Grafting Compatilizer

5 Fine-Blend™ PP-g-MAH Compatilizer

Product Introduction

The grades of Fine-Blend™ PP-g-MAH include three different types: General CMG9801, Low VOC & YI CMG9801-GS and Low Odor CMG5001. The polarity and adhesion of Polypropylene (PP) chains can be greatly changed by introducing highly reactive Maleic anhydride (MAH) groups. With only a small amount of Fine-Blend™ PP-g-MAH added, the interfacial binding force between PP matrix and fillers (such as glass fiber, talc, mica, metal and plant fibers) could be significantly enhanced, leading to the tensile strength, flexural modulus and impact strength of the PP composites greatly improved. And also the Fine-Blend™ PP-g-MAH can be used in PP based alloy to improve its comprehensive performances. The structure schematic of Fine-Blend™ PP-g-MAH as shown below:

![Fig.1 Schematic structure of PP-g-MAH](image)

The grafting degree of PP-g-MAH is a main factor that influences the compatibility of PP based composites, and then has great impact on the final products. Fig.2 shows the FTIR spectra of Fine-Blend™ CMG5001, domestic similar products and imported similar product, we can see from the spectra that the grafting degree of Fine-Blend™ CMG5001 is almost the same with imported product, but significantly higher than the domestic similar products.
Fig. 2 The FTIR spectra of Fine-Blend™ CMG5001, domestic and imported similar products.

### Physical and Chemical Properties

#### Tab. 1 Physical and Chemical Properties of Fine-Blend™ PP-g-MAH

<table>
<thead>
<tr>
<th>Products</th>
<th>Test Method</th>
<th>CMG9801</th>
<th>CMG9801-GS</th>
<th>CMG5001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tm (°C)</td>
<td>DSC</td>
<td>160~170</td>
<td>160~170</td>
<td>160~170</td>
</tr>
<tr>
<td>Acid-base</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>^1Graft Ratio (%)</td>
<td>titration</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>MFR (g/10min)</td>
<td>ASTM D1238</td>
<td>70-130</td>
<td>35-60</td>
<td>90-140</td>
</tr>
</tbody>
</table>

Notes: these are Physical and Chemical Properties only and are not to be construed as specifications. Users should confirm results by their own tests.

^1Low <0.25%, Medium 0.25-0.5%, High 0.5-1.0%;

^2Test Condition: 190°C, 2.16kg.

#### 5.1 Fine-Blend™ CMG9801

**General PP-g-MAH Compatilizer**

**Product Introduction**

Fine-Blend™ CMG9801 is a kind of general PP-g-MAH compatilizer. With the introduction of active anhydride groups, the adhesion between PP matrix and fillers (GF, Talc, Wood Floor and so
can be greatly improved, and then the mechanical properties such as tensile strength, flexural strength and impact strength could also be significantly improved.

**Application Case**

**Case 1: Application of CMG9801 in GF reinforced PP**

<table>
<thead>
<tr>
<th>PP/GF/CMG9801</th>
<th>Tensile strength (MPa)</th>
<th>Flexural strength (MPa)</th>
<th>Flexural modulus (MPa)</th>
<th>Notched Izod impact strength (J/m)</th>
<th>MFR / g/10min</th>
</tr>
</thead>
<tbody>
<tr>
<td>70/30/0</td>
<td>30</td>
<td>40</td>
<td>4300</td>
<td>78</td>
<td>12</td>
</tr>
<tr>
<td>68/30/2</td>
<td>80</td>
<td>94</td>
<td>5450</td>
<td>130</td>
<td>13</td>
</tr>
</tbody>
</table>

**Notes:** PP Shanghai Secco K7926; GF: Jushi 988A

Fig.3 The effect of CMG9801 on notched impact strength of PP+30%GF system

Fig.3 shows that the notched impact strength was obviously improved with the addition of CMG9801. The impact strength reaches a maximum when the content is 3%.
As shown in fig.4, the compatibility between PP matrix and GF was obviously enhanced with the introduction of CMG9801, this is essential to obtain high mechanical performance, and for the final products the phenomenon of “glass emergence” can also be improved.

**Case 2:** The application of CMG9801 in PP/wood floor (WF) composites

![Fig.5 The effect of CMG9801 on flexural strength of PP+30% WF system](image)

![Fig.5 The effect of CMG9801 on tensile strength of PP+30% WF system](image)
Fig. 6 The effect of CMG9801 on tensile strength of PP+30% WF system

Fig. 7 The effect of CMG9801 on notched impact strength of PP+30% WF system

From fig. 5~7 we can see that the mechanical properties of PP+30% WF system can be obviously improved with the addition of CMG9801, and we get the optimum performance when the content is 3%.

Fig. 8 The SEM graph of PP+30% WF system without and with 3% CMG9801

Form Fig. 8, the good wetability of PP matrix with WF can be seen with the addition of 3% CMG9801, this is essential to improve the mechanical properties of the composites, and also the surface properties of the final products can be improved at the same time.

**Recommended Dosage**

2-5%, can be adjusted according to the practical situation.

**Processing guidelines, package & storage and safety information**

Please refer to the product MSDS.
5.2 Fine-Blend™ CMG9801-GS

Low VOC & YI PP-g-MAH Compatilizer

**Introduction**

Compared with CMG9801, CMG9801-GS have the characteristics of Low VOC & Low Yellow Index (YI), so it can meet the higher requirements on VOC and color. CMG9801-GS also have the advantage to improve the long-term heat aging properties of the final products.

**Application Case**

**Case 1: The lower YI of CMG9801-GS**

![YI comparison of imported and domestic products with CMG9801-GS](image)

The YI of CMG9801-GS is much lower than the domestic products, and still has advantage when compared with import product. This means that the final products will have a better color control with the addition of our CMG9801-GS.

**Case 2:** CMG9801-GS shows a better thermal stability
As shown in fig.10, the thermal-decomposition temperature of CMG9801-GS is similar with imported product, but obviously higher than domestic product. Therefore, the final products will have longer long-term heat aging properties with the addition of CMG9801-GS.

**Case 3: The effect of CMG9801-GS on the long-term heat aging properties of PP+30%GF system**

As shown in fig.11, the samples added CMG9801-GS have a much better long-term heat aging properties than domestic products, especially when the aging time longer than 900h. And the CMG9801-GS still have advantages compared with the imported product.

**Case 4: The effect of CMG9801-GS on the properties of PA6/PP alloy**
### Tab.3 the Physical and Chemical Properties of PA6/PP alloy with 4% CMG9801-GS

<table>
<thead>
<tr>
<th>PA6/PP/CMG9801-GS</th>
<th>Tensile Strength / MPa</th>
<th>Flexural Strength / MPa</th>
<th>Flexural Modulus / MPa</th>
<th>Izod Impact strength / J/m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50mm/min</td>
<td>2mm/min</td>
<td>2mm/min</td>
<td>23℃</td>
</tr>
<tr>
<td>80/20/0</td>
<td>52</td>
<td>90</td>
<td>1830</td>
<td>67</td>
</tr>
<tr>
<td>80/20/4</td>
<td>60</td>
<td>94</td>
<td>1890</td>
<td>67</td>
</tr>
</tbody>
</table>

Notes: PP, SABIC 66M10T; PA6: viscosity, 2.80.

**Fig.12** The effect of CMG9801-GS on tensile strength of PA6/PP alloy

**Fig.13** The effect of CMG9801-GS on HDT of PA6/PP alloy
Fig. 14 The SEM graph of PA6/PP alloy without and with 4% CMG9801-GS

Due to the addition of CMG9801-GS, the dispersion phase could be refined and made homogeneously dispersed in the PA6 (fig. 14), improving the mechanical properties and HDT of PA6/PP alloy (fig. 12, 13). When the content of CMG9801-GS is 4%, it offers an optimum overall performance.

**Recommended Dosage**

1-5%, can be adjusted according to the practical situation.

**Processing guidelines, package & storage and safety information**

Please refer to the product MSDS.
5.3 Fine-Blend™ CMG5001

Low Odor PP-g-MAH Compatilizer

Product Introduction

Compared with general PP-g-MAH products, Fine-Blend™ CMG5001 has lower odor. So the odor of the final products will be greatly improved with the addition of our CMG5001, it perfectly suitable for products that have higher requirements on odor.

Application Case

Case 1: CMG5001 has lower smell

Fig.15 Odor test standard of GM (GMW 3205)

Tab.4 the odor test report of CMG5001 in Reliable Analysis
The test results in Reliable Analysis shows that the odor level of CMG5001 at dry and wet state are 6.0 and 7.2, respectively. So it can meet higher requirements on odor level for automobile interiors.

Case 2: The effect of CMG5001 on the properties of PP+30%GF system

![Graph](image)

Fig. 16 the effect of CMG5001 on the notched Izod impact strength of PP+30%GF system

The mechanism of CMG5001 and general PP-g-MAH products are the same, and the improvement of mechanical properties in PP+30%GF system is also very obvious. When the content of CMG5001 is 3%, it offers an optimum overall performance.

Notes: these are typical test data only and are not to be constructed as specifications.

**Recommended Dosage**

1-5%, can be adjusted according to the practical situation.

**Processing guidelines, package & storage and safety information**
Please refer to the product MSDS