Neat blend with calcium carbonate masterbatch for spunbond nonwoven fabrics

The melt elasticity of mineral filled polypropylene (PP) can be improved due to the relatively high amorphous content and structure of Vistamaxx™ performance polymers.

This enhances spinnability / draw-ability in the spunbond process while maintaining key physical properties. Mineral fillers like calcium carbonate (CaCO₃) are typically used in polymer formulations to reduce cost, increase dimensional stability and/or increase stiffness.

One of the key challenges for mineral filled PP in spunbond applications is the significant drop in tensile properties. This document outlines how to retain or improve tensile properties with similar or improved filler loading by using Vistamaxx performance polymers.

Retained tensile properties with increased filler loading
The addition of neat Vistamaxx performance polymers maintains the tensile properties, even with the addition of 10% CaCO₃ filler masterbatch in the formulation, as illustrated in Figure 1. The optimization of the processing conditions is necessary for the retention of tensile properties.

Figure 1:
Vistamaxx 6202 retained tensile properties at higher filler loading. Nonwoven spunbond fabric, 65 gsm, SS fabric structure

Improved tensile properties at the same filler loading level
The addition of neat Vistamaxx performance polymers at the same level of CaCO₃ filler loading helps to improve the tensile properties of the nonwoven fabric in both MD* and CD**. Figure 2 illustrates the comparison of tensile properties in MD and CD of the spunbond fabric produced with 40% CaCO₃ filler masterbatch. Similar to the example in Figure 1, optimization of the processing conditions is necessary for the retention of tensile properties.

Figure 2:
Vistamaxx 6202 improved tensile properties with same filler loading. Nonwoven spunbond fabric, 17 gsm, single S fabric structure
Processing guidelines

Below are some general processing guidelines when adding neat Vistamaxx 6202 to CaCO₃-based filler. Note that these recommendations only serve as guidelines and the type of equipment and filler masterbatch composition could change the processing window outside of the guidelines shown.

- Melt temperature range: 190 – 230°C
- Die temperature range: 200 – 240°C
- Cabin pressure: an increase is recommended
- Quench air temperature: a decrease is recommended, as needed
- Calendar temperature: optimization using a 3 or 5 point bonding curve is recommended

The recommended level of Vistamaxx 6202 for the various levels of CaCO₃ filler masterbatch loading is shown in Table 1.

Feeding system

A weigh feeder capable of dosing up to 40% CaCO₃ masterbatch is preferred over manual blending to achieve a homogeneous blend of Vistamaxx performance polymers, PP, CaCO₃ filler masterbatch and color concentrated masterbatch. This is important, especially at higher filler loading. Segregation of the filler may occur due to the higher density of CaCO₃ compared to PP. Filter choking may arise due to the high CaCO₃ dosage and coarser filler particles in the formulation. If filter choking is observed, the screen pack needs to be replaced and the die should be cleaned prior to further production.

Table 1: Recommended loading level of Vistamaxx 6202 and CaCO₃ filler

<table>
<thead>
<tr>
<th>CaCO₃ masterbatch loading (%)</th>
<th>Vistamaxx 6202 (%)</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>2.0-3.0</td>
</tr>
<tr>
<td>20</td>
<td>4.0-7.0</td>
</tr>
<tr>
<td>30</td>
<td>7.5-10.0</td>
</tr>
<tr>
<td>40</td>
<td>10.0-13.0</td>
</tr>
</tbody>
</table>

About Vistamaxx performance polymers

Vistamaxx performance polymers are a family of polyolefin copolymers of propylene and ethylene. Vistamaxx performance polymers are compatible with many polymers and can be utilized to develop optimized solutions for targeted applications and performance in polypropylene-based nonwoven fabrics. In addition, Vistamaxx polymers have a unique crystalline morphology and very low crystallinity relative to other polyolefin materials.

Note: Use of filled polymer may increase the risk of equipment wear.

Contact your ExxonMobil Chemical representative for more information: exxonmobilchemical.com/nonwovens