PhD Open Days

Biaxially-Oriented PP (BOPP film from Chocolate wrap) pyrolysis

Chemical Engineering

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Abstract

- Polypropylene (PP) → Recyclable plastic → Wrap instructions: throw it in the garbage.
- With EDX characterization is possible identify C, O, Si → Biaxially-Oriented (BO) PP (BOPP).
- Work aim: study chemical recycling by pyrolysis.

Introduction

- Approximately, 380 million tons of plastic is produced annually and only 9% is recycled globally.
- Plastic can be recyclable mechanically or chemically. Despite mechanical recycling being widely used, chemical recycling has been a growing research focus, e.g., pyrolysis.
- Pyrolysis can potentially facilitate the recycling of diverse products made up of multiple layers of different plastics or even different materials.
- The smaller molecules produced through pyrolysis could be used to form plastics once again.

BOPP → PP flattened and stretched in two directions
Plus, vacuum deposition of silicon
↓
improves barrier properties

Experimental

TG/DSC

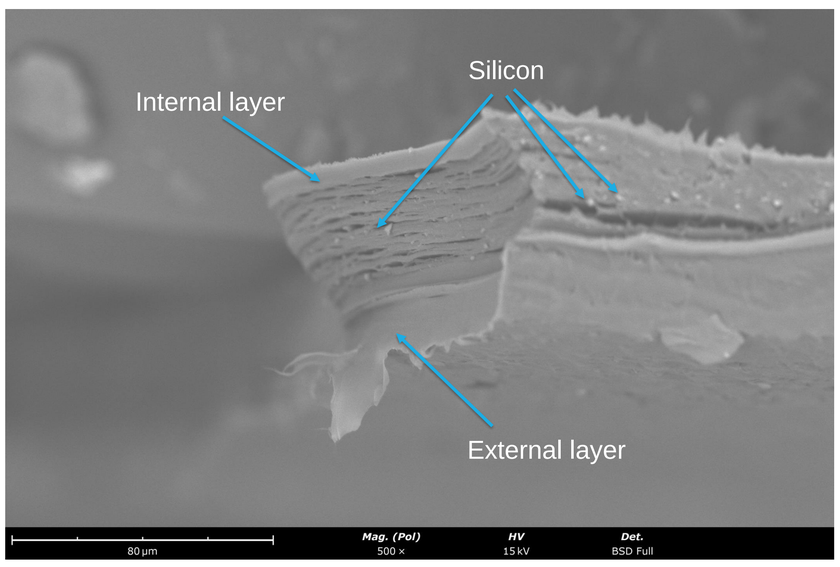
- TA Instruments SDT 2960 Simultaneous DSG-TGA;
- Quartz pan;
- Nitrogen;
- 1st 40 ºC for 5 min;
- 2nd 10 ºC/min up to 800 ºC;
- 3rd 800 °C for 10 min:
- 4th sample was cooled.

SEM with EDX

- ThermoScientific desktop SEM;
- Model Phenom ProX G6;
- EDS detector.

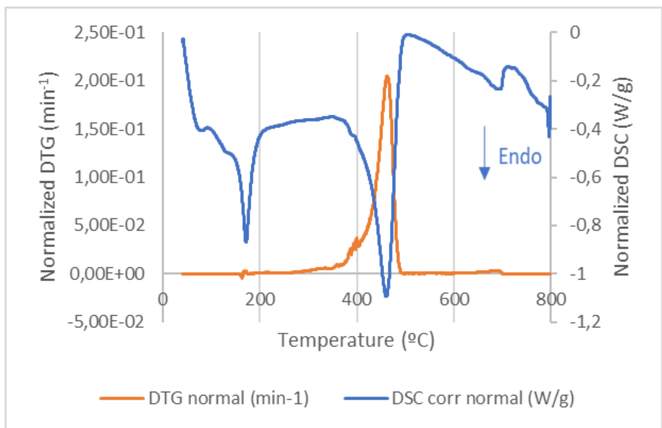
Results

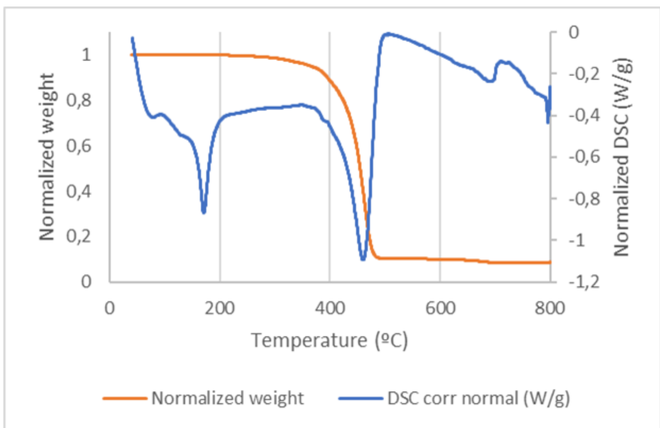
SEM with EDX



Chocolate wrap SEM images.

TG/DSC





T onset (°C)	T max (°C)	T fusion (°C)	T degradation (°C)
430,1	462,7	171,3	375-500

Conclusion

- There is 9% of residue after the pyrolysis of the BOPP, which is mainly composed of the inorganic component;
- When doing a lab-scale reactor under N2 was possible to analyse the liquid and gas phase, both were composed by hydrocarbons. The gas phase contained hydrocarbons between C2 and C6 and ~80 % of the liquid phase was composed by hydrocarbons between C5 and C10.
- Pyrolysis is a promising technique for chemical recycling of BOPP plastics.

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