Asian Journal of Chemistry Vol. 19, No. 7 (2007), 5781-5783

NOTE

Mechanical Properties and the Morphology of Polypropylene Containing Di-*p*-methylbenzylidene

WENTAO HAO and WEN YANG*
College of Chemical Engineering, Hefei University of Technology
Hefei, Anhui, 230009, P.R. China
Fax: (86)(551)2901450; Tel: (86)(551)2903926; E-mail: hfutyw@163.com

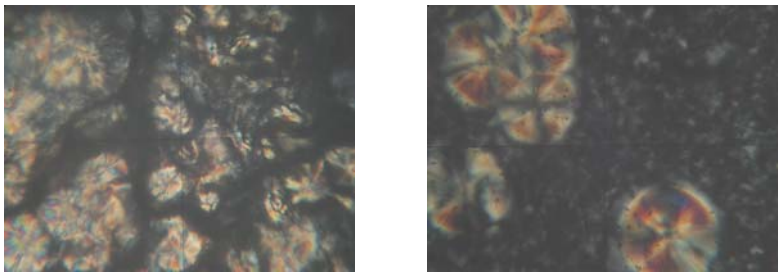
Mechanical properties and morphology of polypropylene (PP) containing di-*p*-methylbenzylidene (Me-DBS), a clarifying nucleating agent, were studied. In this studies, PP containing normal nucleating agent, sodium benzoate (SB), were used as comparison. It was found that the mechanical properties of PP with Me-DBS and SB were much different. Such differences should be contributed to the different nucleating mechanisms and different morphology of PP containing different nucleating agents.

Key Words: Polypropylene, Di-*p*-methylbenzylidene, Sodium benzoate, mechanical properties, Morphology.

Hamada *et al.*[1] reported dibenzylidene sorbitol (DBS), a clarifying nucleating agent for polypropylene (PP). After that, research works were focused on the effects of DBS and its derivatives on the mechanical properties of PP[2,3]. However, there was no report on the difference between the effects of DBS and the other nucleating agent. In this paper, comparison between di-*p*-methylbenzylidene (Me-DBS) and sodium benzoate (SB) was performed. A remarkable differences were found for the mechanical properties of PP/Me-DBS and PP/SB systems. It might be due to the different nucleating mechanisms and different morphology of PP containing different nucleating agents.

Polypropylene S1004, provided by Sinopec Yangzi Petrochemical Company Ltd., China; Me-DBS, provided by Shanxi Institute of Chemical Engineering, China. No more other additives were added in. Twin-screw extruder, SJSH-30, Nanjing Rubber and Plastics Processing Machine Co. Ltd., China; Injector, HTL90-F5B, Ningbo Haitai Group, China; Electronic Universal Testing Machine, CMT5000, Sans Testing Machine Inc., China; Charpy impact testing machine, XCJ-500, Chengde Precision Testing Machine Co. Ltd., China.

The tensile strength of PP/SB reached the lowest point as SB content was 1 wt %, while the tensile strength of PP/Me-DBS remained almost constant. Spherulites would contribute much more to the tensile strength than the imperfect crystals. In the former study, it had been learned that Me-DBS was helpful in accelerating PP to grow larger and more perfect crystals (Fig. 1). When the stress was applied, spherulites in PP/Me-DBS could bear more energy than crystals in PP/SB. On the other hand, crystal size of PP/Me-DBS was almost the same. All the crystals could deform synchronously when stress applied. This is the reason that the tensile strength of PP/Me-DBS could remain constant, while PP/SB could not.



(a) (b)

Fig. 1. Crystalline morphology of PP with different nucleating agents (0.1 wt %, 155°C, 5 h) (a) Sodium benzoate, (b) Me-DBS

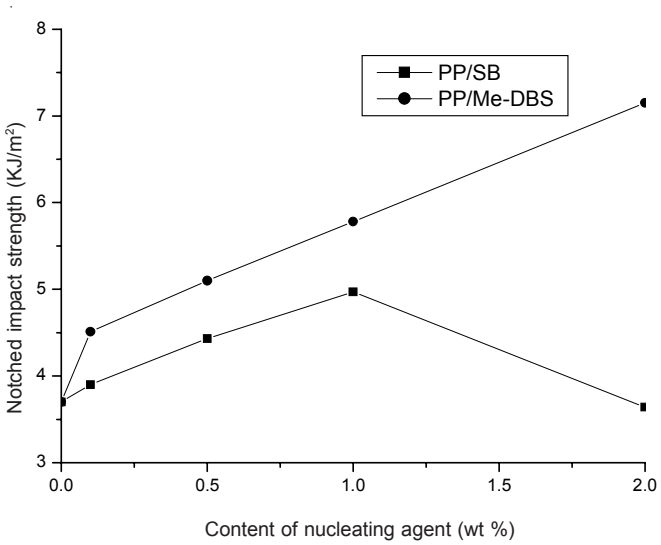
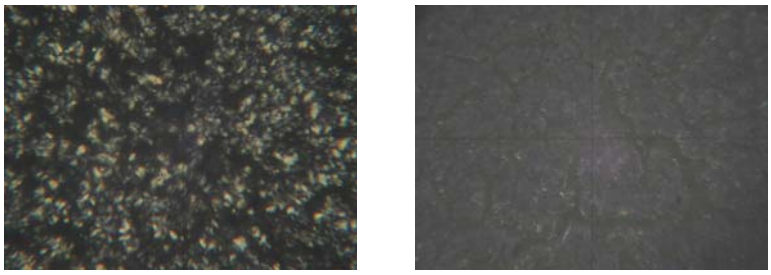


Fig. 2. Impact strength of PP with different content of nucleating agents

The impact strength of PP/Me-DBS was higher than that of PP/SB at any nucleating agent content. With Me-DBS content increasing, the impact strength of PP/Me-DBS increased almost linearly. Impact strength of PP/SB reached the maximum value as SB content was 1 wt %, then decreased rapidly.

It had been found that, as Me-DBS content reached 0.5 wt %, the crystalline morphology was amorphous-like; for PP/SB, crystals could still be seen clearly as SB content equal to 0.5 wt % (Fig. 3). Usually, the impact strength of semi-crystallized materials like PP is determined by the tear strength of interfaces of crystals. Smooth interface will result in poor impact strength. However, blurred interface will result in a better impact performance. Now it could be easy to understand the reason that the impact strength of PP/Me-DBS was higher.



(a) (b)

Fig. 3. Crystalline morphology of PP with different nucleating agent (0.5 wt %, 140°C, 24 h) (a) SB, (b) Me-DBS

Shrinkage of PP was not much affected by the sodium benzoate. The shrinkage for PP/SB was about 1 %. However, the shrinkage of PP/Me-DBS was about 2.5 %. Me-DBS could stimulate the crystallization of PP more rapidly and effectively, which would result in a higher shrinkage.

Conclusions

By comparing the mechanical properties of PP with clarifying nucleating agent Me-DBS and ordinary nucleating agent SB, it was found that they were much different. The differences should be contributed to that Me-DBS could stimulate the crystallization of PP more rapidly and effectively.

REFERENCES

1. K. Hamada and H. Uchiyama, Polyolefin Plastic Compositions Having Improved Transparency, US Patent, 4,016,118 (1975).
2. M. Teng, J. Duan and G. Zhang, *Plastic Additives J.*, **5**, 15 (1999).
3. F. Gong, J. Xu and C. Liu, *Transaction of Jiangsu Tech. College J.*, **15**, 11 (2003).

(*Received*: 13 October 2006; *Accepted*: 22 June 2007) AJC-5773