Nano-Clear®

Nano-Clear SuperCARC® Matte Finish

Extend Painted Surfaces by 15+ Years

Achieve Unmatched **Overcoat** Durability

Military & Industrial Markets

Painted asset owners commonly apply 40 year old CARC technologies (Chemical Agent Resistant Coating) over steel substrates to mitigate the effects of chemical contamination, environmental exposure including oxidation, weather damage, corrosion and desire for better performance. Conventional CARC's alone are currently susceptible to;

- UV degradation
- chemical attack
- chemical absorption
- weathering damage
- corrosion damage

What is needed?

An improved industrial clear matte finish coating that protects military assets more thoroughly than conventional CARC technologies. Nano-Clear SuperCARC will dramatically extend the surface life of conventional CARC by 15+ years.

Nano-Clear SuperCARC®

Nano-Clear **SuperCARC** is designed to be applied directly "**over**" CARC paints, as a clear matte finish **overcoating**. Nano-Clear SuperCARC dramatically extends the service life of painted assets by significantly improving chemical resistance, corrosion resistance, abrasion resistance, scratch resistance, weathering.

Nano-Clear SuperCARC significantly reduces decontamination time while preventing biological agents from penetrating into military paint and allows for easier removal during the decontamination process.

- **Extreme Corrosion Resistance**
  No Rust After 6000 Hour Salt Spray Testing
- **Extreme Abrasion Resistance**
  Only 8.4mg loss after 1000 cycles, 1kg
- **Weatherproof Technology**
  99% Retention after 4000 Hours - Xenon WOM
- **Matte Clear Over Coating**
  Return to Service in 24 hours
- **Reduce Re-Paint Cycle by 2X - 3X**
  As Documented in Production Case Studies
- **Extreme Chemical Resistance**
  Outperformed all CARC Competitors: DoD
- **50% Reduced Cleaning**
  Ice-Repellency
  Water Repellency
  Oil Repellency

What Makes SuperCARC so Unique?

Nano-Engineering Creates Exceptional Crosslink Density

Nano-Clear® SuperCARC is manufactured using proprietary 3D nanostructured polymers - producing extreme crosslink density.

SuperCARC is a two-component clear matte finish over-coating providing extreme corrosion resistance, abrasion, chemical & UV resistance and reduced surface maintenance. SuperCARC penetrates deep into the pores of CARC paints to dramatically improve corrosion resistance, surface hardness, chemical and long-term UV resistance with 50% reduced surface tension.

SuperCARC produces an exceptionally high crosslink dense polymer network designed to withstand harsh environments.

SuperCARC is the world's first clear matte finish designed to be applied directly OVER conventional CARC paints.

Please see the back cover for test results or http://www.nanocoatings.com.

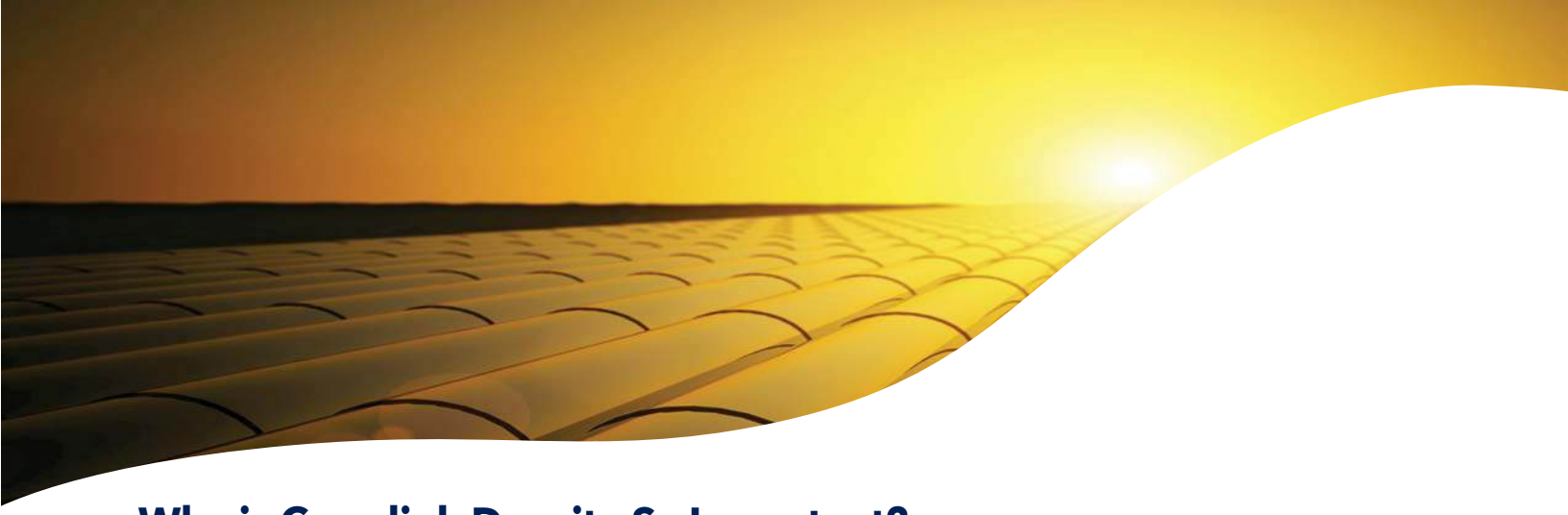
STONEBRIDGE
COATINGS LABORATORY, INC.

Stonebridge Coatings Laboratory has validated Nano-Clear SuperCARC to have the highest scratch resistance and chemical resistance over other leading CARC paints when used alone.

	Sample A Tan CARC	Sample G Tan CARC + SuperCARC
Adhesion	5B	5B
Hardness (Pencil)	2B	>7H
Acid Spot Resistance	No Effect	No Effect
MEK Resistance:		
Double Rubs to Substrate	>200	>1500
Double Rubs to Start of Coating Dissolution	20	>1500
Appearance after 200 DRs	Moderate Burnishing	No Effect
Water Immersion Resistance:		
Visual Observation	No Effect	No Effect
Pencil Hardness	4B	>7H
Adhesion	5B	5B

Nano-Clear®

Nano-Clear SuperCARC Matte Finish is a 2-component multi-functional nanocoating comprised of Nano-Clear NCI Coating @ 100% + Nano-Clear NCIM Matting Additive @ 30% by weight.

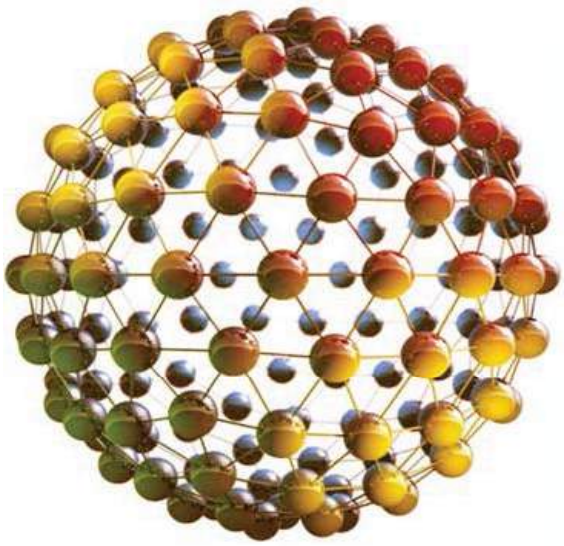


Why is Crosslink Density So Important?

Coatings contain "building blocks" with functional groups. The chemical reaction of these groups during curing forms a network. In most traditional polymers, the network is a linear chain of molecules with low crosslink density.

Linear chain of molecules

Conversely, we "nano-structured" our clearcoat to have a 3D molecular architecture. The 3D polymer network has an exponentially higher number of crosslinked sites. The result is a tightly knit mesh with unprecedented DMA density.



3D molecular architecture

High crosslink density provides highly functional surface properties, including unmatched corrosion resistance, scratch resistance, chemical resistance and UV durability. It also means low surface energy, repelling water (hydrophobic) and aiding in the release of ice, dirt, brake dust, and even concrete dust.

Nano-Clear®

Nano-Clear SuperCARC Matte Finish is a 2-component multi-functional nanocoating comprised of Nano-Clear NCI Coating @ 100% + Nano-Clear NCIM Matting Additive @ 30% by weight.

Nano-Clear® SuperCARC Specifications

Recommended Uses: Newly Painted or Oxidized **CARC** Paints
Chemistry: Nano-Structured Polyurethane / Polyurea Hybrid

PROPERTY/TEST	TEST METHOD	RESULTS	TESTING SOURCE
Crosslink Density	DMA (Dynamic Mechanical Analysis)	2.17 ($X10^3$ mol/m^3)	Nippon Paint
VOC	ASTM D3960	1.25 lb/gal (150 g/l)	Nanovere
Recommended Dry Film Thickness	ASTM D5796	1 mil to 2 mils	Nanovere
Coverage	Nanovere	330 sq ft/gal (at 2 mil)	Nanovere
Gloss 20° / 60°	ASTM D523	0.60 / 1.3	Stonebridge Technical Services
RESISTANCE			
Abrasion Resistance (CS-17, 1 kg, 1000 cycles)	ASTM D4060	8.4 mg loss	Nippon Paint
Pencil Hardness, Scratch	ASTM D3363	7H	Stonebridge
Scratch Hardness	SASO 2833	2500 gm	Saudi Standards, Metrology, & Quality Organization (SASO)
Pencil Hardness, Gouge	ASTM D3363	8H	Stonebridge
Pendulum Hardness (Persoz)	ASTM D4366	> 250 oscillations	Nippon Paint
Impact Resistance 18°C Direct in/lbs	ASTM D2794	50 Pass / 60 Fail	Stonebridge
Impact Resistance 18°C Reverse in/lbs	ASTM D2794	10 Pass / 20 Fail	Stonebridge
Impact Resistance	SASO ISO 3248	1 kg - 160 cm	SASO
Impact Strength	ASTM D2794	145 kg-cm	SASO
Chip Resistance 23°C (2 mils)	ASTM D3170	7A	Stonebridge
Chip Resistance -29°C (2 mils)	ASTM D3170	7B	Stonebridge
Falling Sand Abrasion 100 liters	ASTM D968	Pass	Stonebridge
Mar Resistance	ASTM D5178	5.0 kg	SASO
ENVIRONMENTAL RESISTANCE			
Xenon WOM Resistance 4000 hrs	SAE J1960 ASTM G155	100% Gloss Retention 99% Gloss Retention	Stonebridge Nippon Paint
QUV 313, >1500 hrs	ASTM D4587	100% Gloss Retention	Nippon Paint
Water Immersion Test 240 hrs @ 50°C	ISO 2812-2	Pass	Nippon Paint
Salt Spray, 4000 hrs	SASO ISO 11997	Excellent	SASO
Humidity, 100% RH, 100°F, 240 hrs	ASTM D 1735-02	No loss of adhesion. No change.	American Racing Custom Wheels
CASS 240 hrs @ 50°C	JIS H8502-7	Pass	Nippon Paint
Thermal Shock (100°F 3 hrs, Freeze 3 hrs, Steam Blast 30 sec)	GM9525P	No loss of adhesion. No Change.	American Racing Custom Wheels
CHEMICAL RESISTANCE			
10% Sulfuric Acid	ASTM D 1308	No effect	Stonebridge
10% Hydrochloric Acid	ASTM D 1308	No effect	Stonebridge
10% Sodium Hydroxide	ASTM D 1308	No effect	Stonebridge
10% Ammonium Hydroxide	ASTM D 1308	No effect	Stonebridge
Isopropyl Alcohol	ASTM D 1308	No effect	Stonebridge
Xylene	ASTM D 1308	No effect	Stonebridge
Skydrol® 500 Fluid	ASTM D6943-A	No effect	Stonebridge
MEK Resistance	ASTM 4752	1500 double rubs	Stonebridge
ADHESION, FLEXIBILITY & CLEANING			
Adhesion, Direct to Metal	ASTM D4541	3 Mpa	SASO
Adhesion, Cross Cut	SASO ISO 2409	Rating 10	SASO
Flexibility, 1mm Mandrel	SASO 2833	Passed (Very Good)	SASO
Flexibility, Cylindrical Mandrel	SASO ISO 1519	3 mm Passed (Excellent)	SASO
Flammability: Fire Retardant & Flame Spread	ASTM E84 / BS476	Class 1 (Excellent)	SASO
De-Icing Aid	Coated equipment frozen in 20 ft freezer	It was possible to flake off ice bits and melting was faster.	Schlumberger
Self-Cleaning Properties		Oil & Dirt Release; Hydrophobic, Brake-Dust Release	Nippon Paint
APPLICATION HIGHLIGHTS			
Pot Life	1 Component (1K)	Relative Humidity	20% to 80%
Viscosity	20 cps	Dry Time: Dust Free @ 68-72°F	30 minutes
Spray Applicators	HVLP, Conventional or Airless	Dry-To-Handle @ 68-72°F	4 hours
Wipe-On Application	ShurLine® Deck Pad	Recommended for small areas	Yes
Application Temp	40°F to 90°F		
Operating (Service) Temp	-40°F to 250°F		

Nano-Clear®

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STONEBRIDGE
COATINGS LABORATORY, INC.

Mr. Tom Choate
Nanovere Technologies
4023 S. Old 23, Suite 101
Brighton, MI 48114

Re.: SCLI Job No. 617_146D –Testing of Chemical Agent Resistant Coatings

Dear Mr. Choate:

We have completed the initial screening testing of your chemical agent resistant coatings. Two coated carbon fiber composite samples were received and labeled as CARC and CARC + Nano-Clear SuperCARC Matte over-coating. Table 1 summarizes the samples received. The Sherwin Williams CARC paint was applied as per the enclosed instructions @ 2 mils DFT and allowed to air cure for 24 hours at RT w/50% R.H. The Nano-Clear SuperCARC Matte over-coating was also applied @ 2 mils DFT and allowed to air cure for 24 hours at RT w/50% R.H.

Table 1: Samples

	Sample ID	
	A **SW CARC Only**	**G** **CARC + SuperCARC**
Basecoat	Tan CARC CC-M25 *	Tan CARC CC-M25 *
Topcoat	None	SuperCARC**

* **Sherwin-Williams MIL-DTL-53039E, Type IX**, 1K Aliphatic Polyurethane 3.5 VOC, CARC

** **Nano-Clear SuperCARC Matte Over-Coating**, Nanostructured Polyurethane/Polyurea Hybrid System

The samples were tested for a variety of optical and physical properties. On the following pages, Table 2 lists the tests that were performed while Tables 3 – 5 detail the test results. Test panels will be returned under separate cover.

We thank you for the opportunity to assist you in your testing needs.

Sincerely,

Debora L. Hense

Technical Manager

Table 2: Test Protocol

Property	Test Method
Optical Properties:	
Gloss	ASTM D523
Color	ASTM D2244
Infrared Reflectance	ASTM E-903
Physical Properties:	
Adhesion	ASTM D3359
Hardness (Pencil)	ASTM D3363
Resistance Properties:	
Acid Spot Resistance	MIL-DTL-53039E Sec 4.6.24
MEK Resistance (Double Rubs)	ASTM D4752
Water Immersion Resistance	MIL-DTL-53039 Sec 4.6.22

Regarding optical properties, the 20° and 85° gloss was unchanged by the addition of the topcoat, while the 60° gloss dropped. Color values were not significantly different. Regarding IR reflectance, the topcoat sample was comparable to the control without topcoat from 800 to 1100nm, slightly higher in % IRR from 700 to 800nm and lower than the control for wavelengths greater than 1100nm. Refer to Table 3 for detailed gloss and color measurements and Table 4 for % IR Reflectance.

Table 3: Optical Property Test Results - Gloss & Color

	Sample A Tan CARC	Sample G Tan CARC + SuperCARC
Gloss:		
20°	0.7	0.6
60°	3.6	1.3
85°	7.4	7.8
Color:		
L	65.05	66.66
a	6.36	6.02
b	20.88	20.71

Table 4: Optical Property Test Results – Infrared Reflectance

	Sample A Tan CARC	Sample G Tan CARC + SuperCARC
Wavelength (nm)		
1500	70.76%	59.36%
1467	70.85%	61.55%
1433	71.49%	62.88%
1400	73.98%	66.65%
1367	76.18%	71.32%
1333	76.94%	72.75%
1300	76.94%	73.04%
1267	76.68%	72.04%
1233	74.20%	68.59%
1200	74.52%	69.86%
1167	74.60%	72.21%
1133	72.83%	71.98%
1100	68.72%	68.06%
1067	66.79%	66.79%
1033	65.25%	65.26%
1000	64.14%	64.37%
980	63.55%	63.92%
960	63.10%	63.30%
940	62.43%	62.63%
920	62.48%	62.67%
900	63.33%	63.38%
880	64.10%	64.02%
860	65.25%	65.32%
840	67.19%	67.24%
820	68.90%	68.95%
800	70.16%	70.13%
780	69.73%	70.36%
760	66.54%	67.69%
740	62.03%	63.24%
720	59.31%	60.41%
700	56.86%	58.27%

Regarding physical properties, both the control and topcoat samples showed good adhesion, acid spot and water immersion resistance. The SuperCARC topcoat sample showed superior hardness before and after water immersion and exceptional MEK resistance. The control showed moderate burnishing after 200 MEK double rubs and showed dissolving of the tan coating within 20 MEK double rubs. The SuperCARC topcoat sample was unaffected by >1500 MEK double rubs. Table 5 details these test results.

Table 5: Adhesion, Hardness & Resistance Properties

	Sample A Tan CARC	**Sample G Tan CARC + SuperCARC**
Adhesion	5B	5B
Hardness (Pencil)	2B	>7H
Acid Spot Resistance	No Effect	No Effect
MEK Resistance:		
Double Rubs to Substrate	>200	>1500
Double Rubs to Start of Coating Dissolution	20	>1500
Appearance after 200 DRs	Moderate Burnishing	No Effect
Water Immersion Resistance:		
Visual Observation	No Effect	No Effect
Pencil Hardness	4B	>7H
Adhesion	5B	5B