



## Advantages of GREENMANTRA's Polypropylene Polymer Additive Compounded with Polypropylene Resin

GREENMANTRA<sup>®</sup> combines TECHNOLOGY with SUSTAINABILITY to create unique CERANOVUS<sup>®</sup> A Series Polypropylene (PP) Additives from recycled plastics.

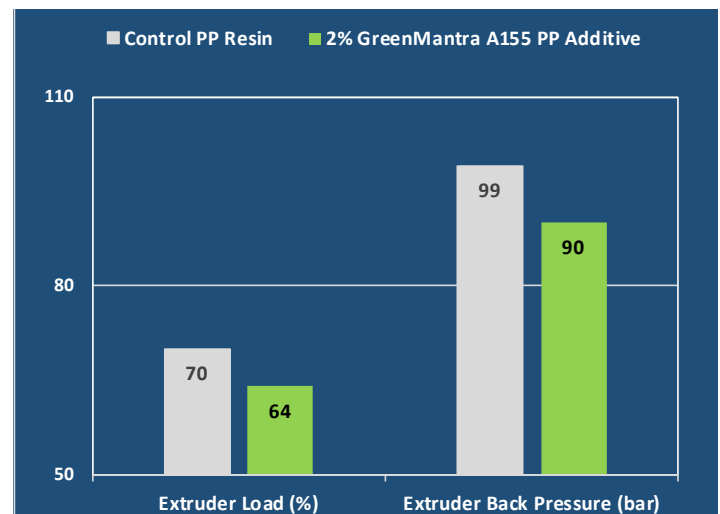
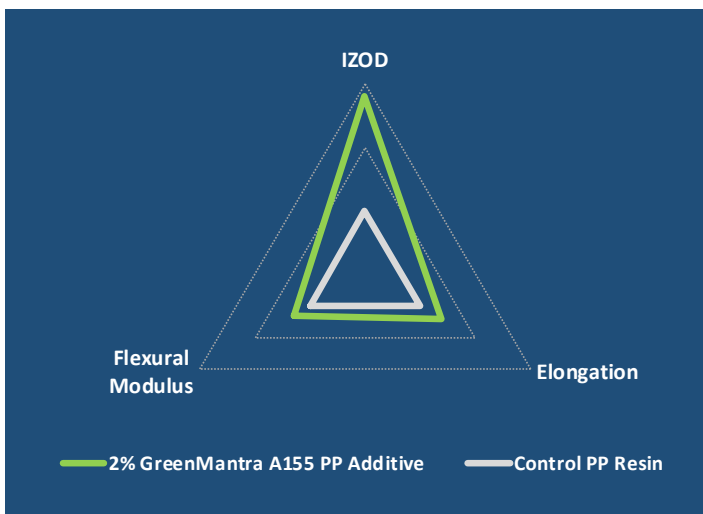
GREENMANTRA<sup>®</sup> has verified the performance advantages of CERANOVUS<sup>®</sup> A155 PP Additive when compounded with a general purpose polypropylene homopolymer resin.

### TYPICAL PROPERTIES OF CERANOVUS<sup>®</sup> A155 PP ADDITIVE

| Density (g/cm <sup>3</sup> )<br>ASTM D1298 | Drop Point (°C)<br>ASTM D3954 | Penetration @ 25°C in dmm<br>ASTM D1321 | Viscosity cps @ 190°C<br>BROOKFIELD |
|--------------------------------------------|-------------------------------|-----------------------------------------|-------------------------------------|
| 0.90                                       | 155                           | 2                                       | 75                                  |

At 2% loading level, CERANOVUS<sup>®</sup> A155 PP Additive delivers a unique combination of physical property and operational advantages in polypropylene compounds:

- 18% increase in IZOD Impact Strength
- 4% improvement in Elongation at Yield
- 9% reduction in Extruder Load and Back Pressure
- Slight improvement in Flexural Modulus
- Slight increase in Melt Flow Rate



*These enhanced properties and optimized processing conditions were confirmed at Plastics Forming Enterprises LLC. Actual results are shown in the tables on the reverse side.*

Table 1: Physical Properties of PP Resin Compounded with CERANOVUS® A155 PP

| Formulation and Performance Variables | Control | Sample 1 | Sample 2 |
|---------------------------------------|---------|----------|----------|
| General Purpose Polypropylene Resin % | 100     | 98       | 96       |
| CERANOVUS® A155 PP Additive %         | 0       | 2        | 4        |
| Melt Flow Rate (g/10 min)             | 4.25    | 4.34     | 4.50     |
| % change relative to Control          | -       | 2%       | 6%       |
| IZOD (lb-ft/in)                       | 0.79    | 0.93     | 0.79     |
| % change relative to Control          | -       | 18%      | -        |
| Flexural Modulus (PSI)                | 175,476 | 180,456  | 201,209  |
| % change relative to control          | -       | 3%       | 15%      |
| Tensile @ Yield (PSI)                 | 4,326   | 4,147    | 4,512    |
| % change relative to control          | -       | -4%      | 4%       |
| Elongation Average                    | 26.81%  | 27.78%   | 25.65%   |
| % change relative to control          | -       | 4%       | -4%      |

**Formulation and Trial Conditions:**

Polypropylene Homopolymer Resin was compounded with 2% and 4% CERANOVUS® A155 PP Additive, extruded and then injection molded into parts for testing.

**Performance Advantages:**

- ✓ 2% additive levels delivered optimum results in physical properties
- ✓ IZOD Impact Strength, Flexural Modulus and Elongation each increased while improving melt flow rate



**IMPROVE PERFORMANCE**



**REDUCE COSTS**



**ENHANCE SUSTAINABILITY**

Table 2: Processing Results at Constant Screw Speed and Constant Feed Rate

| Formulation and Performance Variables | Control | Sample 1 | Sample 2 |
|---------------------------------------|---------|----------|----------|
| General Purpose Polypropylene Resin % | 100     | 98       | 96       |
| CERANOVUS® A155 PP Additive %         | 0       | 2        | 4        |
| Constant Extruder Screw RPM           | 200     | 200      | 200      |
| Average Throughput (lbs/hr)           | 480     | 480      | 480      |
| Extruder Load (%)                     | 70      | 64       | 62       |
| % change relative to Control          | -       | -9%      | -11%     |
| Extruder Pressure (bar)               | 99      | 90       | 88       |
| % change relative to Control          | -       | -9%      | -11%     |

**Formulation and Trial Conditions:**

Steady-state extrusion with constant screw speed of 200 RPM and feed rate of 480 lbs / hr

**Performance Advantages:**

- ✓ 4% additive level delivered optimum processing results
- ✓ Decrease in Extruder Load and Pressure correlates to less equipment wear and tear



Products containing CERANOVUS A Series additives contribute towards LEED certification and credits programs.



81 Elgin Street | Brantford, ON N3S 5A1 | Canada  
info@greenmantra.com | 888-519-2015

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CERANOVUS A Series polyethylene and polypropylene additives are made from 100% post consumer and post industrial recycled plastics as certified by SCS Global Services