



BENEFITS

- Melt strength improvement in extrusion and forming processes
- Extrusion stability in foaming process
- Higher regrind levels

SUGGESTED MARKETS/ APPLICATIONS

- Extruded foam
- Thermoforming
- Extrusion coating
- Blow molding
- Blown film

ADDITIONAL INFO

- SDS: Dymalink® 9200
- Technical Update: Rheological Modification of Polyolefins Using Dymalink® 9200

Increasing Regrind Levels in High-Melt-Strength Polypropylene Using Dymalink® 9200

Introduction

Dymalink® 9200 is an acrylate functional zinc salt that reacts with aliphatic polymers to form a carbon-carbon covalent link. The polar zinc cations tend to assemble into ionic clusters within the polymer matrix, promoting the formation of a dynamic network as illustrated in Figure 1. This network promotes melt strength behavior, even at very low loadings.

Some secondary processes, such as thermoforming or extruded foam, use HMS-PP and produce a large amount of scrap that is shredded, repelletized, and added back to the original compound. Due to low melt strength of the regrind only a small amount can be incorporated back into the base compound. Dymalink 9200 can increase the melt strength of this regrind.

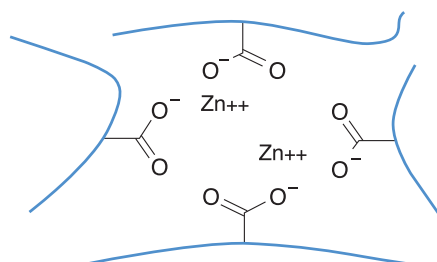


Figure 1: Schematic of the ionic cross-linking system.

Experimental

Simulated regrind material was created by passing a commercially available HMS PP through a twin-screw extruder up to 4 times. This regrind material was then compounded with Dymalink 9200 at 1%, 1.5% and 2% addition levels. Specimens were cut from compression molded sheets and tested on a TA Instruments DHR-2 using a SER3 elongational viscosity fixture. Elongational viscosity testing was performed at 180°C using a constant strain rate of 0.1s⁻¹.

In the first stage of testing, one pass through the extruder was enough for the HMS PP to see a reduction of melt viscosity of 90%, shown in Table 1. During this study the 1.5% loading of Dymalink 9200 was optimum for this material and increased the elongational viscosity from 125,000 to 1,139,000 Pa.s, an increase of over 800%.

Table 1: HMS PP regrind: various levels of Dymalink 9200. Elongational viscosity at 180°C and 0.1s⁻¹ strain rate.

Extrusion Passes	HMS PP (Pa.s)	1% Dymalink (Pa.s)	1.5% Dymalink (Pa.s)	2% Dymalink (Pa.s)
0	1,271,700	–	–	–
1	125,000	–	–	–
2	128,000	603,000	1,139,000	1,004,000
3	99,000	817,000	658,000	426,000
4	54,000	728,000	462,000	452,000

In the second stage of testing, the regrind sample containing 1.5% Dymalink was blended into virgin HMS PP and compared against compounded regrind containing no Dymalink. The regrind addition was increased by 5% increments up to 25% of the total compound. Specimens were compression molded and tested for elongational viscosity at 180°C and a strain rate of 0.1s⁻¹.

The elongational viscosity of the 95/5 base compound/regrind control was measured at 587,000 Pa.s. Using the regrind with 1.5% Dymalink 9200, an elongational viscosity of 687,000 Pa.s was achieved with 25% regrind level. The Dymalink-modified regrind at 5% level achieved a higher melt viscosity than the virgin HMS PP at 1,565,000 Pa.s compared to 1,270,000 Pa.s of the virgin HMS PP. Further, the Dymalink-modified regrind allows for up to 20% regrind incorporation while maintaining over 1,000,000 Pa.s elongational viscosity, as shown in Table 2.

Table 2: Base compounds with regrind: Elongational viscosity at 180°C and 0.1s⁻¹ strain rate. Parallel plate rheology G'/G'' crossover point T=190°C. Melt flow rate 230°C/2.16 kg.

Virgin to HMS-PP Ratio	Elongational Viscosity		Melt Flow Rate	
	Control (Pa.s)	1.5% Dymalink 9200 (Pa.s)	Control (g/10 minutes)	1.5% Dymalink 9200 (g/10 minutes)
100/0	1,270,000	–	2.1	–
95/5	587,000	1,565,000	6.1	6.3
90/10	61,000	1,183,000	6.5	6.3
80/20	63,000	1,019,000	6.4	6.4
75/25	–	687,000	–	6.6

Summary

Addition of Dymalink 9200 to HMS PP regrind improves its melt strength, allowing for significantly higher levels of regrind in melt-strength sensitive operations such as extruded foam, thermoforming, extrusion coating, blow molding, and profile extrusion. Dymalink 9200 allows converters flexibility to tailor PP-based compounds to their specific end-use needs. Dymalink 9200 is commercially available globally.

About TOTAL Cray Valley

TOTAL Cray Valley is the premier global supplier of specialty chemical additives, hydrocarbon specialty chemicals, and liquid and powder tackifying resins used as ingredients in adhesives, rubbers, polymers, coatings, and other materials. TOTAL Cray Valley has pioneered the development of these advanced technologies, introducing hundreds of products that enhance the performance of products in energy, printing, packaging, construction, tire manufacturing, electronics, and other demanding applications.

For more information, please visit our website at www.crayvalley.com.

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