High Strength Mineral Reinforcements for Plastic Composites

- Excellent balance in stiffness and impacts
- Weight reduction
- Improved mechanical properties
- Excellent surface and scratch resistance
- Odorless

GLOBAL MINERAL REINFORCEMENT SOLUTIONS
Wollastonite

Wollastonite’s reinforcing properties, thermal stability, low resin demand and chemical purity make it a superior reinforcement in plastic composites. Due to its acicular structure, wollastonite provides an increase in flexural modulus, improved heat distortion temperature, reduced CTE and shrinkage with improved scratch resistance. When using fine particle size, high aspect ratio wollastonite, composites exhibit an excellent balance of impact strength, high elongation and polymer structure rigidity. In addition, these grades also lower unit and compounding costs through the extension/replacement of milled glass, chopped glass and other synthetic fibers. NYLITE™, a new proprietary blend of wollastonite and additive, chemically modified offer compounders high strength, weight reduction and superior scratch resistance.

Aluminosilicate

PHYLLOCOAT™ is a new non-directional reinforcement for low density polyethylene film, nylon, elastomers and other engineered alloys and blends. It’s a lamellar aluminosilicate, chemically modified for automotive and transportation applications requiring superior balance of physical properties in straight mineral or glass/mineral systems. New compounding data has demonstrated superior performance to that of other platy-type mineral reinforcements, like calcined clay. PHYLLOMAT™ (untreated aluminosilicate) is also a cost-effective extension to chopped and milled glass fiber also offering reduced warpage and improved surface appearance (reduce glass read out).

PHYLLOMAT™ is a new non-directional reinforcement for low density polyethylene film to improve IR absorption, improve optical properties for higher transmission of visible light, enhance barrier effects and provides good UV stability.

Chemical Modification Technology

NYCO is a leader in chemical modification technology, offering a variety of modifications from organo silanes to wetting agents for improved mechanical properties, processing and throughput rates. Optimum properties are created by properly matching the correct chemical modification to the polymer matrix at the right concentration level. New developments are underway to create the next generation chemical modifications to meet customer’s specifications like cold temperature impacts and other physical properties along with continued enhancements in handling and processing.

<table>
<thead>
<tr>
<th>WILLSBORO PRODUCTS/ TYPICAL PROPERTIES</th>
<th>NYLITE™</th>
<th>NYGLOS® 4W</th>
<th>NYGLOS® 8</th>
<th>NYGLOS® 12</th>
<th>PHYLLOCOAT™ (Aluminosilicate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.E. BRIGHTNESS</td>
<td>93</td>
<td>92</td>
<td>91</td>
<td>89</td>
<td>82</td>
</tr>
<tr>
<td>BULK DENSITY (lbs./cu.ft.) (g/cc)*</td>
<td>(21) (0.34)</td>
<td>(13) (0.20)</td>
<td>(14) (0.22)</td>
<td>(15.6) (0.24)</td>
<td>(19) (0.30)</td>
</tr>
<tr>
<td>LOOSE TAPPED</td>
<td>(34) (0.54)</td>
<td>(22) (0.35)</td>
<td>(30) (0.48)</td>
<td>(35.4) (0.57)</td>
<td>(27) (0.43)</td>
</tr>
<tr>
<td>OIL ABSORPTION (lbs./100 lbs.)</td>
<td>68</td>
<td>55</td>
<td>45</td>
<td>44</td>
<td>53</td>
</tr>
<tr>
<td>MICROTRAC D50 (μm)</td>
<td>8</td>
<td>7</td>
<td>12</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>ASPECT RATIO (L/D)</td>
<td>13:1</td>
<td>9:1</td>
<td>13:1</td>
<td>13:1</td>
<td>10:1</td>
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</tbody>
</table>

* Typical values for bulk density will change with chemical modification.
Wollastonite Performance Benefits by Reinforced and Filled Systems

General
- Low CLTE (no gap)
- Improved heat distortion temperature
- Improved dimensional stability and shrinkage control
- Cost-effective replacement for milled glass
- Partial replacement for chopped glass
- Total replacement of competitive minerals in straight mineral or mineral/glass formulations
- Low permeability and excellent weatherability properties
- Excellent paintability (on-line, in-line and off-line)

Engineered Polymers, Alloys and Blends
- Eliminates introduction of moisture
- Additive for meeting UL-94-FR requirements
- High stiffness and impact
- Excellent fire and smoke suppressant properties
- Improved polymer toughness
- Improved surface aesthetics
- Excellent surface reflectivity in vacuum/plateable applications
- Low or elimination of out-gassing

Polyolefins
- Excellent balance in stiffness and impacts
- Weight reduction
- Less whitening, excellent mar and scratch resistance
- Odorless, no monomer absorption, non-toxic
- Excellent creep resistance
- Excellent UV stability
- Low fogging properties

Thermosets
- Excellent surface hardness and abrasion resistance

Thermoplastic Elastomers
- Improved flexural and compressive strength
- High stiffness and notched/unnotched/izod impacts
- High brightness, low haze
- High temperature resistance

Global Mineral Reinforcement Solutions

Wollastonite Processing Guidelines
- Twin screw compounding is the preferred process for compounding high aspect ratio (HAR) wollastonite.
- Wollastonite products having lower aspect ratios have been successfully compounded on continuous mixer, banbury, and single screw compounding lines.
- It is normally not recommended to add wollastonite products into the main feed throat due to the possibility of aspect ratio attrition, especially for HAR products. Downstream feeding into the melt via side feeder or open top barrel is generally more successful.
- As with all twin screw compounding, proper screw design is required to achieve optimum performance and properties. This is especially important for HAR products. NYCO has in-house expertise to help maximise the benefit of using wollastonite.
- A good general rule of thumb is to process HAR wollastonite in the same manner as chopped fiberglass.
- When feeding more than 30% wollastonite, it may be necessary to “back vent” the barrel immediately upstream of the point of addition. This is especially useful when processing nylon, polyester, or other polymers that may contain excess moisture.
- When processing high loadings of more than 30%, it may be beneficial to split-feed the wollastonite into two feed zones.
- Low aspect ratio wollastonite can be throat fed like platy-type materials.

<table>
<thead>
<tr>
<th>MINERA PRODUCTS/TYPICAL PROPERTIES</th>
<th>ASPECT® 3000</th>
<th>ASPECT® 4000</th>
<th>NYGLOS® M2992-ND</th>
<th>NYGLOS® M15</th>
<th>M9000 WOLLASTOCOAT®</th>
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<td>LOOSE TAPPED</td>
<td>(18) (0.29)</td>
<td>(25) (0.40)</td>
<td>(38) (0.60)</td>
<td>(33) (0.53)</td>
<td>(40) (0.64)</td>
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<td>(28) (0.45)</td>
<td>(44) (0.70)</td>
<td>(56) (0.90)</td>
<td>(53) (0.85)</td>
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<td>16</td>
<td>6</td>
<td>16</td>
<td>3</td>
</tr>
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NYCO
**a member of IMERYS**

- Premium quality minerals
- State-of-the-art processing operations
- World-class chemical modification technology
- Industry leader
- World-wide distribution network
- Customer-focused global technical support

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For any further information, please contact:
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### Relative Particle Size

#### WOLLASTONITE High Aspect Ratio Grades

- **NYGLOS® M2992-ND**  
  6 x 42 micron

- **NYGLOS® 4W**  
  7 x 63 micron

- **NYGLOS® 8**  
  12 x 156 micron

- **NYGLOS® 12**  
  18 x 234 micron

- **NYGLOS® 20**  
  30 x 300 micron

#### ALUMINOSILICATE Lamellar Grade

- **PHYLLOCOAT™**  
  6 x 0.7 micron

- **ASPECT® 3000**  
  7 x 49 micron

- **ASPECT® 4000**  
  16 x 112 micron

- **NYGLOS® M15**  
  16 x 128 micron

- **NYLITE™**  
  8 x 104 micron

- **NYAD® G**  
  55 x 825 micron

#### WOLLASTONITE Powder Grades

- **NYAD® M9000**  
  3 x 9 micron

- **NYAD® M1250**  
  4 x 12 micron

- **NYAD® M400**  
  9 x 27 micron

- **NYAD® M3**  
  6 x 30 micron

- **NYAD® M325**  
  12 x 48 micron

- **NYAD® M200**  
  20 x 100 micron

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