STABILITY OF GRAFTED MALEIC ANHYDRIDE IN PP-g-MAH

INTRODUCTION

The aim of this test was, to show the stability of grafted maleic anhydride (MAH), when exposed to different conditions.

When polymers, grafted with MAH are exposed to water/moisture, the anhydride group slowly converts to maleic acid, reducing the effectiveness of MAH by around 5 times.

MATERIALS USED

We tested and compared the stability between these two materials:

- Fusabond P353 – Polypropylene Copolymer, grafted with MAH
  Produced on: 24.10.2018
  Stored in 20 kg LDPE bag
- GRAFTABOND PPH-MAH 70025 CA – Polypropylene Homopolymer, grafted with MAH
  Produced on: 20.8.2018
  Stored in 20 kg LDPE bag

TESTS PERFORMED

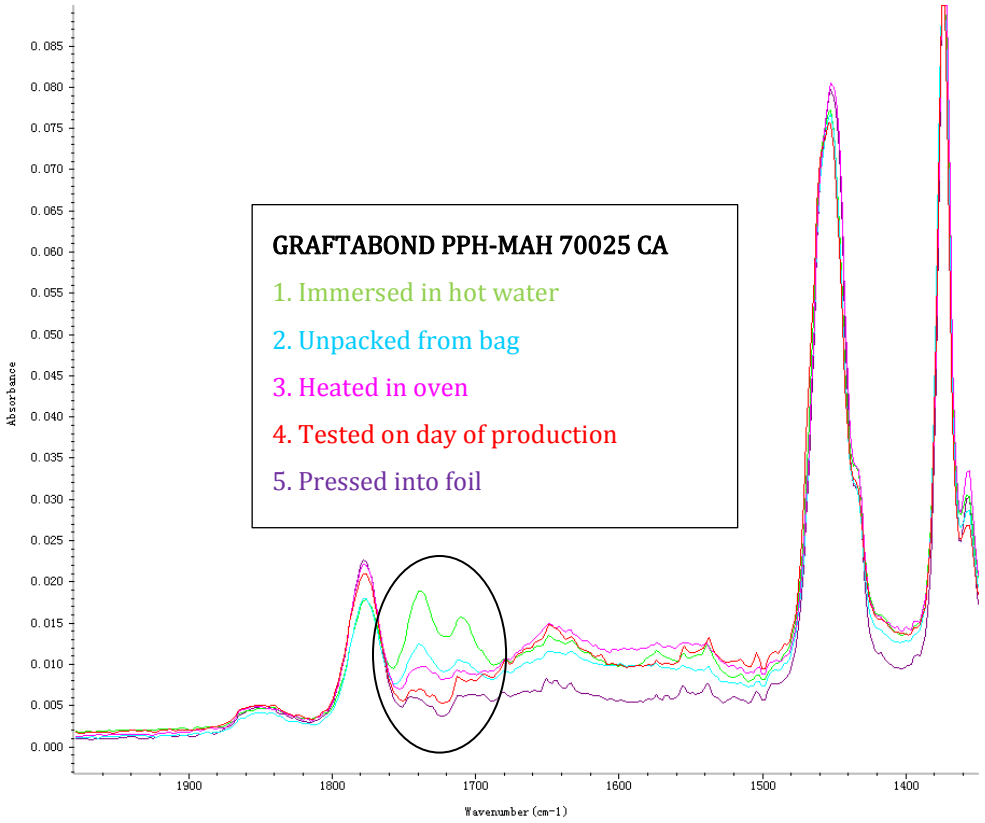
We tested the materials after the following conditions:

- After being unpacked from bags
- Immersed in water at 50°C for 1 hour
- Heated in an oven at 80°C for 3 hours
- Pressed into a foil at 200°C for 10 seconds

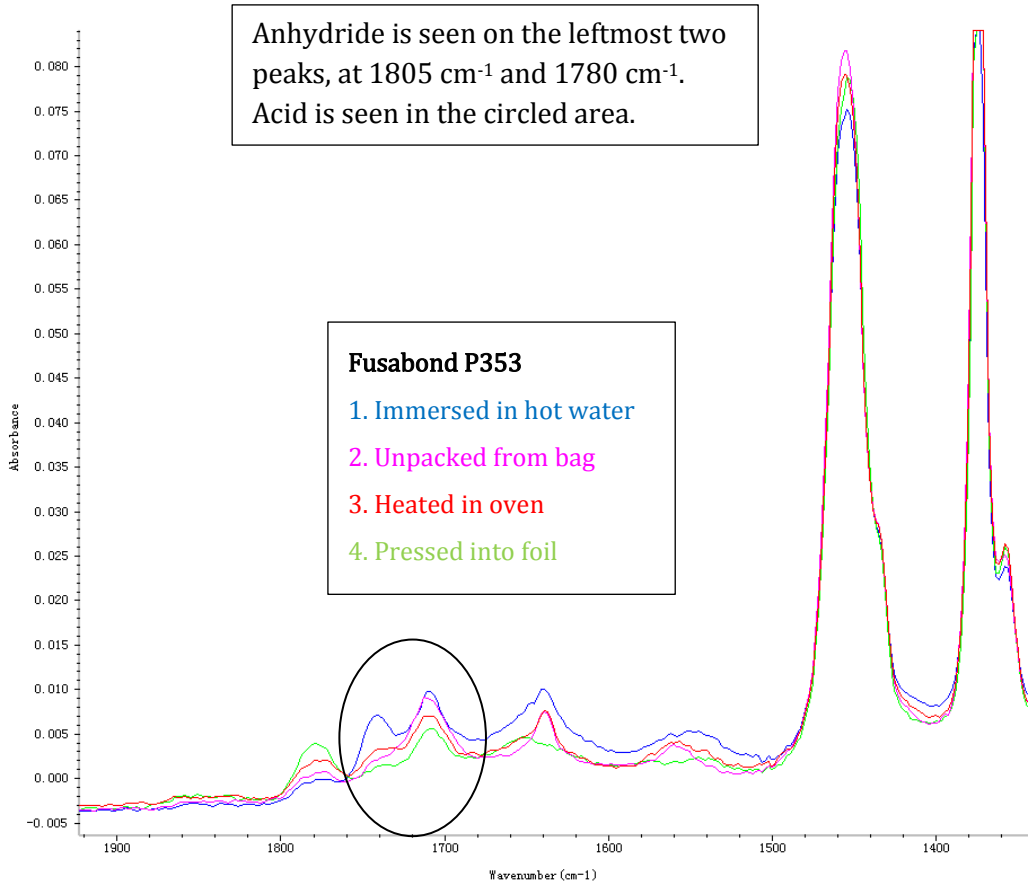
*GRAFTABOND PPH-MAH 70025 CA spectra was also compared to the day it was produced

Percentage of anhydride and acid content was determined by FTIR spectroscopy.

RESULTS

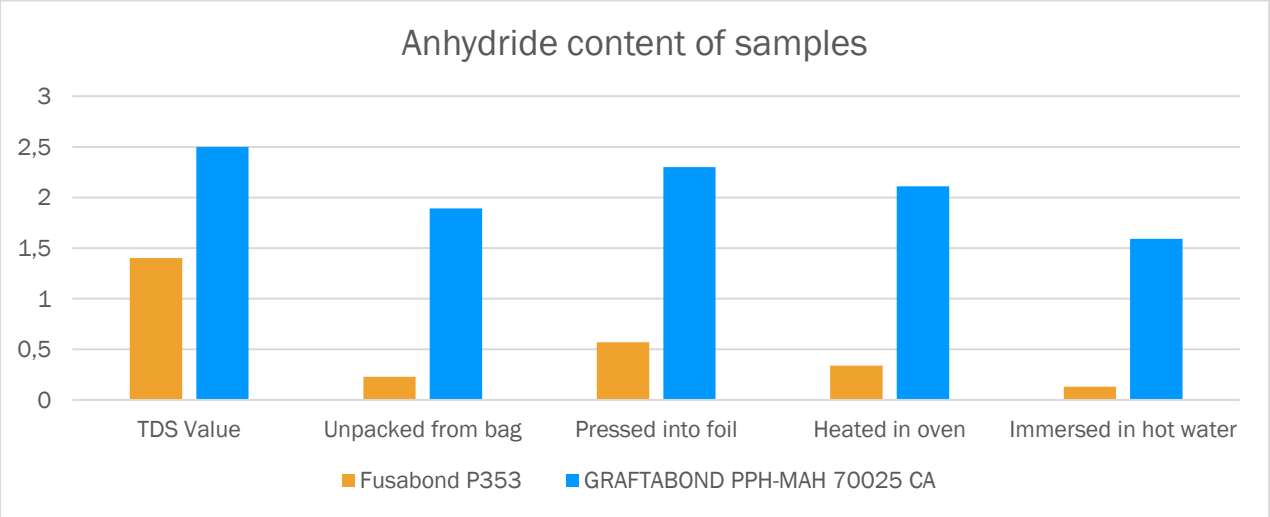


Anhydride is seen on the leftmost two peaks, at 1805 cm^{-1} and 1780 cm^{-1}.
Acid is seen in the circled area.



We calculated the percentage of anhydride, by using the area of peaks at 1850 cm^{-1} and 1780 cm^{-1}.

Sample State	Anhydride Content [%]	
	GRAFTABOND	*FUSABOND*
Datasheet Value	≈2,5	1,4
Unpacked from bag	1,89	0,23
Pressed into foil	2,30	0,57
Heated in oven for 3 hours	2,11	0,34
Immersed in hot water for 1 hour	1,59	0,13



CONCLUSIONS

- When left unopened for longer time, the anhydride of MAH converts to acid, reducing the effectiveness of the additive
- This process is fastest when the material is exposed to water/moisture and heat
- Acid can be converted back to anhydride, by applying heat
- As seen from the spectra, Fusabond P353 always has some acid present, while GRAFTABOND PPH-MAH 70025 CA can convert almost fully to anhydride

Both materials from bag:

- Fusabond P353 retains 16% of MAH in anhydride
- GRAFTABOND PPH-MAH 70025 CA retains 76% of MAH in anhydride

Pressed into foil:

- Fusabond P353 converts 43% of acid to anhydride
- GRAFTABOND PPH-MAH 70025 CA converts 92% of acid to anhydride