Eastoflex Amorphous Polyolefins (APOs) in Hot-Melt Sealants

Sealant formulations generally contain elastomer, tackifying resins, fillers, pigments, and antioxidants. Various *Eastoflex* APOs from Eastman have been evaluated as rheology and adhesion modifiers in sealant formulations and as extenders for higher-cost sealant base raw materials. These amorphous polyolefins include propylene homopolymers and copolymers of propylene with ethylene or hexene. Sealant blends containing butyl elastomer, styrene-ethylene-butadiene-styrene blocked copolymer, and polyisobutadiene were compounded with the amorphous polyolefins. Sealant formulations are presented in this publication, along with standard sealant test data, to illustrate how *Eastoflex* amorphous polyolefins can lower the cost of sealant formulations, reduce process energy, and enhance peel adhesion in resilient and semi resilient sealant formulations.

Compatibility of Amorphous Polyolefins With Various Sealant Base Materials

Compatibility was determined by blending equal parts by weight of the amorphous polyolefin with the sealant material in a sigma blade mixer for 2 hours. The final product was then examined for uniformity as an indication of compatibility.

APO materials were judged to be compatible when tested with the following sealant materials:

- Polybutenes
- Ethylene-propylene diene monomer (EPDM)
- Cross-linked butyl elastomers
- Styrene-ethylene-butadiene-styrene (SEBS) elastomer
- Hydrogenated resin

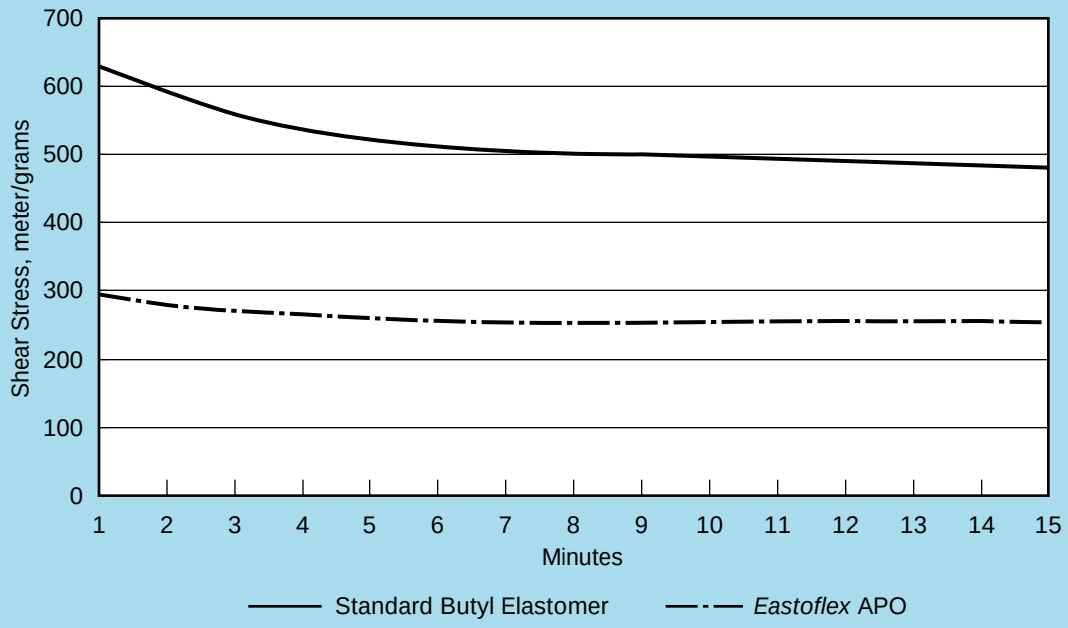
Amorphous Polyolefins Reduce Process Energy

Table 1 describes a butyl sealant in which a portion of the elastomer is replaced with *Eastoflex* APO. A dramatic reduction in process energy is seen in Figure 1. Numbers in parentheses in Tables 1 through 3 correspond to the Materials and Suppliers list at the end of this publication.

Table 1 **Butyl Sealant Formulation**

	Wt %	
Material	**Standard**	**APO**
Cross-Linked Butyl Elastomer (1)	25	15
Eastotac H-130E Resin (6)	30	30
Polybutene (9)	24	24
$CaCO_3$ (4)	20.5	20.5
Antioxidant (3)	0.5	0.5
Eastoflex APO (7)	—	10

Figure 1 **Reduction in Blending Energy With Addition of *Eastoflex* APO Brabender Torque Rheology**



Sample Preparation

Formulations studied were compounded in a sigma blade mixer at batch temperatures of 250°–350°F. The elastomer was added, along with small amounts of APO to ensure sufficient shear. The resin, antioxidant, and filler were then added, with the polybutene added last. After the final polybutene addition, the entire mass was mixed for 1 hour.

Procedure

Start: Turn on oil heat to jacketed sigma blade mixer and set temperature at 350°F.

15 min: Add elastomer, half of APO, and antioxidant. Turn mixer on.

30 min: Add remaining APO and resin.

15 min: Add filler and pigments.

30 min: Add increments of polybutene until batch is smooth and uniform.

60 min: Mix.

The data in Table 2 indicate that substitution of SEBS with *Eastoflex* P1023 amorphous propylene homopolymer (APP) will lower the cost of the formulation and enhance peel adhesion.

Table 3 data indicate that substitution of cross-linked butyl elastomer with *Eastoflex* P1023 results in a slight decrease in peel strength. Costs benefits can be achieved with this raw material substitution.

Table 2 **Styrene-Ethylene-Butadiene-Styrene Formulations**

	Wt %	
Material	**A**	**B**
SEBS Elastomer (2)	20	10
Eastotac H-130E Resin (6)	20	20
Polybutene (9)	30	30
$CaCO_3$ (4)	17.5	17.5
TiO_2 (5)	6	6
ZnO (8)	6	6
Antioxidant (3)	0.5	0.5
Eastoflex P1023 APP (7)	—	10
Test Results	**Value**	
Penetration Hardness, ASTM D 1321, dmm	32	39
Peel Adhesion, ASTM C 794 Modified, pli (avg)	11	22
Canvas to Cold-Rolled Steel Failure	Adhesive	Cohesive

Table 3 SEBS/Cross-Linked Butyl Rubber Formulation

	Wt %	
Material	**A**	**B**
SEBS Elastomer (2)	10	10
Cross-Linked Butyl (1)	10	5
Eastotac H-130E Resin (6)	20	20
Polybutene (9)	30	30
$CaCO_3$ (4)	17.5	17.5
TiO_2 (5)	6	6
ZnO (8)	6	6
Antioxidant (3)	0.5	0.5
Eastoflex P1023 APP (7)	—	5
Test Results	**Value**	
Penetration Hardness, ASTM D 1321, dmm	54	47
Peel Adhesion, ASTM C 794 Modified, pli (avg)	27	25
Canvas to Cold-Rolled Steel Failure	Adhesive	Cohesive

Materials and Suppliers

1. *Kalar* 5214, Hardman, Inc.
2. *Kraton* G-1652, Shell Chemical Company
3. *Irganox* 1010, Ciba-Geigy Corporation
4. *Atomite*, ECC America, Inc.
5. *Ti-Pure* R-900, E. I. du Pont Company, Inc.
6. *Eastotac* H-130E, Eastman Chemical Company
7. *Eastoflex* APO, *Eastoflex* P1023 propylene homopolymer, Eastman Chemical Company
8. Zinc Oxide, New Jersey Zinc
9. *Indopol* H-300, Amoco Chemical Company

Information

NORTH AMERICA

Eastman Chemical Company
Corporate Headquarters
P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

Telephone:
U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations (1) 423-229-2000
Fax: (1) 423-229-1064

http://www.eastman.com

LATIN AMERICA

Eastman Chemical Latin America, Inc.
2333 Ponce de Leon Blvd.
Suite R-20
Coral Gables, FL 33134 U.S.A.

Telephone: (1) 305-461-8240
Fax: (1) 305-461-8254

EUROPE / MIDDLE EAST / AFRICA

Eastman Chemical, Europe, Middle East, and Africa Ltd.
Tobias Asserlaan 5
2517 KC The Hague
NETHERLANDS

Telephone: (31) 70 370 1711
Fax: (31) 70 370 1704

ASIA PACIFIC

Eastman Chemical Japan Ltd.
Yebisu Garden Place Tower, 32F
4-20-3 Ebisu
Shibuya-ku, Tokyo 150 JAPAN

Telephone: (81) 3-5424-1551
Fax: (81) 3-5424-1590

Eastman Chemical Asia Pacific Pte. Ltd.
#05-04 Winsland House
3 Killiney Road
Singapore 239519 SINGAPORE

Telephone: (65) 738-4877
Fax: (65) 732-4930

Material Safety Data Sheets providing safety precautions that should be observed in handling and storing Eastman products are available on request. You should obtain and review the available material safety information before handling any of these products. If any materials mentioned are not Eastman products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

Neither Eastman Chemical Company nor its marketing affiliates shall be responsible for the use of this information, or of any product, method, or apparatus mentioned, and you must make your own determination of its suitability and completeness for your own use, for the protection of the environment, and for the health and safety of your employees and purchasers of your products. No warranty is made of the merchantability or fitness of any product, and nothing herein waives any of the Seller's conditions of sale.

Eastoflex and *Eastotac* are trademarks of Eastman Chemical Company.

EASTMAN

ECP 7862 3A (6-98) Printed in U.S.A.

Publication WA-12B
June 1998