**Dry film property**                       | **Nano-Clear** | **Test Method**       
---|---|---
Pencil Hardness         | 4H             | ASTM D3363            
Pendulum Hardness (Persoz) | > 250           | ASTM D4366            
Abrasion Resistance (CS-17, 1kg, 1000 cycles) | 8.4 mg          | ASTM D4060            
Impact Strength (kg-cm)  | > 140           | ASTM D2794            
Water immersion test (240 hours @ 50°C)     | Pass            | ISO 2812-2             
CASS @ 50°C             | Pass 240 hr.   | JIS H8502-7           
% Gloss retention (> 1500 hours QUV 313)     | > 100           | ASTM D4587            
% Gloss retention (> 4000 hrs Xenon WOM)     | > 99            | ASTM G155             
MEK resistance          | > 1500          | ASTM D4752            
Salt Spray              | Pass 4000 hr.  | ASTM B117             

*Testing performed by Nippon Paint Singapore*  
Dr. Daniel Wang, Principal Scientist  

**Nano-Clear for Industrial Applications**  
**Product # NCI Test Data**
Summary of Macro-Testing of Diamond-like Coatings

Alcoa Team: Dr. Skiles & Dr. Sullivan
Nanovere: Thomas Choate, CTO

[Table]

<table>
<thead>
<tr>
<th>Supplier</th>
<th>PreTreatment</th>
<th>Coating</th>
<th>Pencil</th>
</tr>
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<tr>
<td>Nanovere</td>
<td>F-PAA</td>
<td>Vecrod 164-50</td>
<td>6H</td>
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<tr>
<td>Nanovere</td>
<td>Non-Chrome (ALX009)</td>
<td>Vecrod 164-50</td>
<td>4H</td>
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<td>Nanovere</td>
<td>Cleaned Only</td>
<td>Nano-Clear NCI-RC</td>
<td>4H</td>
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<td>Nanovere</td>
<td>Cleaned Only</td>
<td>Vecrod 164-50</td>
<td>3H</td>
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<tr>
<td>Nanovere</td>
<td>Chrome Conv.</td>
<td>Vecrod 164-50</td>
<td>3H</td>
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<tr>
<td>Nanovere</td>
<td>SAA type II</td>
<td>Vecrod 164-50</td>
<td>3H</td>
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<td>Cleaned Only</td>
<td>Vecrod X-SC2K</td>
<td>3H</td>
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<td>Nanovere</td>
<td>R-995</td>
<td>Vecrod 164-50</td>
<td>2H</td>
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<td>Nanovere</td>
<td>Cleaned Only</td>
<td>Vecrod 164-50</td>
<td>2H</td>
</tr>
<tr>
<td>Nanovere</td>
<td>R-995</td>
<td>Vecrod 164-50</td>
<td>F</td>
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# Characteristics

<table>
<thead>
<tr>
<th>SIno</th>
<th>Method of Tests</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Polyurethane White without Nano-Clear NCI</td>
<td>Polyurethane White with Nano-Clear NCI</td>
</tr>
<tr>
<td>2</td>
<td>SASO 2833</td>
<td>SASO 2833</td>
</tr>
<tr>
<td>3</td>
<td>SASO 2833</td>
<td>SASO 2833</td>
</tr>
<tr>
<td>4</td>
<td>ASTM D4060</td>
<td>ASTM D4060</td>
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<tr>
<td>5</td>
<td>ASTM D5178</td>
<td>ASTM D5178</td>
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<td>6</td>
<td>SASO 2833</td>
<td>SASO 2833</td>
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<td>7</td>
<td>SASO 2833</td>
<td>SASO 2833</td>
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<td>8</td>
<td>ASTM D4752</td>
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<td>SASO 2833</td>
<td>SASO 2833</td>
</tr>
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<td>10</td>
<td>ASTM D4541</td>
<td>ASTM D4541</td>
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<td>11</td>
<td>SASO ISO 15184</td>
<td>SASO ISO 15184</td>
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<td>12</td>
<td>SASO ISO 2409</td>
<td>SASO ISO 2409</td>
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<tr>
<td>13</td>
<td>SASO ISO 1519</td>
<td>SASO ISO 1519</td>
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<td>14</td>
<td>SASO ISO 3248</td>
<td>SASO ISO 3248</td>
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<tr>
<td>15</td>
<td>BS476 / ASTM E84</td>
<td>BS476 / ASTM E84</td>
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<tr>
<td>16</td>
<td>SASO ISO 11997</td>
<td>SASO ISO 11997</td>
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<tr>
<td>17</td>
<td>SASO ISO 16474-2</td>
<td>SASO ISO 16474-2</td>
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Nano-Clear NCI & BASF Automotive OEM - Dynamic Mechanical Analysis (DMA) results (31/10/2013)

Request No. NTP13126

Report No. PR-NT-13-121

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Sample Name</th>
<th>System</th>
<th>Tg by DMA (°C)</th>
<th>T'<em>{E'} at T'</em>{E'} \text{min} (MPa)</th>
<th>X-linking density by DMA, (X10^3 mol/m^3)</th>
<th>E' at 40°C, MPa</th>
<th>E'' at 40°C, MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>R13879</td>
<td>Nano-Clear NCI</td>
<td>1K Air Cure (72°F)</td>
<td>96.1</td>
<td>150</td>
<td>1.51</td>
<td>813.7</td>
<td>173.1</td>
</tr>
<tr>
<td>R13724</td>
<td>BASF Auto OEM</td>
<td>1K High Bake (285°F)</td>
<td>59.75</td>
<td>109</td>
<td>0.49</td>
<td>389.9</td>
<td>170.3</td>
</tr>
</tbody>
</table>
General Dynamics Land Systems
6000 E. 17 Mile Road
Sterling Heights, MI 48313

Nanovere Technologies, LLC.
4023 S. Old US 23, Suite 101
Brighton, MI 48114
C/O: Dennis Haag / Tom Choate

RE: GD Corrosion Resistance Certification

Dear Dennis & Tom,

Our test data showed that the steel part after primer and top coat with your Nano-Clear NCI product has no sign of corrosion after 4193 hrs. This is very unusual for steel parts to pass 4000 hrs based on my past experiences with coatings. For Aluminum / Titanium joints, no sign of corrosion after 4193 hrs, indicates that this coating is well suited for dissimilar metal joint protection.

I would recommend sharing this data with ARL (Army Research Laboratory) and further evaluation through ARL. The Aluminum / Magnesium tests we are performing will also provide more information after we are done - so more supporting information will be available later.

Thank you for your support.

Jing Zhang
CBRN and HazMat
Mechanical Systems & Materials
General Dynamics Land Systems
6000 E. 17 Mile Road
Sterling Heights, MI 48313
Mr. Thomas Choate  
Nanovere Technologies  
4023 S. Old US 23, Suite 101  
Brighton, MI  48116

We have completed 4,000 hour weatherometer (WOM) testing of your Nano-Clear NCI. It was compared to PPG’s CeramiClear product and an OEM clearcoat from DuPont. In all categories tested, the Nano-Clear NCI product performed better than or equivalent to the PPG and DuPont products. Nano-Clear NCI performed exceptionally well after 4,000 hours of WOM exposure. Refer to Table 3 for detailed test results.

Table 1 details the clearcoats that were tested along with their physical properties. All tests were performed on the Nano-Clear NCI and PPG clearcoats (A & B) and some additional tests were performed on the DuPont OEM clearcoat (C).

<table>
<thead>
<tr>
<th>Sample Clearcoat</th>
<th>A Nano-Clear</th>
<th>B D8126/D8226</th>
<th>C Acrylic Silane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>Nanovere Technologies</td>
<td>PPG Industries</td>
<td>DuPont</td>
</tr>
<tr>
<td>% Non-Volatile (Weight)</td>
<td>37%</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>% Non-Volatile (Volume)</td>
<td>---</td>
<td>49.8%</td>
<td>---</td>
</tr>
<tr>
<td>Volatile Organic Content less Exempts</td>
<td>Solvents are VOC Exempt</td>
<td>2.01 lbs/gal</td>
<td>---</td>
</tr>
<tr>
<td>Mix Ratio (by Volume)</td>
<td>1</td>
<td>2 : 1</td>
<td>---</td>
</tr>
<tr>
<td>Potlife @ 68 °F / 20 °F</td>
<td>No Potlife</td>
<td>1 hour</td>
<td>---</td>
</tr>
<tr>
<td>Recommended Dry Film Thickness</td>
<td>2 mils</td>
<td>2 - 2.5 mils</td>
<td>---</td>
</tr>
<tr>
<td>Dry Times:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dust-Free @ 68-72 °F</td>
<td>30 minutes</td>
<td>30 minutes</td>
<td>---</td>
</tr>
<tr>
<td>Dry-to-Handle @ 68-72 °F</td>
<td>4 hours</td>
<td>4 hours</td>
<td>---</td>
</tr>
<tr>
<td>Dry-to-Handle @ 150 °F</td>
<td>30 minutes</td>
<td>30 minutes</td>
<td>---</td>
</tr>
</tbody>
</table>

STS #306_1C
Clearcoats A and B were mixed according to their directions and applied to coated steel panels, within 15 minutes of mixing, using wire wound applicator method. They were allowed to flash off for 3 – 5 minutes prior to baking for 30 minutes at 150°F. They were aged for 24 hours under ambient conditions prior to testing. Total clearcoat thickness for both clearcoats was 1.9 – 2.1 mils. Table 2 details the test panels that were prepared.

Table 2: Test Panels

<table>
<thead>
<tr>
<th>Panel ID</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearcoat</td>
<td>Nano-Clear</td>
<td>D8126/D8226</td>
<td>RK8010A DuPont</td>
</tr>
<tr>
<td>Basecoat Code</td>
<td>542AC301 White</td>
<td>542AC301 White</td>
<td>542AC301 White</td>
</tr>
<tr>
<td>Primer</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>E-Coat</td>
<td>ED6060</td>
<td>ED6060</td>
<td>ED6060</td>
</tr>
<tr>
<td>Pretreatment</td>
<td>B952 P60 DIW: Unpolish</td>
<td>B952 P60 DIW: Unpolish</td>
<td>B952 P60 DIW: Unpolish</td>
</tr>
<tr>
<td>Substrate</td>
<td>Cold Rolled Steel</td>
<td>Cold Rolled Steel</td>
<td>Cold Rolled Steel</td>
</tr>
<tr>
<td>ACT Labs Product ID No.</td>
<td>APR45582</td>
<td>APR45582</td>
<td>APR44364</td>
</tr>
</tbody>
</table>

Panels were tested for appearance, mechanical and durability properties similar to those required of BMW. Descriptions of test methods can be found at the end of this report.

The Nano-Clear showed superior cold temperature chip resistance, direct and reverse impact resistance compared to the CeramiClear and OEM clearcoats. It showed slightly more haze than the CeramiClear product. Both Nano-Clear and CeramiClear showed no breakthrough of clearcoat after exposure to 100 liters of sand via the Falling Sand Abrasion Test. The OEM clearcoat failed after 100 liters.

The initial 20° gloss of the OEM clearcoat was slightly higher than the other clearcoats, but the Nano-Clear (A) showed the best gloss retention (100%) after 4,000 hours of WOM exposure. It had similar color change than the DuPont OEM and PPG CeramiClear clearcoats. The CeramiClear showed better gloss retention than the control with little color change. Table 3 details the test results.

Please call me should you have questions or comments at (810) 750-0040. Thank you for the opportunity to perform the above work for Nanoverene Technologies, Inc.

We look forward to working with you in the future.

Sincerely,

Debora L. Hense
Consultant

Table 3: Detailed Test Results
## Clearcoat Manufacturer Cure Schedule

<table>
<thead>
<tr>
<th>Clearcoat</th>
<th>A Nano-Clear</th>
<th>B CeramiClear</th>
<th>C Acrylic Silane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>30' @ 150°F</td>
<td>30' @ 150°F</td>
<td>DuPont OEM</td>
</tr>
<tr>
<td>DFT (mils)</td>
<td>2.0 +/- 0.1</td>
<td>2.0 +/- 0.1</td>
<td>2.0 +/- 0.1</td>
</tr>
</tbody>
</table>

### Scrape Adhesion per ASTM D2197

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratch</td>
<td>0.25 Kg</td>
<td>0.10 Kg</td>
<td></td>
</tr>
<tr>
<td>Gouge</td>
<td>&gt; 11 Kg</td>
<td>&gt; 11 Kg</td>
<td></td>
</tr>
</tbody>
</table>

### Chip Resistance Per ASTM D3170 *

| Room Temperature (23°C) | 7A | 6A | 6A |
| Cold Temperature (-29°C) | 7B | 5B | 5B |

### Falling Sand Abrasion per ASTM D968 (100 Liters)

|       | Pass | Pass | Fail |

### Impact Resistance per ASTM D2794 at -18°C

| Direct (inch-pounds) | 50P / 60F | 30P / 40F | 40 P / 50F |
| Reverse (inch-pounds) | 20F / 10P | 5F | 5F |

### Humidity Resistance per ASTM D4585

| 500 Hours - Blistering per ASTM D714 | No Effect | No Effect | No Effect |
| 500 Hours - Appearance | No Effect | No Effect | No Effect |

### Transmission & Haze per ASTM D1003

| Haze (%) | 1.29 | 1.09 |
| Total Luminous Transmittance (%) | 89.18 | 89.91 |
| Diffuse Transmittance (%) | 1.15 | 0.98 |

### WOM Resistance per SAE J1960

| 20° Gloss - Initial | 82.0 | 82.4 | 87.8 |
| 20° Gloss - 500 Hours | 88.0 | 86.8 | 88.0 |
| 20° Gloss - 1,000 Hours | 95.0 | 91.0 | 95.0 |
| 20° Gloss - 2,000 Hours | 83.5 | 79.9 | 84.0 |
| 20° Gloss - 3,000 Hours | 83.4 | 77.9 | 82.4 |
| 20° Gloss - 4,000 Hours | 83.1 | 78.4 | 80.8 |
| % Gloss Retention - 4,000 Hours | 100% | 95% | 92% |
| ΔE - 500 Hours | 0.35 | 0.27 | 0.61 |
| ΔE - 1,000 Hours | 0.41 | 0.35 | 0.44 |
| ΔE - 2,000 Hours | 0.55 | 0.48 | 0.32 |
| ΔE - 3,000 Hours | 0.57 | 0.48 | 0.30 |
| ΔE - 4,000 Hours | 0.63 | 0.48 | 0.41 |

* Number & Letter Categories for Chip Ratings:

<table>
<thead>
<tr>
<th>Rating</th>
<th>No. of Chips</th>
<th>Chip Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
<td>A = &lt;1 mm</td>
</tr>
<tr>
<td>9</td>
<td>1 - 4</td>
<td>B = 1-3 mm</td>
</tr>
<tr>
<td>8</td>
<td>5 - 9</td>
<td>C = 3-6mm</td>
</tr>
<tr>
<td>7</td>
<td>10 - 24</td>
<td>D = &gt;6mm</td>
</tr>
<tr>
<td>6</td>
<td>25 - 49</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>50 - 74</td>
<td></td>
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<tr>
<td>4</td>
<td>75 - 99</td>
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<tr>
<td>3</td>
<td>100 - 150</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>151 - 250</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>&gt; 250</td>
<td></td>
</tr>
</tbody>
</table>
DESCRIPTION OF TEST METHODS

**Chip Resistance** – Per ASTM D3170. This method covers the determination of the resistance of coatings to chipping damage by stones or other flying objects. One pint of standardized road gravel (~ ½” diameter) was projected by means of controlled air blast (70 +/- 5 psi) at the panels. One set was tested under ambient conditions and another set tested at -29°C +/- 2°C. After gravel blast, tape is applied and removed from the surfaces. The panels are rated using visual standards in the test method. They are summarized below:

<table>
<thead>
<tr>
<th>Rating</th>
<th>No. of Chips</th>
<th>Chip Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
<td>A = &lt;1 mm</td>
</tr>
<tr>
<td>9</td>
<td>1 - 4</td>
<td>B = 1-3 mm</td>
</tr>
<tr>
<td>8</td>
<td>5 - 9</td>
<td>C = 3-6mm</td>
</tr>
<tr>
<td>7</td>
<td>10 - 24</td>
<td>D = &gt;6mm</td>
</tr>
<tr>
<td>6</td>
<td>25 - 49</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>50 - 74</td>
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<td>75 - 99</td>
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<td>3</td>
<td>100 - 150</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>151 - 250</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>&gt; 250</td>
<td></td>
</tr>
</tbody>
</table>

**Delta E (ΔE)** – Per SAE J1545. This method measures the color of the exposed samples and the color of the unexposed samples and calculates a color difference (ΔE) by the square root of the sum of the squares of the delta L*, a* and b* values obtained from the color measurements.

**Falling Sand Abrasion** – Per ASTM D968 Method A. This method covers the determination of the resistance of organic coatings to abrasion produced by abrasive sand falling onto coatings applied to a plane, rigid surface. A specified amount of sand was allowed to fall from a specified height through a guide tube onto the panels until a minimum of 4mm area of clearcoat was removed. This is the end point.

**Gloss** – Per ASTM D523. This method covers the measurement of specular gloss of non-metallic specimens for glossmeter geometries 20°, 60° and 85°.

**Humidity Resistance** – Exposure per ASTM D4585. This practice covers basic principles and operating procedures for testing water resistance of coatings using controlled condensation. A vapor temperature of 60°C was maintained for the duration of testing. Immediately upon removal from the humidity chamber, the panels were observed for defects including blisters, blushing, color change, rust, water spots, etc. If no defects were observed, the panels were rated as PASS.

**Impact Resistance** – Per ASTM D2794. This method covers a procedure for rapidly deforming by impact a coating film and its substrate. A standard weight is dropped a distance so as to strike an indenter that deforms the coating and the substrate. The indentation can be either an intrusion (direct impact) or extrusion (reverse impact). Films generally fail by cracking. The results are reported as the maximum number of inch-pounds of force applied to the coating and substrate at which the coating does not crack (P for pass) or when the coating cracks (F for fail).

STS #306_1C
Scrape Adhesion – Per ASTM D2197. This method covers the determination of the adhesion of organic coatings when applied to smooth, flat (planar) panel surfaces. The adhesion is determined by pushing the panels beneath a rounded stylus or loop that is loaded in increasing amounts until the coating is removed from the substrate surface. Two measurements were recorded, the first the load at which marring of the surface was observed, and the second the load at which the clearcoat was removed by the stylus.

Transmission & Haze – Per ASTM D1003. This method covers the evaluation of specific light-transmitting and wide-angle-light-scattering properties of the planar sections of materials. The clearcoats were drawn down over glass panels, cured and measured.

Weatherometer Resistance – Exposure per SAE J1960. This method covers the practices and procedures for the simulated weathering of coated panels.
<table>
<thead>
<tr>
<th>Sample</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearcoat</td>
<td>Nano-Clear</td>
<td>CeramiClear</td>
<td>SB Acrylic Silane</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Nanoverge</td>
<td>PPG</td>
<td>Melamine OEM</td>
</tr>
<tr>
<td>Cure Schedule</td>
<td>30' @ 150°F</td>
<td>30' @ 150°F</td>
<td>DuPont</td>
</tr>
<tr>
<td>Clearcoat DFT (mils)</td>
<td>1.8 - 2.0</td>
<td>1.8 - 2.0</td>
<td>2.1 - 2.0</td>
</tr>
<tr>
<td>Gloss per ASTM D523</td>
<td>86.0 / 92.2</td>
<td>85.8 / 92.0</td>
<td>88.1 / 94.1</td>
</tr>
<tr>
<td>Adhesion per ASTM D3359 Method B to White (A1 &amp; B1)</td>
<td>5B / 100%</td>
<td>5B / 100%</td>
<td>5B / 100%</td>
</tr>
<tr>
<td>Adhesion per ASTM D3359 Method B to Silver (A2 &amp; B2)</td>
<td>0B / 0%</td>
<td>0B / 0%</td>
<td>---</td>
</tr>
<tr>
<td>Pencil Hardness - Scratch per ASTM D3363</td>
<td>4H</td>
<td>F</td>
<td>4H</td>
</tr>
<tr>
<td>Pencil Hardness - Gouge per ASTM D3363</td>
<td>5H</td>
<td>3B</td>
<td>2B</td>
</tr>
<tr>
<td>Pencil Hardness - Gouge per ASTM D3363 After 24 Hr. Recovery</td>
<td>2H</td>
<td>3B</td>
<td>2B</td>
</tr>
<tr>
<td>Taber Abrasion per ASTM D4060 (mg lost per 1,000 cycles)</td>
<td>19.85</td>
<td>36.20</td>
<td>52.20</td>
</tr>
<tr>
<td>Impact Resistance per ASTM D2794 - Initial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct (inch-pounds)</td>
<td>150 Fail / 140 Pass</td>
<td>90 Fail / 80 Pass</td>
<td>50 Fail / 40 Pass</td>
</tr>
<tr>
<td>Reverse (inch-pounds)</td>
<td>160 Pass</td>
<td>120 Fail / 100 Pass</td>
<td>10 Fail / 5 Pass</td>
</tr>
<tr>
<td>Impact Resistance per ASTM D2794 - After 48 Hrs. @5°F (2500lbs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct (inch-pounds)</td>
<td>70 Fail / 60 Pass</td>
<td>60 Fail / 50 Pass</td>
<td>20 Fail / 10 Pass</td>
</tr>
<tr>
<td>Reverse (inch-pounds)</td>
<td>5 Fail</td>
<td>5 Fail</td>
<td>5 Fail</td>
</tr>
<tr>
<td>Flexibility per ASTM D522</td>
<td>Pass 1/4</td>
<td>n/a</td>
<td>Fail 3/4&quot; / Pass 1&quot; **</td>
</tr>
<tr>
<td>Chemical Spot Resistance per ASTM D1308</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10% Sulfuric Acid</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>10% Hydrochloric Acid</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>10% Sodium Hydroxide</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>10% Ammonium Hydroxide</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>Isopropyl Alcohol</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>Xylene</td>
<td>No Effect</td>
<td>Slight Softening</td>
<td>Slight Swelling</td>
</tr>
<tr>
<td>Xylene (24 hour recovery)</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>MEK</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>Skydrol 500 Fluid Resistance per ASTM D6943 Method A</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>MEK Resistance per ASTM D4752 (Double Rubs)</td>
<td>&gt; 1,500</td>
<td>260</td>
<td>&gt; 1,500</td>
</tr>
</tbody>
</table>
July 17, 2017

Mr. Tom Choate  
Nanovere Technologies  
4023 S. Old 23, Suite 102  
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 NCIM Matt Clear. 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 Nanovere NCIM Matte Clear Coating was also applied @ 2 mils DFT and allowed to air cure for 24 hours at RT w/50% R.H.

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<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SW CARC Only</td>
<td>CARC + NCIM Matt Clear</td>
</tr>
<tr>
<td>Basecoat</td>
<td>Tan CARC CC-M25 *</td>
<td>Tan CARC CC-M25 *</td>
</tr>
<tr>
<td>Topcoat</td>
<td>None</td>
<td>NCIM Matt Clear**</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optical Properties:</strong></td>
<td></td>
</tr>
<tr>
<td>Gloss</td>
<td>ASTM D523</td>
</tr>
<tr>
<td>Color</td>
<td>ASTM D2244</td>
</tr>
<tr>
<td>Infrared Reflectance</td>
<td>ASTM E-903</td>
</tr>
<tr>
<td><strong>Physical Properties:</strong></td>
<td></td>
</tr>
<tr>
<td>Adhesion</td>
<td>ASTM D3359</td>
</tr>
<tr>
<td>Hardness (Pencil)</td>
<td>ASTM D3363</td>
</tr>
<tr>
<td><strong>Resistance Properties:</strong></td>
<td></td>
</tr>
<tr>
<td>Acid Spot Resistance</td>
<td>MIL-DTL-53039E Sec 4.6.24</td>
</tr>
<tr>
<td>MEK Resistance (Double Rubs)</td>
<td>ASTM D4752</td>
</tr>
<tr>
<td>Water Immersion Resistance</td>
<td>MIL-DTL-53039 Sec 4.6.22</td>
</tr>
</tbody>
</table>

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

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<th>Sample G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tan CARC</td>
<td>Tan CARC with NCIM Matt Clear</td>
</tr>
<tr>
<td><strong>Gloss:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20°</td>
<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>60°</td>
<td>3.6</td>
<td>1.3</td>
</tr>
<tr>
<td>85°</td>
<td>7.4</td>
<td>7.8</td>
</tr>
<tr>
<td><strong>Color:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>65.05</td>
<td>66.66</td>
</tr>
<tr>
<td>a</td>
<td>6.36</td>
<td>6.02</td>
</tr>
<tr>
<td>b</td>
<td>20.88</td>
<td>20.71</td>
</tr>
</tbody>
</table>
# Table 4: Optical Property Test Results – Infrared Reflectance

<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>Sample A Tan CARC</th>
<th>Sample G Tan CARC w/ NCIM Clear</th>
</tr>
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<tr>
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</tr>
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<tr>
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<td>69.86%</td>
</tr>
<tr>
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</tr>
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<td>63.10%</td>
<td>63.30%</td>
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<tr>
<td>940</td>
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<tr>
<td>920</td>
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<td>62.67%</td>
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Table 5: Adhesion, Hardness & Resistance Properties

<table>
<thead>
<tr>
<th></th>
<th>Sample A Tan CARC</th>
<th>Sample G Tan CARC with NCIM Matt Clear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesion</td>
<td>5B</td>
<td>5B</td>
</tr>
<tr>
<td>Hardness (Pencil)</td>
<td>2B</td>
<td>&gt;7H</td>
</tr>
<tr>
<td>Acid Spot Resistance</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>MEK Resistance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Rubs to Substrate</td>
<td>&gt;200</td>
<td>&gt;1500</td>
</tr>
<tr>
<td>Double Rubs to Start of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coating Dissolution</td>
<td>20</td>
<td>&gt;1500</td>
</tr>
<tr>
<td>Appearance after 200 DRs</td>
<td>Moderate Burnishing</td>
<td>No Effect</td>
</tr>
<tr>
<td>Water Immersion Resistance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Observation</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>Pencil Hardness</td>
<td>4B</td>
<td>&gt;7H</td>
</tr>
<tr>
<td>Adhesion</td>
<td>5B</td>
<td>5B</td>
</tr>
</tbody>
</table>
## Nano-Clear NCI for Industrial - Ammon Painting Restoration & Abatement

### Summary of Bridge Testing, MoDOT Chemical Laboratory

<table>
<thead>
<tr>
<th>Test Panels</th>
<th>Test Conditions</th>
<th>Test Method</th>
<th>Testing Time</th>
<th>Test Results Nano-Clear NCI</th>
<th>Test Results Conventional Topcoat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating applied over existing paint system</td>
<td>UV Exposure / Condensation</td>
<td>ASTM G154</td>
<td>2000 hr.</td>
<td>PASS</td>
<td>Fail</td>
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<td></td>
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<td></td>
<td>No Weathering Observed</td>
<td></td>
</tr>
<tr>
<td>Coating applied over existing paint system</td>
<td>Salt Fog Exposure / Corrosion Resistance</td>
<td>ASTM B117</td>
<td>2000 hr.</td>
<td>PASS</td>
<td>Fail</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No Weathering or Corrosion Observed</td>
<td></td>
</tr>
<tr>
<td>Coating applied over existing paint system</td>
<td>UV Exposure on MoDOT Laboratory Roof</td>
<td>NONE</td>
<td>4000 hr.</td>
<td>PASS</td>
<td>Fail</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No Weathering Observed</td>
<td></td>
</tr>
</tbody>
</table>

---

Kit Bond Bridge - Kansas City, MO

Lewis & Clark Viaduct - Kansas City, MO
July 17, 2017

Mr. Tom Choate
Nanovere Technologies
4023 S. Old 23, Suite 102
Brighton, MI  48114

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

Dear Mr. Choate:

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<tr>
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</tr>
<tr>
<td>Topcoat</td>
<td>None</td>
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* Sherwin-Williams MIL-DTL-53039E, Type IX, 1K Aliphatic Polyurethane 3.5 VOC, CARC
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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.

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<tr>
<td>Infrared Reflectance</td>
<td>ASTM E-903</td>
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<tr>
<td><strong>Physical Properties:</strong></td>
<td></td>
</tr>
<tr>
<td>Adhesion</td>
<td>ASTM D3359</td>
</tr>
<tr>
<td>Hardness (Pencil)</td>
<td>ASTM D3363</td>
</tr>
<tr>
<td><strong>Resistance Properties:</strong></td>
<td></td>
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</tr>
<tr>
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<tr>
<td>Water Immersion Resistance</td>
<td>MIL-DTL-53039 Sec 4.6.22</td>
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</table>

Regarding optical properties, the $20^\circ$ and $85^\circ$ gloss was unchanged by the addition of the topcoat, while the $60^\circ$ 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.

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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>$\text{L}$</td>
<td>65.05</td>
<td>66.66</td>
</tr>
<tr>
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</thead>
<tbody>
<tr>
<td>Adhesion</td>
<td>5B</td>
<td>5B</td>
</tr>
<tr>
<td>Hardness (Pencil)</td>
<td>2B</td>
<td>&gt;7H</td>
</tr>
<tr>
<td>Acid Spot Resistance</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td><strong>MEK Resistance:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Rubs to Substrate</td>
<td>&gt;200</td>
<td>&gt;1500</td>
</tr>
<tr>
<td>Double Rubs to Start of Coating Dissolution</td>
<td>20</td>
<td>&gt;1500</td>
</tr>
<tr>
<td>Appearance after 200 DRs</td>
<td>Moderate Burnishing</td>
<td>No Effect</td>
</tr>
<tr>
<td><strong>Water Immersion Resistance:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Observation</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>Pencil Hardness</td>
<td>4B</td>
<td>&gt;7H</td>
</tr>
<tr>
<td>Adhesion</td>
<td>5B</td>
<td>5B</td>
</tr>
</tbody>
</table>
Leading US Tank Car Manufacture / Leasing Company

**Technical Challenge**

- Reduce Material Cost
- Reduce Labor Cost
- Reduce Energy Cost
- Extend In-Service Life
- Reduce VOC
- Improve UV Resistance

**Technical Solution:**

Nano-Clear for Industrial Applications was chosen to replace epoxy 2K black. Nano-Clear 1K restores oxidized paint, enhances underlying black color, dramatically improves surface hardness and prevent further UV degradation of underlying paints.

**Nano-Clear Coating Benefits:**

- Material Savings - 5 gal of Nano-Clear vs. 30 gal of Epoxy
- Energy Savings - No Heat Required to Cure
- Environmental - Lower VOC per Facility
- Higher Production Throughput with Nano-Clear
- 2X Extended Service Life of Tank Car
- Savings - $925 per Tank Car using Nano-Clear