat is a specialized pigmented resin layer applied to the outer surface of composite materials.

It provides both aesthetic appearance and protection against environmental factors.

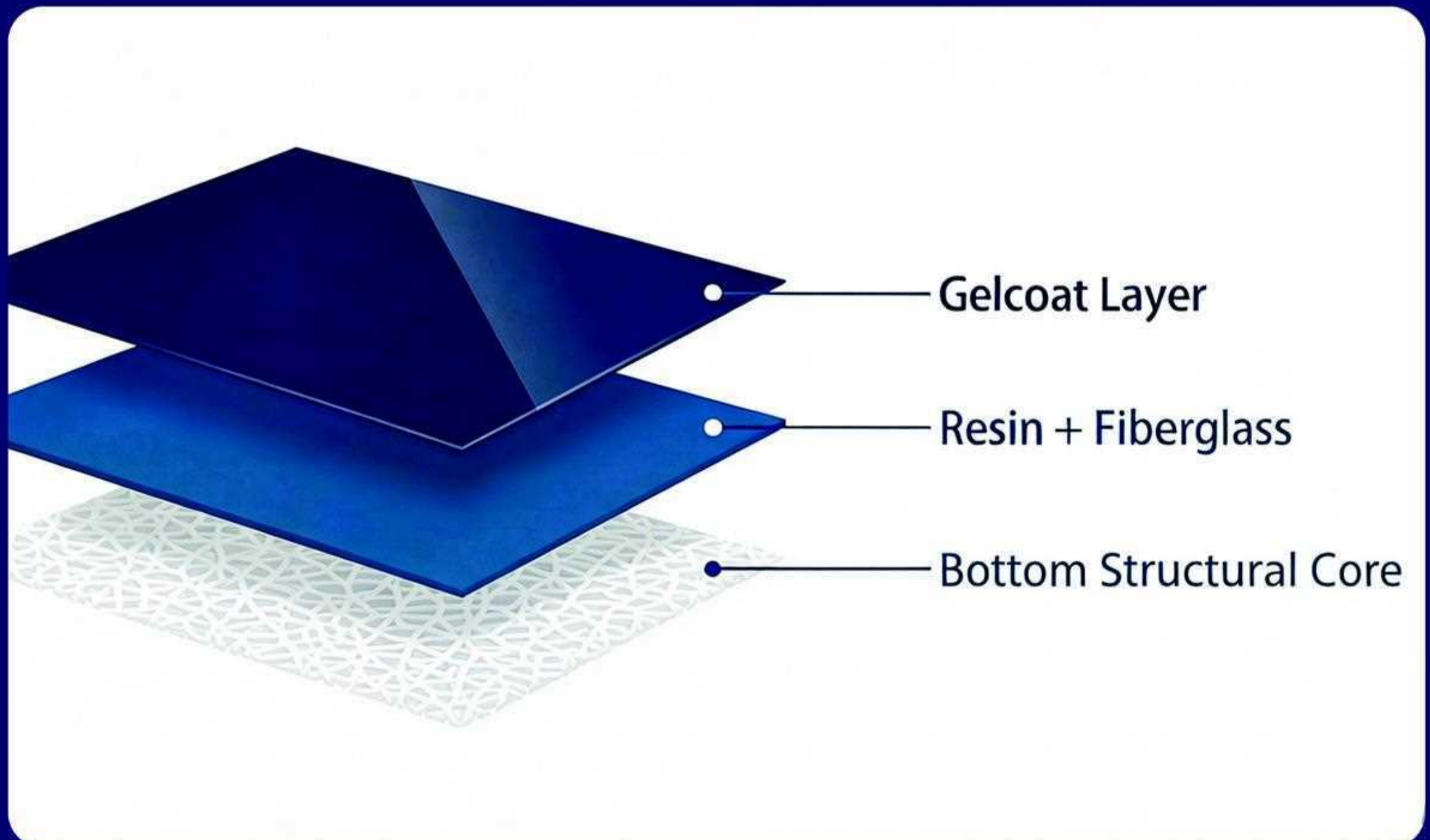
Without gelcoat, composite surfaces are vulnerable to water, UV radiation, and chemicals.

Key functions of gelcoat:

- Water and moisture barrier
- UV protection
- Glossy, smooth finish
- Chemical resistance
- Abrasion resistance

Typical thickness: 0.4 - 0.8 mm

It's the "skin" of the composite — thin but vital.



STRUCTURE & TYPES

KEY COMPONENTS

Resin Matrix

- Unsaturated polyester (standard)
- Vinyl ester (high performance)
- Epoxy (special applications)

Pigments

- Provide color and opacity
- TiO_2 is most common white pigment

Fillers

- Talc, calcium carbonate
- Increase surface hardness

Additives

- Thixotropic agents (anti-sag)
- UV stabilizers
- Air release agents

GELCOAT TYPES

ORTHOPHTHALIC:

Most economical, general purpose

ISOPHTHALIC:

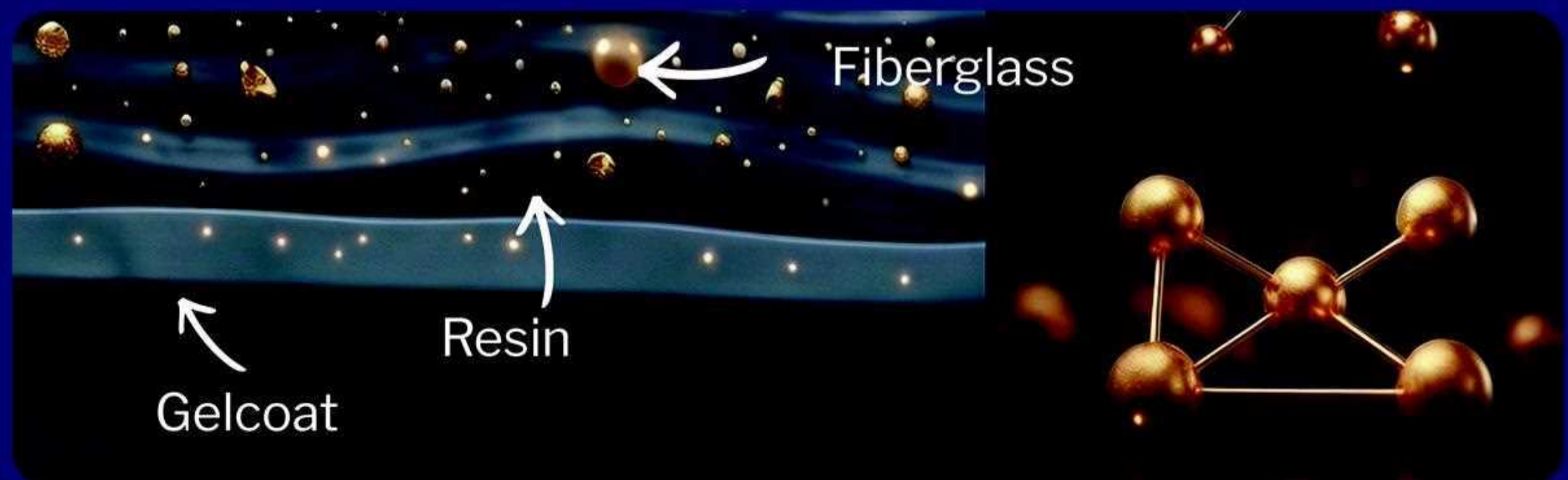
High water and chemical resistance
Marine industry standard

NEOPENTYL GLYCOL (NPG):

Superior weather resistance
Color stable, non-yellowing

VINYL ESTER:

Maximum chemical resistance
For industrial tanks and equipment





APPLICATION METHODS

GELCOAT APPLICATION METHODS

METHOD 1 – BRUSH / ROLLER

Simplest technique. Suitable for small parts and repairs. 2-3 coats applied. Disadvantage: thickness control is difficult.

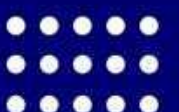
METHOD 2 – SPRAY

Most common professional method. Applied with a special gelcoat gun. Provides uniform thickness. Fast and efficient.

METHOD 3 – POUR (CAST)

Ideal for large flat surfaces. Liquid gelcoat poured and spread on the mold. Excellent surface quality.

CRITICAL POINT: Lamination must begin before the gelcoat fully gels!



DEFECTS & SOLUTIONS

COMMON GELCOAT DEFECTS

PINHOLING (POROSITY)

Air bubbles create tiny holes on the surface. Caused by excessive styrene evaporation or incorrect application.

CRACKING (CRAZING)

Hairline cracks from excessive thickness or impact. Thermal expansion differences can also cause this.

COLOR FADING

Pigments degrade due to long-term UV exposure.

OSMOTIC BLISTERING

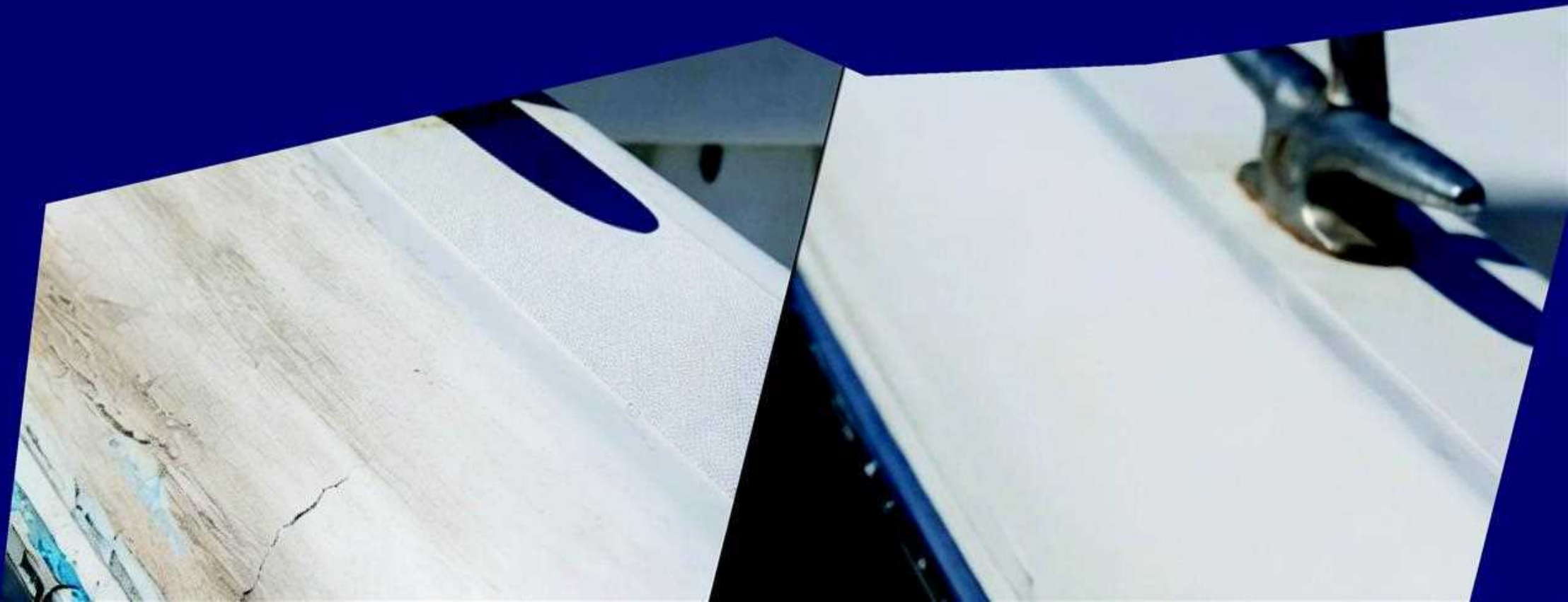
Water molecules penetrate beneath the gelcoat forming blisters. The most feared marine problem.

ADHESION FAILURE

No bond between gelcoat and laminate. Caused by wrong timing or contamination.

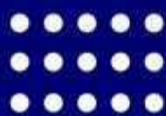
SOLUTION TIPS:

- Correct thickness (0.4-0.8 mm)
- Controlled environment (humidity <70%)
- Proper curing time
- Quality raw materials
- Regular maintenance and polishing





GELCOAT IN THE MARINE INDUSTRY



GELCOAT IN THE MARINE INDUSTRY

Gelcoat is synonymous with marine. It's indispensable for boat and yacht manufacturing.

SEAWATER RESISTANCE

Isophthalic and NPG-based gelcoats provide superior barrier against saltwater and moisture. Prevents osmotic blistering.

INTENSE UV EXPOSURE

Sunlight at sea is much stronger than on land. Quality gelcoats contain UV stabilizers and maintain color for years.

AESTHETIC DEMAND

Yacht owners demand flawless gloss. Gelcoat provides deep shine without the need for paint.

IMPACT RESISTANCE

Flexible yet durable structure is essential against dock impacts and rope abrasion.



AUTOMOTIVE & INDUSTRIAL

AUTOMOTIVE SECTOR

- RV and caravan exterior panels
- Truck cabins
- Bus front panels

Provides Class A surface finish for SMC/BMC parts. Paint-ready smooth surfaces.

Gelcoat advantage: No rust like steel, lighter weight, impact resistant.

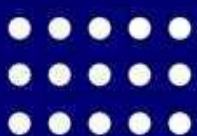
INDUSTRIAL APPLICATIONS

- Chemical storage tanks
- Pipe interior coatings
- Wastewater treatment pools
- Food processing equipment

Vinyl ester gelcoats preferred for chemical resistance. Protection against acids, bases, and solvents.

BUILDING & CONSUMER

- Shower stalls, bathtubs
- Sinks, countertops
- Pool coatings





NEW GENERATION TECHNOLOGIES

BIO-BASED GELCOATS

Plant-based alternatives replace petroleum raw materials. Soybean oil, castor oil, and bio-polyols are now used.

- Carbon footprint 30-50% lower
- Same gloss and durability
- Supports LEED certification

SELF-HEALING GELCOATS

Microcapsule technology enables scratches to heal automatically. When capsules break, released resin fills the gap.

NANO-REINFORCED GELCOATS

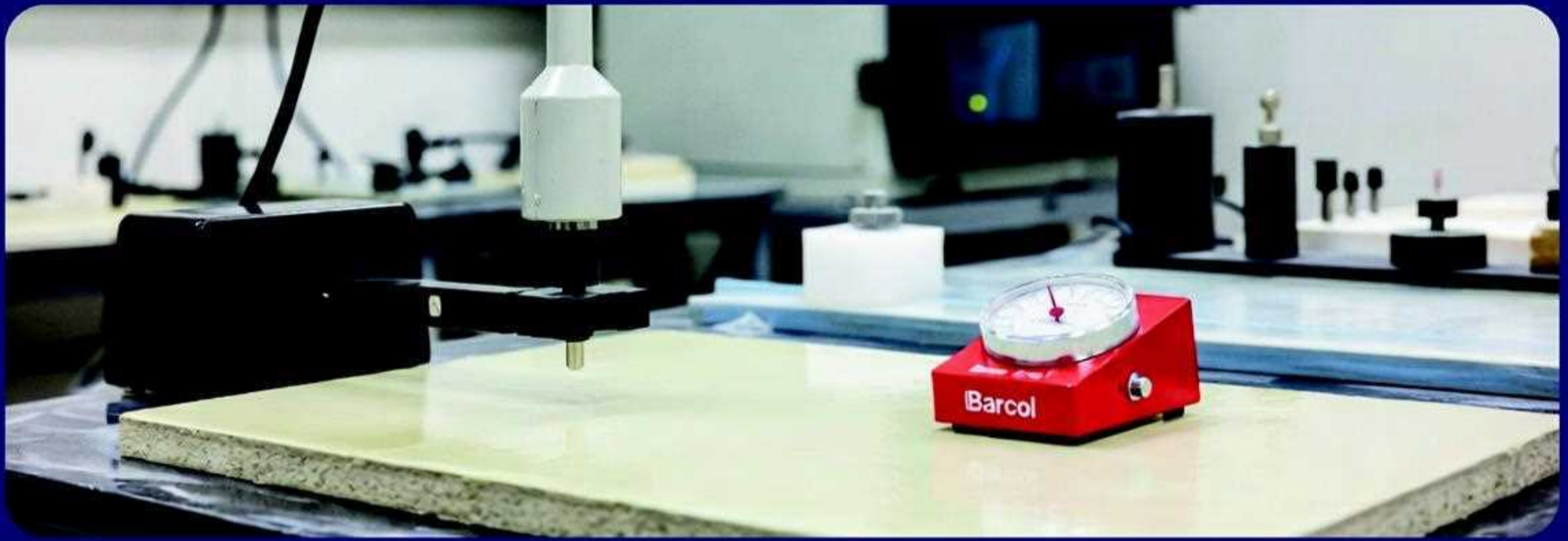
Graphene, nano-silica, and nano-clay reinforced gelcoats offer:

- 3x scratch resistance
- Superior UV protection
- Thinner application possible

RECYCLABLE GELCOATS

Vitrimer chemistry brings gelcoats into the circular economy. A holistic solution to composite waste.





GELCOAT SELECTION & QUALITY CRITERIA

GELCOAT SELECTION & QUALITY CRITERIA

HOW TO CHOOSE THE RIGHT GELCOAT?

- Define the application environment (water, sun, chemicals)
- Assess mechanical demands (flexibility, hardness)
- Consider application method (brush, spray, pour)
- Balance budget and performance

QUALITY TESTS:

- Gloss Measurement (60°): >85 GU
- Barcol Hardness: 35-50 range
- QUV Weathering: 1000+ hours
- Osmosis Resistance (ISO 62): Mass gain <1%
- Impact Resistance (ISO 6272): No cracking
- Tensile Strength (ISO 527): >50 MPa





CONCLUSION

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Gelcoat is the silent hero of the composite world. An invisible but vital shield.

- Combines aesthetics and protection in one layer
- Lasts 20+ years with proper selection and application
- Future-ready with bio-based and smart technologies
- Wide application range from marine to industrial

Remember: The best composite starts from the surface.

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