American NanoMyte™  
A Subsidiary of NEI Corporation  
Anti-Corrosion Coatings  

Corrosion inhibiting chromate-free nanocomposite pretreatments and nanoparticle primer additive for structural metals  

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# Anti-Corrosion Coatings

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NEI Corporation Spins Out American NanoMyte (Formerly NEI Corrosion Technologies)

• **Experience** in developing, manufacturing and distributing nanoscale materials for a broad range of customers around the world.

• **Expertise** in nanoparticle synthesis, surface modification and coatings, and nanotechnology-based formulations.

• **Nanomyte™** line of products, developed by creating nanostructures and modifying them through novel chemistry, fall into two broad categories:

  - **Additives** - nanomaterials tailored to meet the specific performance and manufacturing requirements of our customers
  - **Alternates** - nanoscale counterparts of microscale materials
Small Technology for Big Applications

Nanotechnology enables control of matter and material properties at the nanometer scale.

- **High Barrier to Entry**
- **Tune Process Conditions**
- **Sustainable Competitive Advantage**
- **Control Properties**
- **Customize Performance**
American NanoMyte’s Mission

- Use NEI’s proprietary nanotechnology to create custom products that meet or exceed the demanding anti-corrosion requirements encountered in diverse military and commercial (dual-use) applications:

  - Aerospace
  - Marine
  - Automotive
  - Industrial
  - Construction
  - Medical

- Leverage and build on NEI’s unique abilities to functionalize inorganic nanoparticles and disperse them in organic (polymeric) matrices to create nanocomposite (hybrid) structures for anti-corrosion applications.

- Continuously strive to provide value to our customers by offering differentiated nanotechnology-enabled products that solve their relevant corrosion problems.
Corrosion Protection Coating Components

- Topcoat
- Primer
- Pretreatment

Metal Alloy
American NanoMyte’s Coating System

- **Self-Healing Topcoat**
  - UV protection, scratch resistance and aesthetic appearance

- **Chromate-Free Primer**
  - Corrosion protection

- **Self-Healing, Chromate-Free Pretreatment**
  - Adhesion and corrosion protection

- Metal Alloy
Nanomyte™ Anti-Corrosion Coatings: Focus on Pretreatments and Primers

- Chromate-free conversion coatings and coating additives
- Formulations designed to inhibit corrosion in lightweight metals (aluminum, magnesium) and steel alloys
- Provide exceptional adhesion strength and barrier protection
- Exhibit self-healing (damage responsive) behavior

![Diagram showing pretreatment, primer, and metal substrate layers]
The Nanomyte Advantage: Chromate-Free, Self-Healing Barrier Coating Inhibits Corrosion
The Opportunity

• **Increase use of lightweight metals**
  - Aluminum and magnesium alloys
  - More prone to corrosion

• **Phase out chromates**
  - Carcinogen
  - Exposure limits reduced from 50 to 5 µg/m³
  - No suitable alternative to chromate conversion coating

• **Extend life of coatings and metal parts**
  - Need for self-healing non-chromate conversion coatings
  - Reduce environmental concerns (eliminate abrasion blasting)
  - Push paint rework out in time (improve abrasion blasting)
Nanomyte Pretreatment Products

- Nanomyte™ PT-10 for aluminum alloys
- Nanomyte™ PT-15 for magnesium alloys
Nanomyte Pretreatment Performance

**ASTM B-117 Salt Spray Test**
- Pretreatment only – Metal surfaces remain bright with no corrosive degradation observed
- Pretreatment + Primer – Pass 2,000 hours of the test

**ASTM D-3359 Tape Adhesion Test**
- Pretreatment significantly improves adhesion between metal and coating

**ASTM D-522 Bend Test**
- Pretreatment does not affect flexibility of primer coatings
Nanomyte PT-10 on Aluminum
Nanomyte pretreatment shows no visible sign of corrosion compared to chromate.

Salt water immersion of aerospace aluminum for 2 weeks.
Significant improvement of adhesion between aluminum and primer coating

Coating applied over non-abraded aluminum alloy

Coating applied over abrasion blasted aluminum alloy

Coating applied over Nanomyte PT-10 pretreatment

ASTM D-3359 adhesion test on marine aluminum. Panels soaked in water for 24 hrs at 37°C before the test.
Pretreatment significantly enhances adhesion after 4 weeks in salt spray test.

- Primer and topcoat delaminate on untreated aluminum panels.
- Primer (yellow) remains intact on Nanomyte PT-10 treated aluminum panels.
Nanomyte PT-15 on Magnesium
Nanomyte has better corrosion resistance than non-chrome pretreatment

Pretreated magnesium panels after salt water immersion for 120 hours

NOTE: The black discoloration on the chromate sample is a protective oxide film that protects Mg from corrosion
Nanomyte PT-15 performs well on E-coated Mg panels after 6 weeks in salt spray test

Untreated Mg

Non-Chromate Std.

Nanomyte PT-15
Adding nanoparticles to primer reduces blistering on Mg in salt water immersion test.
Optical micrographs of artificial defect: Primer with nanoparticles shows corrosion inhibition.

Substrate: Mg AZ91D

Before salt water immersion:
- Primer as is
- Primer with nanoparticles

After 48-hr salt water immersion:
- Primer as is
- Primer with nanoparticles

Corrosion observed before immersion in salt water.

No corrosion observed after 48-hr salt water immersion.
Summary: Nanomyte Pretreatments

- Nanomyte chromate-free pretreatments inhibit corrosion on aluminum and magnesium as well as other non-chromate products and may be able to replace hazardous chromate conversion coatings.
- Formulations are compatible with conventional coating methods. The pretreatment generally forms a thin layer with a thickness of 0.5 - 2 microns. It provides excellent adhesion to the primer and barrier protection, in addition to inhibiting corrosion through self-healing.
- An additional advantage of our pretreatment is the elimination or augmentation of physical surface preparation via abrasion blasting prior to chemical coating. This process improvement can result in significant savings and benefit to the user.
Summary: Nanomyte Primers

• Functionalized nanoparticle additives are being developed that can be easily incorporated and dispersed into primer coating formulations in the same manner as conventional corrosion inhibiting pigments.

• The additives are completely chromate-free and economical, potentially allowing for the use of a thinner primer coating.

• American NanoMyte can work with you on your specific primers to introduce corrosion inhibiting functionalities.
Business Partnerships Add Value

• We provide value by customizing solutions and seamlessly integrating our nano-engineered materials into customers’ products.

• We are currently seeking development partners for our anti-corrosion coatings. Sample requests are welcome.
Two-Step Approach to Collaborative Product Development

(1) First we engage with customers in a simplified technical development program at low cost and with short time frames to develop custom solutions for their specific end-user applications.

(2) Concurrently with the technical initiative we work with business development staff to formulate long term Business Agreement options.

Common business relationships that we typically consider include:
- Supply of tonnage quantity pretreatments and primer-additives
- License manufacture of pretreatment and primer-additives to you
- Transfer intellectual property via a one-time sale
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