Chapter from the book Polypropylene
Downloaded from: http://www.intechopen.com/books/polypropylene

Interested in publishing with IntechOpen?
Contact us at book.department@intechopen.com
The Influence of Filler Component on Mechanical Properties and Thermal Analysis of PP-LDPE and PP-LDPE/DAP Ternary Composites

Kamil Şirin¹, Mehmet Balcan² and Fatih Doğan³

¹Celal Bayar University, Faculty of Science and Arts, Department of Chemistry, Manisa, ²Ege University, Faculty of Science, Department of Chemistry, İzmir, ³Çanakkale Onsekiz Mart University, Faculty of Education, Secondary Science and Mathematics Education, Çanakkale, Turkey

1. Introduction

Composite material is a material system consisting of a mixture or combination of two or more micro-constituents mutually insoluble and differing in form and/or material composition. Particulate-filled thermoplastic composites have proved to be of significant commercial importance in recent years, as industrialists and technologists have sought to find new and cost-effective materials for specific applications (Shonaike & Advani, 2003; Ma et al., 2007). With addition of inorganic filler, various changes occur in the molecular and supermolecular structure of a thermoplastic resin. Composite properties depend on a variety of material-process variables (e.g., polymer matrix structure, filler content, chemical composition, surface activity, particle size and shape, compounding extruder design, mold design, and extruder-molding process conditions). Some changes may be latent or delayed (i.e., occurring later in the service life of the plastic part as a result of surrounding conditions). Reduction of molecular weight, crystal and spherulite size, and molecular mobility are among the most profound effects that solid filler has on the polymer matrix structure (Ayae & Takashi, 2004). The microstructure of the polymer-filler interphase is mirrored by the mechanical integrity of the molded part and long-term durability to extremes of surrounding temperatures and applied stresses. Calcium carbonate is very commonly used filler in the plastics industry. The incorporation of fillers such as calcium carbonate into thermoplastics is a common practice in the plastics industry, being used to reduce the production costs of molded products. Fillers are also used to modify the properties of plastics, such as the modulus and strength. High filler loadings, however, may adversely affect the processability, ductility, and strength of composites (Rai & Singh, 2003). Some polyolefins are prone to chain-scission reactions in the presence of free radicals. PP is degraded due to chain scission in β position to the macroradicals site, while PE is crosslinked, due to macroradical recombination (Braun et al., 1998). The use of organic
peroxides for controlled degradation of PP is the most important commercial application of the chain-scission or visbreaking of polyolefin chains and results in the so-called controlled rheology PP grades with enhanced melt flow behavior (Zweifel, 2001). Polypropylene (PP) filled with calcium carbonate is among the more recent development on the polyolefin market and in the last decade have shown impressive growth rates. In polyethylene sector, calcium carbonate fillers now play a role preferably in films and sheets. Low density polyethylene’s (LDPE and LLDPE) are usually filled with very pure calcium carbonate grades. Several studies dealing with the melt rheology, mechanical, deformation, impact behavior and thermal properties of various blend or composites were published during the last decade (Chen et al., 2004; El-Sabbagh et al., 2009; Kolarik & Jancar, 1992; Mishra et al., 1997; Sirin & Balcan, 2010, Zhang et al., 2002). Wang WY (Wang, 2007, 2008) was studied the preparation and characterization of calcium carbonate/Low-Density-Polyethylene and CaCO$_3$/acrylonitrile-butadiene-styrene composites. Tang et al. studied rheological properties of nano-CaCO$_3$/ABS composites such as shear viscosity, extension viscosity, and entry pressure dropped by capillary extrusion (Tang & Liang, 2003). Liang investigated the tensile, flow, and thermal properties of CaCO$_3$-filled LDPE/LLDPE composites (Liang, 2007). Effects of coupling agents on mechanical and morphological behavior of the PP/HDPE blend with two different CaCO$_3$ were studied by Gonzalez et al. (Gonzalez et al., 2002) . Also, several researches have reported different properties of ternary composites with calcium carbonate (Jancar & Dibenedetto, 1995; Kim et al, 1993; Premphet, 2000).

This study has focused on the investigation of the changes on thermal, mechanical and morphological properties of PP-LDPE/DAP (90/10 /0.06 wt. %) blend and PP-LDPE/DAP (90/10 /0.0 wt. %) blend when different ratios of 5-10-20 wt. % CaCO$_3$ are added. The blend (PP-LDPE/DAP (90/10/0.06 wt.%)) used in this study was prepared in terms of heat sealing strength properties by the results based on our previous work (Sirin & Balcan, 2010) and is optimum as well (Sirin, 2008).

### 2. Experimental

#### 2.1 Materials

Isotactic polypropylene (PP-MH418) and Low-density polyethylene (LDPE-I 22-19 T) were supplied as pellets by Petkim Petrochemical Company (Aliaga, Izmir, Turkey). The number-average molecular weight ($M_n$), weight-average molecular weight ($M_w$) and polydispersity index (PDI) values of PP and LDPE homopolymer were 20300, 213600 g.mol$^{-1}$ and 10.5, and 29600, 157000 g.mol$^{-1}$ and 5.3, respectively. The specific gravity of the PP-MH418 is 0.905 g.cm$^{-3}$ and that of the LDPE-I 22-19 T is 0.919-0.923 g.cm$^{-3}$, with melt flow index of 4-6 g.10 min$^{-1}$ (2.16 kg, 230 ± 0.5 ºC) and 21– 25 g.10 min$^{-1}$ (2.16 kg, 190 ± 0.5 ºC), respectively. (2, 5-dimethyl-2, 5-di (tert-butyl peroxy)-hexane, (Sinochem, Tinajin/Chine) was used as dialkly peroxide (DAP). Calcium carbonate filler (AS 0884 PEW) was provided by Tosaf Company (Israel).

#### 2.2 Preparation of blends

In the preparation of the composites, two different procedures were used. In the first procedure, PP-LDPE/CaCO$_3$ composites were prepared without addition of DAP. These composites are called as PC0, PC1, PC2 and PC3. In the second procedure, PP-LDPE/CaCO$_3$
composites were prepared with (0.06 % wt.) addition of DAP. These composites are called as PC4, PC5, PC6 and PC7. All compounds were prepared by using single screw extruder (Collin E 30P). The blends were prepared by melting the mixed components in extruder which was set at the extruder diameter: 30 mm, length to diameter ratio: 20, pressure: 9-10 bar, temperature scale composites from filing part to head were 190-250 ºC and screw operation speed: 30 rev.min⁻¹. The composites were produced as 70 µm thick and 10 cm wide films. These ratios and their codes are given in Table 1. All of these composites were prepared as samples weighing 1000 grams, while keeping the PP-LDPE (90/10) ratio constant.

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Composition, wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP</td>
<td>LDPE</td>
</tr>
<tr>
<td>PC0</td>
<td>90</td>
</tr>
<tr>
<td>PC1</td>
<td>90</td>
</tr>
<tr>
<td>PC2</td>
<td>90</td>
</tr>
<tr>
<td>PC3</td>
<td>90</td>
</tr>
<tr>
<td>PC4</td>
<td>90</td>
</tr>
<tr>
<td>PC5</td>
<td>90</td>
</tr>
<tr>
<td>PC6</td>
<td>90</td>
</tr>
<tr>
<td>PC7</td>
<td>90</td>
</tr>
</tbody>
</table>

Table 1. Nomenclature, components and composition of composites

2.3 Melt flow index (MFI) measurements

Melt flow index measurements of the composites were carried out on a MFI (MP-E) Microprocessor apparatus at 230 ºC and under a 2.16 kg weight. The capillary die was 2.095 mm in diameter and 8 mm in length. About 5 g of composite was put into barrel and heated for 5 min to reach the predetermined temperature on the plunger to extrude the melt through the capillary die. After a steady flow state was reached, five samples were cut sequentially and their average weight value was obtained. Experiments were done according to ASTM D-1238.

2.4 Mechanical testing measurements

The tensile properties were determined using an Instron tensile tester (model 4411) following the ASTM D-638 procedure and using type 1 test specimen dimensions. The crosshead speed was set at 50 mm.min⁻¹ and 5 samples were tested for each composition. Tensile stress at yield, tensile strength at break and elongation at break were determined from the recorded force versus elongation curve.

2.5 Hardness test measurements

Shore D scale was used to determine the hardness values of all samples. The tests were carried out Zwick/Roell apparatus of out at the room temperature and 76 cm Hg pressure hardness
test (Shore D) was performed according to ASTM D 2240. Hardness test measurements were carried out the dimensions of 60x60x4 mm at 50 N, at the room temperature.

2.6 Heat seal tester

Heat sealing testers of samples were carried out with a TP701 (trade name, Tester Sangyo K.K.) apparatus at 1 sec timer and 2 kg/cm² pressure.

2.7 Thermal measurements

Differential scanning calorimetric (DSC) analyses were performed in a Shimadzu DSC-50 thermal analyzer in nitrogen atmosphere. The samples were heated from 25 to 200 °C at 10 °C min⁻¹, cooled to 25 °C at the same rate, and re-heated and cooled under the same conditions. Melting ($T_m$) and crystallization ($T_c$) temperatures and enthalpies were determined from the second scan. $T_m$ was considered to be the maximum of the endothermic melting peak from the heating scans and $T_c$ that of the exothermic peak of the crystallization from the cooling scans. The heat of fusion ($\Delta H_f$) and crystallization enthalpy ($\Delta H_c$) were determined from the areas of melting peaks and crystallization peaks.

The crystallinity of composites were calculated with the total enthalpy method [see eq. (1)]; in all calculations, the heats of fusion at equilibrium melting temperature were 209 and 293 Jg⁻¹, for PP and LDPE crystals, respectively (Brandrup & Imegut, 2003)

$$X_c = \frac{\Delta H_f}{\Delta H_{crys}} \times 100$$  

Where:

$\Delta H_f$ = Heat of fusion (Jg⁻¹)

$\Delta H_{crys}$ = 100% crystal polymer crystallization energy (Jg⁻¹)

$X_c$ = Crystallinity (%) 

The various melting and crystallization parameters which were determined by means of heating and cooling scans for composites are given in Table 3. Thermogravimetric (TG-DTG-DTA) curves were performed on a Seteram Labsys TG-16 thermobalance, operating in dynamic mode, with the following conditions; sample weight ~5 mg, heating rate = 10 °C.min⁻¹, atmosphere of nitrogen (10 cm³.min⁻¹), sealed platinum pan.

2.8 Scanning electron microscopy (SEM)

A Philips XL-305 FEG e SEM model scanning electron microscopy (SEM) was used to examine the morphologies of the composites.

3. Conclusion

3.1 Mechanical analysis

CaCO₃ has a high chemical purity, which eliminates a negative catalytic effect on the aging of polymers. In addition, it has high whiteness and low refractive index that can help to reduce consumption of expensive abrasive pigments such as titanium dioxide. On the other
hand CaCO$_3$ is very well suited for the manufacture of colorful products. Low abrasiveness, which contributes to low wear of machine parts such as extruder screws and cylinders, is another advantage. These properties and its low cost make CaCO$_3$ a very strong alternative to be considered as filler.

Melt flow index (MFI) analysis of composites are shown in Table 2. MFI values of composites without peroxide showed small differences by increasing amount of CaCO$_3$. Contrariwise, MFI values of composites with peroxide are proportional to the increasing amount of CaCO$_3$. MFI values of composites without DAP are between 9 and 10 g/10 min, however addition of 0.06 %wt. DAP to the composites resulted MFI values to vary between 22 and 26 g/10 min. This increase in MFI values is a result of degradation of PP by the DAP.

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>MFI / g.10 min$^{-1}$ ± 0.1</th>
<th>Tensile strength at break / kg.cm$^{-2}$±10</th>
<th>Tensile strength at yield/ kg.cm$^{-2}$±10</th>
<th>Elongation at break/ (%)±5</th>
<th>Hardness (ShoreD) ±1</th>
<th>Heat sealing strength/ kg.cm$^{-2}$± 0.1 at 145 ºC</th>
<th>Heat sealing strength/ kg.cm$^{-2}$±0.1 at 150 ºC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC0</td>
<td>9.20</td>
<td>270</td>
<td>322</td>
<td>240</td>
<td>62.10</td>
<td>2.15</td>
<td>3.27</td>
</tr>
<tr>
<td>PC1</td>
<td>9.40</td>
<td>171</td>
<td>263</td>
<td>190</td>
<td>62.60</td>
<td>1.52</td>
<td>3.10</td>
</tr>
<tr>
<td>PC2</td>
<td>9.60</td>
<td>125</td>
<td>240</td>
<td>160</td>
<td>63.10</td>
<td>1.33</td>
<td>2.50</td>
</tr>
<tr>
<td>PC3</td>
<td>9.70</td>
<td>98</td>
<td>210</td>
<td>141</td>
<td>63.20</td>
<td>1.11</td>
<td>2.04</td>
</tr>
<tr>
<td>PC4</td>
<td>22.00</td>
<td>290</td>
<td>360</td>
<td>310</td>
<td>63.00</td>
<td>2.53</td>
<td>9.80</td>
</tr>
<tr>
<td>PC5</td>
<td>23.80</td>
<td>180</td>
<td>298</td>
<td>287</td>
<td>63.50</td>
<td>1.62</td>
<td>4.74</td>
</tr>
<tr>
<td>PC6</td>
<td>24.50</td>
<td>230</td>
<td>336</td>
<td>302</td>
<td>63.90</td>
<td>1.96</td>
<td>5.22</td>
</tr>
<tr>
<td>PC7</td>
<td>25.20</td>
<td>146</td>
<td>218</td>
<td>161</td>
<td>63.40</td>
<td>1.44</td>
<td>4.22</td>
</tr>
</tbody>
</table>

Table 2. MFI, heat sealing strength and mechanical analysis values of composites

Mechanical analysis of the composites such as tensile strength at break, tensile strength at yield and elongation at break are shown in Table 2. As shown in Table 2, samples with/without peroxides showed increase and decrease in their mechanical properties of composites in terms of increasing amount of CaCO$_3$. The highest values in mechanical properties were observed in PC6. Even though PP, LDPE and CaCO$_3$ amounts were same in PC6 and PC2, there was only change in peroxide amounts. In other words, when PC6 and PC2 were compared it was observed that tensile strength at break, at yield, elongation at break values and heat sealing strength values of the composite PC6 showed high peaks. Table 2 summarizes tensile strength at break values for composites which do not contain peroxide displayed decreasing. However, by adding peroxide and increasing the amount of CaCO$_3$, these values showed increasing due to crosslinking of LDPE with the effect of peroxide. Furthermore, the tensile strength of the composites decreased with increasing amount of CaCO$_3$ due to the weak interfacial adhesion and dispersion of the CaCO$_3$ filler.
to PP-LDPE surface. The decrease of yield stress is likely due to the depending between
inorganic fillers and the PP matrix at large deformations. In particular, a higher drop in
tensile strength at yield is observed for PP-LDPE/CaCO$_3$, possibly due to the splitting of
aggregated particles as well as depending between CaCO$_3$ particles and the PP matrix. In
Table 2, with/without peroxide it is clearly shown that elongation at break values of the
composites decreases with increasing ratio of CaCO$_3$. On the other hand, while
comparing samples with CaCO$_3$ to each other the highest mechanical properties were
observed in PC6. The reason for this is that adding DAP effect LDPE by crosslinking and
PP by degradation. Shore D values of the composites with/without DAP increase in some
degree with increasing amount of CaCO$_3$. As mentioned above, the reasons for increase in
shore d values of the composites are addition of DAP effect to LDPE by crosslinking, PP
by degradation, and dispersion of CaCO$_3$ in PP and LDPE. Table 2 shows that, increasing
amounts of CaCO$_3$ resulted a decrease on heat sealing strength values at 145 °C and 150
°C independent of DAP. Therefore, the decrease of heat sealing strength is owing to the
depending between inorganic filler and the blends matrix of deformations. PP-
LDPE/CaCO$_3$ composites still gave better heat sealing strength results than homopolymer
PP and LDPE. In previous studies, we have examined heat sealing strength of
homopolymer PP and LDPE (Sirin & Balcan, 2010; Şirin, 2008) Same as in mechanical
properties values, heat sealing strength values showed similar trend in composite PC6 for
best results.

### 3.2 Morphology observation

Figure 1 (a-g) shows the scanning electron microscopy (SEM) micrographs of composites
reinforced with different amounts of CaCO$_3$ (0, 5, 10, and 20 %wt.) and DAP (0, 0.06
%wt.). From these micrographs, it is clear that CaCO$_3$ fillers were dispersed well in PC4,
PC6 and PC7 matrices with DAP of composites. In these matrices, a homogeneous
dispersion of reinforcing particles can also be observed. Moreover, the fillers remained
intact within the matrix. This indicates that good bonding existed between the CaCO$_3$
particles and matrix. In contrast, the agglomeration of fillers can be observed for the
composites containing CaCO$_3$ particles and dialkylperoxide (DAP). In homogeneous
dispersion of fillers can cause a loss in the mechanical strength of the composites
considerably. At higher loading levels however, CaCO$_3$ will agglomerate and remain
confined in the polymer matrix.

### 3.3 Thermal analysis of composites

The results of the thermal analysis that was carried out by means of differential scanning
calorimetry (DSC) are presented in Table 3. Overall, there were increased effect of both the
content of the CaCO$_3$ filler and its healing on the melting temperature ($T_m$) and the
crystallization temperature ($T_c$). However, a decrease in the energy required for the fusion of
the crystalline parts was noted when the content of the filler in the composite increased. The
melting enthalpy and crystallinity % ($X_c$) of the CaCO$_3$ containing composites with DAP
(0.06 %wt.) were a little higher than the composites without DAP. Yet, the values of heat of
fusion remain lower than that of homopolymer PP or LDPE. It can therefore be noted that
the filler alters the crystalline phase of the polymer.
Fig. 1. SEM micrograph of blend and composites (a) PC0 (b) PC1 (c) PC2 (d) PC3 (e) PC4 (f) PC5 (g) PC6 (h) PC7
<table>
<thead>
<tr>
<th>Sample Code</th>
<th>T_m/ °C</th>
<th>ΔH_f/ J·g⁻¹</th>
<th>T_m/ °C</th>
<th>ΔH_f/ J·g⁻¹</th>
<th>T_c/ °C</th>
<th>ΔH_c/ J·g⁻¹</th>
<th>X_c/ %</th>
<th>X_c/ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC0</td>
<td>102.00</td>
<td>2.90</td>
<td>162.10</td>
<td>91.00</td>
<td>95.00</td>
<td>3.00</td>
<td>118.40</td>
<td>88.90</td>
</tr>
<tr>
<td>PC1</td>
<td>102.60</td>
<td>2.90</td>
<td>162.90</td>
<td>83.10</td>
<td>94.50</td>
<td>2.90</td>
<td>118.90</td>
<td>90.40</td>
</tr>
<tr>
<td>PC2</td>
<td>102.80</td>
<td>2.30</td>
<td>162.30</td>
<td>73.20</td>
<td>96.80</td>
<td>1.20</td>
<td>119.30</td>
<td>76.00</td>
</tr>
<tr>
<td>PC3</td>
<td>103.40</td>
<td>2.20</td>
<td>162.30</td>
<td>73.20</td>
<td>94.20</td>
<td>3.20</td>
<td>120.10</td>
<td>87.00</td>
</tr>
<tr>
<td>PC4</td>
<td>103.20</td>
<td>3.10</td>
<td>162.30</td>
<td>85.50</td>
<td>99.40</td>
<td>1.10</td>
<td>121.90</td>
<td>87.00</td>
</tr>
<tr>
<td>PC5</td>
<td>103.20</td>
<td>2.40</td>
<td>164.90</td>
<td>81.70</td>
<td>95.30</td>
<td>2.00</td>
<td>119.00</td>
<td>80.40</td>
</tr>
<tr>
<td>PC6</td>
<td>106.30</td>
<td>2.80</td>
<td>165.10</td>
<td>86.40</td>
<td>99.20</td>
<td>2.80</td>
<td>120.70</td>
<td>86.90</td>
</tr>
<tr>
<td>PC7</td>
<td>104.70</td>
<td>1.10</td>
<td>164.60</td>
<td>62.00</td>
<td>97.40</td>
<td>1.30</td>
<td>120.40</td>
<td>76.90</td>
</tr>
</tbody>
</table>

Table 3. Thermal properties of PP-LDPE/CaCO₃ composites

Thermal behavior of the composites was studied with a thermogravimetric analyzer under a protective nitrogen atmosphere. The temperature was scanned from 30 ºC to 700 ºC at a heating rate of 10 ºC.min⁻¹. Figure 2 and 3 shows the typical thermogravimetric curves for composites with/without DAP and different filler contents are presented. 5 % and 20 % weight loss temperatures (T_{-5 \%} and T_{-20 \%}) and maximum weight loss temperature (t_{W_{max}T}), derived from the derivative weight loss and differential thermal analysis curves are tabulated in Table 4.

<table>
<thead>
<tr>
<th>Compounds</th>
<th>aT_on</th>
<th>bW_max,T</th>
<th>weight loss/ (5 %)</th>
<th>weight loss/ (20 %)</th>
<th>residual</th>
<th>Endo</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC0</td>
<td>403</td>
<td>454</td>
<td>406</td>
<td>438</td>
<td>0.5</td>
<td>105.2, 162.2, 457</td>
</tr>
<tr>
<td>PC1</td>
<td>402</td>
<td>453</td>
<td>406</td>
<td>438</td>
<td>3</td>
<td>105.8, 162.6, 458</td>
</tr>
<tr>
<td>PC2</td>
<td>405</td>
<td>454</td>
<td>407</td>
<td>440</td>
<td>9</td>
<td>106.6, 163.2, 457</td>
</tr>
<tr>
<td>PC3</td>
<td>405</td>
<td>455</td>
<td>407</td>
<td>440</td>
<td>18</td>
<td>106.5, 163.5, 459</td>
</tr>
<tr>
<td>PC4</td>
<td>407</td>
<td>456</td>
<td>409</td>
<td>443</td>
<td>6</td>
<td>107.2, 164.4, 459</td>
</tr>
<tr>
<td>PC5</td>
<td>409</td>
<td>457</td>
<td>413</td>
<td>444</td>
<td>11</td>
<td>107.9, 165.7, 459</td>
</tr>
<tr>
<td>PC6</td>
<td>414</td>
<td>461</td>
<td>415</td>
<td>444</td>
<td>11</td>
<td>108.1, 167.3, 462</td>
</tr>
<tr>
<td>PC7</td>
<td>414</td>
<td>459</td>
<td>409</td>
<td>444</td>
<td>26</td>
<td>108.7, 164.5, 460</td>
</tr>
</tbody>
</table>

Table 4. Thermal decomposition values of all the compounds (aThe onset temperature, bMaximum Weight Temperature)
TG curves for all the compounds exhibits one stage decomposition and a similar characterizations. The thermal decomposition of composites occurs between 403 and 500 ºC. The thermal stabilities of composites increased usually with increasing CaCO$_3$ content. PC6 has the highest thermal stability among the polymer blends. It is also shown that the rate curve related to compound shifts to a higher temperature. Also, three endothermic thermal effects at different temperature in DTA profiles correspond to the melting and the decomposition of composites. In DTA curves, the first two peaks are two melting peaks.
This is another proof showing that the components are incompatible. But CaCO₃ dispersed completely in the blends and it didn’t result another peak. As observed, melting peaks were between 105-108 °C (LDPE) and 162-167 °C (PP), decomposition temperatures related to the maximum weight loss ($W_{\text{max.T}}$) were between 454-459 °C. In the case of composites, although PP and LDPE decomposition completely at 500 °C, according to the amount of CaCO₃ 5, 10, or 20 % amount of mass, remained due to the reason that CaCO₃’s decomposition temperature is between 850-900°C.

In conclusion, polypropylene-Low Density Polyethylene blends with/without DAP and containing different amount CaCO₃ filler component was prepared by melting-blend with a single-screw extruder. The effects of CaCO₃ filler component on mechanical and thermal properties of prepared composites were investigated. Addition of CaCO₃ particles to the polymer matrix with DAP significantly increased MFI values. It was observed that mechanical properties (tensile strength at break, at yield, elongation at break values and heat sealing strength values) of the composite PC₆ showed high peaks. With addition of CaCO₃, while mechanical properties of the composites were decreasing shore D values showed increasing. Heat sealing strength at 150 °C increased by increasing amount of CaCO₃ particles in the polymer matrix with DAP. SEM images showed that CaCO₃ particles were well-dispersed in the polymer matrix with DAP. The observation of TG/DTG/DTA curves revealed that the thermal stabilities of composites increased usually by increasing amounts of CaCO₃ and the blends are incompatible.

4. Acknowledgements

This study was carried out in Petkim Petrochemical Holding A.Ş., Turkey. In addition, it was supported by the research funds of Celal Bayar University (Project No: FEF-2006/085).

5. References


The Influence of Filler Component on Mechanical Properties and Thermal Analysis of PP-LDPE and PP-LDPE/DAP Ternary Composites


www.intechopen.com

This book aims to bring together researchers and their papers on polypropylene, and to describe and illustrate the developmental stages polypropylene has gone through over the last 70 years. Besides, one can find papers not only on every application and practice of polypropylene but also on the latest polypropylene technologies. It is also intended in this compilation to present information on polypropylene in a medium readily accessible for any reader.

How to reference
In order to correctly reference this scholarly work, feel free to copy and paste the following: