### Description & General Information

- **NDF** pigments are designed specifically to provide increased shear stability versus traditional Cornflake and Silver Dollar flakes while providing excellent brightness, flop, sparkle and color stability.
- **NDF** pigments are suitable for conventional and high solids paint systems. On request and based on the application, we can offer stabilized pigments for water-based systems.
- **NDF**'s are more stable in circulation systems than conventional Aluminum pigments.
- **NDF**'s pigments provide improved shear stability due to increased thickness and edge uniformity.
- Improved shear stability means the pigment will not lose brightness and flop during high stress applications, e.g. in automotive recirculation systems / coil applications.

### Application Areas

**NDF**'s are used for a wide field of applications, such as:
- Automotive OEM & Accessories
- Coil coatings
- Wheel rims
- Packaging - exterior and interior food can coatings
- Graphic Arts applications - flexographic and gravure printing

### Pigment Characteristics / Morphologies (Aspect Ratio)

- **NDF**'s pigments provide improved shear stability due to increased thickness and edge uniformity.
- Improved shear stability means the pigment will not lose brightness and flop during high stress applications, e.g. in automotive recirculation systems / coil applications.

#### SEM pictures:

- **Conventional Flake**
- **NDF**
- **Silver Dollar**

#### Aspect Ratio

- **NDF**
- **Silver Dollar**

**Better Coverage and Hiding power**

**Better shear stability**
Shear Stability

Shear Stability is described as the property of a pigment flake to retain structure, color, brightness and flop when exposed to a high shear situation.

When pigments are exposed to high shear forces, such as in paint recirculation systems, they can experience physical damage to the flake perimeter, and in worst cases actual fractures to the flakes. This damage will result in an appearance change which is normally observed as a decrease in color, brightness and flop.

Shear stability is a concern in the Automotive and Coil Coatings Industries, and other applications where liquid paint is exposed to high shear.

NDF pigments offer the solution: Superior shear stability, unique color position with excellent brightness, color stability and flop:

Shear Stability is influenced by several factors:
• Pigment Structure / Morphology
• Paint System – high solids vs. low solids and solventborne vs. waterborne
• Application System – Pumps, paint recirculation, roller applicator, high speed ‘bell’ cup

In order to determine pigment stability properties, Laboratory Test Methods are used to simulate the shear in Automotive OEM paint recirculation systems, e.g., Waring Blender Test.

Compare Silver Dollar – NDF in coating: Shear stability

<table>
<thead>
<tr>
<th>Shear Stability</th>
<th>L* 15°</th>
<th>L* 15°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver Dollar unsheared</td>
<td>120</td>
<td>115</td>
</tr>
<tr>
<td>Silver Dollar sheared</td>
<td>110</td>
<td>105</td>
</tr>
<tr>
<td>NDF unsheared</td>
<td>130</td>
<td>125</td>
</tr>
<tr>
<td>NDF sheared</td>
<td>140</td>
<td>135</td>
</tr>
</tbody>
</table>

Illustration after Waring Blender test: Deviation in L* (15°) between “unsheared” and “sheared” paint application. Measured with Spectrophotometer (e.g., BYK-mac).
NDF 2000 – Enhanced Product Portfolio

- Brighter metallic effect
- Increased flop / travel
- Comparable tint strength (to Standard Product Portfolio)

<table>
<thead>
<tr>
<th>NDF</th>
<th>Visual effect</th>
<th>D10</th>
<th>D50</th>
<th>D90</th>
<th>NVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDF 2120</td>
<td>fine</td>
<td>7</td>
<td>12</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>NDF 2140</td>
<td>medium – fine</td>
<td>9</td>
<td>14</td>
<td>22</td>
<td>70</td>
</tr>
<tr>
<td>NDF 2180</td>
<td>medium</td>
<td>11</td>
<td>19</td>
<td>30</td>
<td>75</td>
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</tbody>
</table>

NDF 3000 – Premium Product Portfolio

- Narrowed particle size distribution
- Brighter metallic effect
- Increased flop / travel
- Higher color purity
- Comparable tint strength (to Standard Product Portfolio)

<table>
<thead>
<tr>
<th>NDF</th>
<th>Visual effect</th>
<th>D10</th>
<th>D50</th>
<th>D90</th>
<th>NVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDF 3090</td>
<td>fine</td>
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<tr>
<td>NDF 3125</td>
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<tr>
<td>NDF 3150</td>
<td>medium – fine</td>
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<td>16</td>
<td>24</td>
<td>75</td>
</tr>
</tbody>
</table>
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