

# Nanovere Technologies, LLC

## Nano-Clear®

F R O S T  
&  
S U L L I V A N

**Top Innovator Award**  
Nanocoatings / Nanotechnology



F R O S T  
&  
S U L L I V A N

**Technology  
Leadership Award**  
Industrial Corrosion Protection  
Coatings Industry



# Company Background

**Thomas Choate** – Founder & Chief Technology Officer

**In 1986**, Thomas founded Felix Dental Manufacturing (acquired by American Dental in PA) with a focus on research, development and manufacturing of high crosslink density dental composites.

**In 2003**, Nanovere began the research and development of 3D nanostructured polymers and coatings based on the novel concept of “extreme crosslink density to achieve multi-functional properties”.

**2006-2014**: Focus on research, development and joint development agreements (Alcoa Aluminum, Nippon Paint, BASF) and polymer licensing.

**2015-Present**: Focus on manufacturing and supply of multi-functional industrial coatings under the Nano-Clear brand. Nanovere partners with industry specific global partners to market & distribute our technologies.

## ***Core Competency***

- Synthesis of Hyperbranched & Dendritic Polymers
- Development of First-to-Market Coating Technologies
- Manufacture & Supply of Multi-Functional Coatings
- Focus on Core, Partner for Non-Core (industry specific partners)

## ***Market Focus***

- Industrial
- Oil & Gas
- Marine
- Fleet Vehicles
- Military

# Introduction

High value - steel asset owners are burdened with the ongoing cost of corrosion damage, chemical attack, abrasion, water damage, humidity, salts, ice, heat and long-term UV degradation.

Conventional epoxy coatings for example, provide remarkable adhesion and excellent “initial” corrosion resistance and “initial” abrasion and chemical resistance. These epoxy based coated assets begin to fall-short when exposed to harsh UV rays and long-term environmental attack. When these painted assets begin to degrade or chalk from the sun; corrosion resistance and other physical properties become “adversely impacted”.

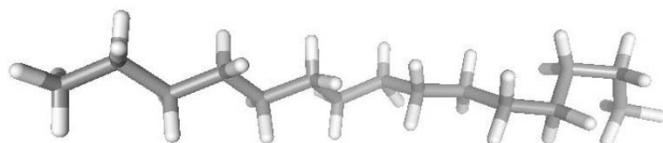
Nano-Clear Coatings were designed to be applied directly “over” epoxy and PU based coatings to combat severe environmental conditions. Nano-Clear Coatings were developed using Nanovere’s own proprietary 3D nanostructured polymers designed to dramatically improve the corrosion resistance, abrasion, chemical & UV resistance of painted assets.



***Nano-Clear Industrial Coatings extend the surface life of painted assets more thoroughly than existing two- or three component coating technologies.***

# Nano-Clear Difference

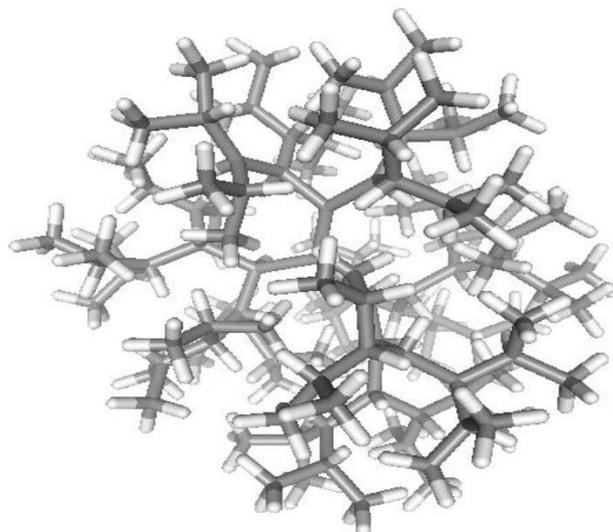
## Conventional Coatings – Linear Chain Molecules



### Conventional Coatings:

- **Poor Crosslink Density =**
- Poor long-term weathering
- Poor corrosion resistance
- Poor chemical resistance
- Poor scratch resistance

## Nano-Clear Coatings – 3D Nanostructured Architecture



### Nano-Clear Coating Benefits:

- **Extreme Crosslink Density =**
- Extreme long-term weathering
- Extreme corrosion resistance
- Extreme chemical resistance
- Extreme scratch resistance
- Flexible due to 3D structure

# Nano-Clear Coating Overview

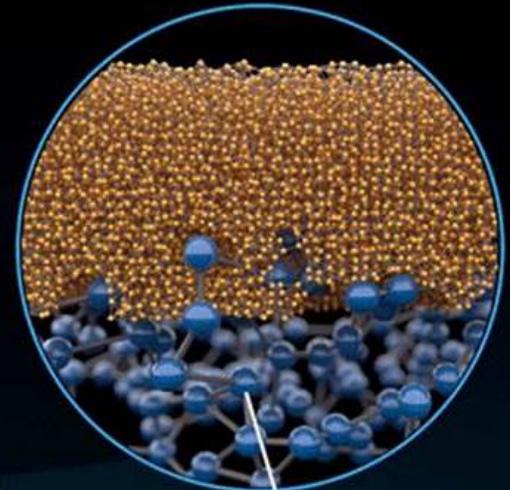
## NCI Application

NANO-CLEAR NCI ENHANCES & EXTENDS THE SURFACE LIFE OF PAINT BY 10+ YEARS



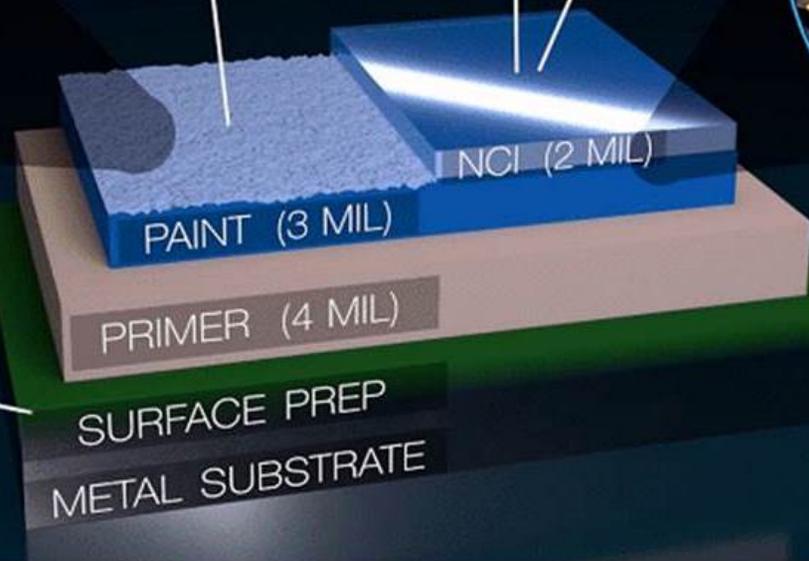
UNTREATED SURFACE

COATED WITH NCI



NCI FORMS A COVALENT BOND WITH PAINT MOLECULES TO ENSURE LONG-TERM ADHESION AND PERMANENCE

METAL SURFACE PREPARATION INCLUDES SAND BLASTING WITH PROPER CLEANING TO REMOVE SURFACE CONTAMINANTS



PAINT (3 MIL)

NCI (2 MIL)

PRIMER (4 MIL)

SURFACE PREP  
METAL SUBSTRATE

# Nano-Clear Coatings

## Multi-Functional Nanocoatings with Remarkable Properties

### High Crosslink Density

- Nano-Structured Polymer Architecture
- High X-Link Density (DMA tested)
- Scratch, Chemical, UV Resistance
- Excellent Corrosion Resistance
- Customized Formulations

### Reduced Surface Maintenance

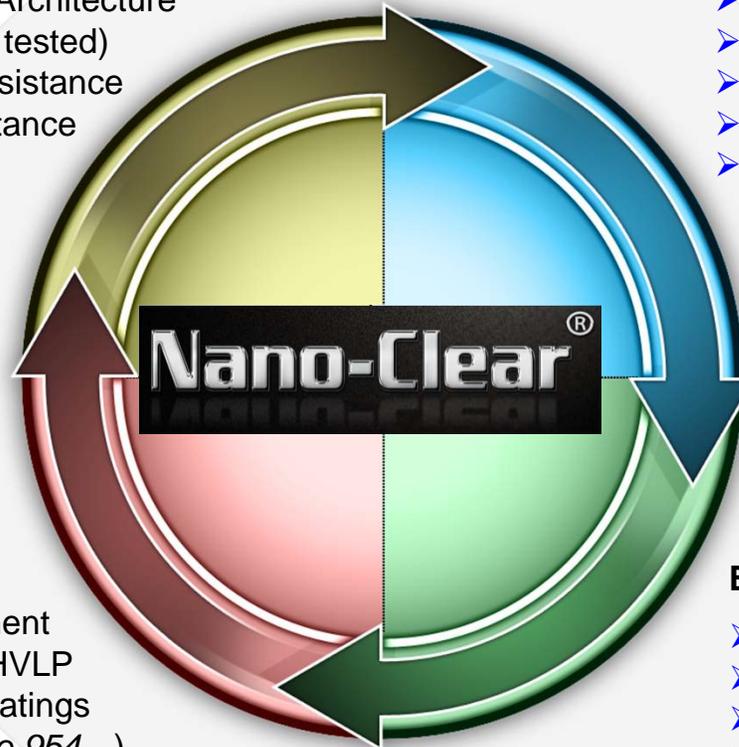
- Oil & Dirt Repellency
- Water Repellency
- Ice Repellency (NCIF)
- Algae Repellency
- Reduced Cleaning

### Application Parameters

- Convenient One Component
- Conventional, Airless or HVLP
- Applied over epoxy topcoatings (*Macropoxy 646, Interzone 954...*), polyurethane topcoatings, gelcoatings, fiberglass, powder coatings, cement...

### Extreme Weathering

- Polyurethane/Polyurea Hybrid
- High UV Resistance
- High Crosslink Density
- Service Range: - 40°F to 400°F
- High Chemical Resistance

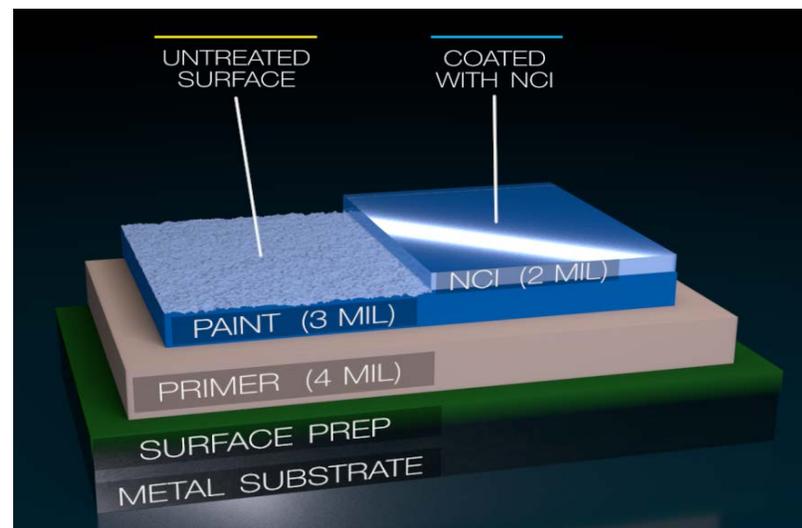


Test Data: <http://www.nanocoatings.com/ncitestdata.pdf>

# Nano-Clear Overview

## Multi-Functional Surface Properties

- High gloss or flat finish 1K solvent borne clear coating
- Extends surface life of new or old paint with 10+ year performance
- Extend Re-Paint Lifecycle by 3X
- Reduce Surface Maintenance by 50%
- Extreme X-link density PU / Polyurea / Polysilane Hybrid Nanocoating
- **Multi-functional surface properties:**
  - Extreme scratch, chemical, corrosion and UV resistance
  - Applied directly over 2K epoxies, 2K PU's, powder coats, cement, wood, fiberglass
  - Can also be applied directly over surface treated aluminum (VV-200)
  - Functional Additives to impart additional "anti-xyz" surface properties
- **Functional Additives:** Accelerator, Matting, Surface Treatment, Fluoropolymer, Anti-Barnacle...
- **Conventional Application Parameters:** HVLP or Airless spray
  - Dust-free in 30 min.
  - Tack-free in 60 min.
  - Handle in 4 hr. (full cure in 24 hours).
- **Application Potential:** Industrial, Industrial Marine, O&G, Military & Fleet customers
- **Package Stability:** 2 years when stored at 4-22°C (39-72°F). High temp formulations marketed.



# Nano-Clear Platform

## Nano-Clear Industrial Coatings

**Nano-Clear<sup>®</sup>**

- Nano-Clear NCI Industrial Coating Platform
- Nano-Clear NCF for Fleet Vehicles
- Nano-Clear NCIF Easy-Clean Coating
- Nano-Clear Matte Finish Coating (SuperCARC)
- Nano-Clear VV-300 Hard Coating for PC & Glass

## Nano-Clear Functional Coating Materials

- Nano-Clear VV-200 Surface Treatment for Metal
- Nano-Clear NCIM Functional Matting Additive
- Nano-Clear NCA Accelerator
- Nano-Clear NCFP Easy Clean Additive

# Competitive Analysis

Property	Method	Nano-Clear® NCI Coating	Axalta IMRON® 2.1 HG-C	Axalta IMRON® 3.5 HG-D	PPG Amercoat PSX® 700
Mfg. Recommended Use		Newly Painted or Sanded Oxidized	Newly Painted Only	Newly Painted Only	Newly Painted Only
Polymer Chemistry		Nanostructured Polyurethane / Polyurea Hybrid	Polyurethane Copolymer	Polyurethane	Epoxy Polysiloxane Hybrid
Mixing Ratio	Ratio	1K - no mixing	1K – no mixing	2:1 Mix Ratio	4:1 Mix Ratio
Recommended Dry Film Thickness (mils)	ASTM D5796	2 mil	3 mils	5 mils	5 mils
Pencil Hardness	ASTM D3363	4H - 7H	H	F	N/A
Pendulum Hardness (Persoz)	ASTM D4366	220	N/A	24	N/A
Abrasion Resistance (CS-17, 1 kg, 1000 cycles)	ASTM D4060	8.4 mg loss	N/A	N/A	53 mg loss
Impact Strength (kg-cm)	ASTM D2794	> 140	> 160	> 100	N/A
Water Immersion Test	ISO 2812-2	Pass	Pass	Pass	Pass
QUV Resistance (> 1500 hours)	ASTM D4587	100%	94%	90%	50%
Xenon WOM (> 2000 hours)	ASTM G155	99%	N/A	N/A	N/A
MEK Resistance	ASTM D4752	>1500	>200	>100	>100
Salt Spray (5000 hours)	ASTM B-117	No rust, no blisters.	No rust, no blisters.	No rust, no blisters.	No rust, no blisters.
DMTA – Crosslink Density	XLD (X103 mol/m3)	2.17	N/A	N/A	N/A
<b>Competitive Commentary</b>		<i>Nano-Clear has been awarded the NACE Innovation of the Year Award for Corrosion, F&amp;S Technology Leadership Award and PaintSquare Top Product Award for Steel.</i>	<i>NCI has 4X better scratch resistance, but similar UV resistance to Imron.</i>	<i>NCI has 5X better scratch resistance, similar UV resistance + 50% less DFT.</i>	<i>NCI has 6X better abrasion resistance, 50% better UV resistance + 50% less DFT.</i>

# Strategic Partnership



*Henkel AG & Co. KGaA, commonly known as Henkel, is a German multinational chemical and consumer goods company headquartered in Düsseldorf, Germany. It is active in both the consumer and industrial sectors. Revenues of 20 Euros in 2021.*

## **Background:**

- *Henkel is the global leader in metal surface treatments*
- *Desire to market innovative coatings applied over conventional industrial paints*

**Solution:** *Henkel partnered with Nanovere to private label Nano-Clear Coatings under the Loctite PC brand.*

[https://dm.henkel-dam.com/is/content/henkel/LOCTITE\\_PC4400\\_Product\\_information\\_sheet](https://dm.henkel-dam.com/is/content/henkel/LOCTITE_PC4400_Product_information_sheet)

# Nano-Clear Case Study



*Diamond Offshore Drilling, Inc. is a leader in offshore drilling, providing contract drilling services to the energy industry around the globe with a total fleet of 16 offshore drilling rigs, consisting of 12 semisubmersibles and four dynamically positioned drill ships.*

## **Technical / Business Challenge**

- *Improve Overall Safety & Appearance for Fleet of Lifeboats*
- *Significantly Reduce Repaint & Polishing Lifecycles*
- *Reduce Safety Inspections of Lifeboats*

**Solution:** *Diamond Offshore tested and validated Nano-Clear NCI on pilot lifeboats in 2018. Diamond Offshore approved the implementation of NCI on the entire fleet of lifeboats aboard 16 drill ships.*

# Nano-Clear Case Study



**GENCO SHIPPING & TRADING**

*Genco Shipping & Trading Limited is a leading provider of international seaborne drybulk transportation services. Genco transports iron ore, coal, grain, steel products and other drybulk cargoes along worldwide shipping routes.*



## **Technical / Business Challenge**

- *Reduce Costly Re-paint Cycles on Fleet of 56 ships*
- *Reduce Corrosion Damage*
- *Improve Brand Appearance*
- *Reduce Barnacle Formation / Energy Costs*

**Solution:** *Genco Shipping tested Nano-Clear NCI Coating over a two-component epoxy using a wet-on-wet application method. Genco approved and implemented Nano-Clear NCI on Baltic Hare ship deck in China.*

# Nano-Clear Case Study



*Pemex is the largest company in Mexico. It operates through the whole chain of value of the industry, from exploration and production -upstream- to industrial transformation, logistics and marketing –downstream.*

## **Technical / Business Challenge**

- *Significantly Reduce Corrosion Costs of AST Farms*
- *Reduce Repaint Cycles using Epoxy only*
- *Reduce AST Surface Maintenance Costs*

**Solution:** *Pemex performed multiple pilots of Nano-Clear NCI with various industrial assets over a 2 year testing period. NCI exceeded all technical specifications when applied directly over Interzone 954 using a wet-on-wet application method. Pemex approved NCI for use over all newly painted AST's.*

# Nano-Clear Case Study

**TOSHIBA**  
Leading Innovation >>>



*Toshiba International Corporation (TIC) is a Toshiba America Inc. (TAI) Group Company comprised of Motors & Drives, Automotive Systems, Power Electronics and Transmission & Distribution.*

## **Technical / Business Challenge**

- *Plant Floor Safety Line Degradation due to High-Low Abrasion*
- *Significantly Reduce Epoxy Repaint Cycles*
- *Reduce Plant Down-Time due to Repainting*

**Solution:** *Toshiba production facility in TX began testing Nano-Clear NCI over epoxy based plant flooring back in 2014. NCI proved to have dramatically higher abrasion resistance than epoxy alone. NCI has significantly reduced Toshiba's plant floor - safety line repaint cycles.*

# Nano-Clear Case Study



Altec is a leading provider of products and services to the electric utility, telecommunications, tree care, lights and signs, and contractor markets. Altec delivers products and services to more than 100 countries throughout the world.

## ***Technical / Business Challenge***

- *Extend the Surface Life of Altec New Vehicle Builds*
- *Improve Overall Brand Appearance*
- *Significantly Reduce Costly Repaint Cycles due to Corrosion*

***Solution:*** *Altec tested and validated Nano-Clear NCI for corrosion, scratch, chemical and UV resistance over a 1 year period. NCI exceeded Altec's technical specifications and approved the use of Nano-Clear NCI over all newly manufactured vehicles.*



# Nano-Clear Case Studies / Partners



**STERLING CRANE**

# Nano-Clear Resources

- **Nanovere Website:** <https://www.nanocoatings.com>
- **Nanovere History:** <http://www.nanocoatings.com/history>
- **Nano-Clear Overview:** <http://www.nanocoatings.com/technical>
- **Case Studies:** <http://www.nanocoatings.com/casestudies>
- **Nano-Clear Test Data:** <http://www.nanocoatings.com//mt-content/uploads/2022/10/ncitestdata.pdf>
- **Video Library:** <https://www.youtube.com/user/nanovere>
- **Technical Data Sheet:** <http://www.nanocoatings.com/mt-content/uploads/2022/10/ncitds.pdf>
- **Nano-Clear SuperCARC:** <http://www.nanocoatings.com/mt-content/uploads/2022/10/supercarc.pdf>
- **Safety Data Sheet:** <http://www.nanocoatings.com/mt-content/uploads/2022/10/ncisds.pdf>
- **Application Process:** <http://www.nanocoatings.com/mt-content/uploads/2022/10/nciapplication.pdf>
- **Industrial Brochure:** <http://www.nanocoatings.com/mt-content/uploads/2022/10/ncibrochure.pdf>
- **Marine Brochure:** <http://www.nanocoatings.com/mt-content/uploads/2022/10/ncbrochure.pdf>
- **Oil & Gas Brochure:** <http://www.nanocoatings.com/mt-content/uploads/2022/10/ncobrochure.pdf>
- **Fleet Brochure:** <http://www.nanocoatings.com/mt-content/uploads/2022/10/ncfbrochure.pdf>