Who is in compliance?

Some manufacturers are not complying with ASTM standards for polymer-modified bitumen products

by **Mark S. Graham** and **James R. Kirby, AIA**

Polymer-modified bitumen sheet products for use in low-slope roof systems first were introduced to the U.S. roofing industry in 1975. Since then, their acceptance and use as membrane components in polymer-modified bitumen roof systems and conventional built-up roofing ply sheets in multiple-ply hybrid roof systems have grown substantially.

Usage

NRCA's 1998-1999 Annual Market Survey reveals polymer-modified bitumen roof systems account for about 22 percent of the total U.S. low-slope roofing market. And polymer-modified bitumen roof systems account for about 16 percent of all roof systems (i.e., low- and steep-slope combined) installed in the United States during 1998.

According to NRCA's *1999 Low-Slope Roofing Materials Guide*, 40 manufacturers produce 420 polymer-modified bitumen sheet products available to U.S. roofing professionals. About 1,540 manufacturers' membrane specifications include polymer-modified bitumen sheet products.

Given the market share of polymer-modified bitumen roof systems and number of manufacturers, products and specifications associated with them, roofing professionals must be capable of classifying and differentiating among the products.

Until recently, there had been no recognized, quantifiable method in the United States for performing such classifications. This recently changed, however, when the American Society for Testing and Materials (ASTM) published several new material standards for polymer-modified bitumen sheet products during 1997 and 1998.

ASTM

ASTM, a not-for-profit organization based in Philadelphia, Pa., provides a forum for manufacturers, users, consumers and those having a general interest (e.g., government representatives, academics) to write standards for materials (e.g., building materials), products, systems and services. Organized in 1898, ASTM has grown

ASTM D 6222, Type I, Grade S

Manufacturer	Product(s)
Allied Signal*	Infinitee ST
Firestone	APP 160 APP 170 APP 180 APP 180 FR
GAF*	Ruberoid Torch S Ruberoid
IKO	Armourplast Classic
U.S. Intec*	Intec SP4

ASTM D 6222, Type I, Grade G

Manufacturer	Product(s)
Allied Signal*	Infinitee GTC Infinitee GTC-FR
GAF*	Ruberoid Torch G Ruberoid Torch 170 FR
IKO	Armourplast Granular
U.S. Intec*	Intec GBSP4 Intec GBSP4 FR

Note: Asterisks indicate that package labeling stating ASTM compliance will be used once current stocks of packaging are depleted.

Figure 1

ASTM D 6222, Type II, Grade S

Manufacturer	Product
ICA	ICA Premium APP Smooth
Modbit Corp.*	Bitutak MB

ASTM D 6222, Type II, Grade G

Manufacturer	Product(s)
GAF*	Ruberoid Torch Plus Ruberoid Torch FR
ICA	ICA Premium APP Mineral ICA Premium APP Slate
Modbit Corp.*	Bitutak MB Granule
U.S. Intec*	Intec GBSP 250 FR

Figure 2

ASTM D 6223, Type I, Grade S	
Manufacturer	**Products**
Performance*	Derbigum GP Derbigum GP FR

ASTM D 6223, Type I, Grade G	
Manufacturer	**Products**
Performance*	Derbicolor GP Derbicolor GP FR

ASTM D 6223, Type II, Grade S	
Manufacturer	**Product(s)**
Performance*	Derbigum XPS Derbigum XPS FR
Southwestern Petroleum Corp.	SWEPCO UNI + SHIELD SYS 302

ASTM D 6223, Type II, Grade G	
Manufacturer	**Products**
Performance*	Derbicolor XPS Derbicolor XPS FR

Figure 3

into one of the largest voluntary standards development organizations in the world.

Because ASTM has no technical research or testing facilities of its own, research is conducted by more than 34,000 technically qualified volunteer members from around the world. These technical volunteers are involved with more than 132 standards writing committees and numerous subcommittees and task forces.

ASTM standards are drafted by technical task forces. Once a task force has developed a draft standard, the draft is voted on by a subcommittee and committee. Because ASTM standards are developed through a consensus process, there must be agreement among two-thirds of the voting task force, subcommittee and committee members on a particular standard before it is approved and published.

ASTM material standards typically are viewed as having the minimal properties necessary for a material to perform adequately. In some instances, ASTM material standards are included in building codes and minimum requirements for construction.

The new ASTM standards for polymer-modified bitumen sheet products were developed by ASTM Committee D-8 on Roofing, Waterproofing and Bituminous Materials. The committee is composed of roofing professionals, including contractors and manufacturers.

Test-method standards

In 1991, ASTM published the first edition of ASTM D 5147, "Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Materials." This standard provided the roofing industry with a recognized basis for testing and evaluating polymer-modified bitumen sheet products. The standard's current edition is ASTM D 5147-97, which was written in 1997.

Included in ASTM D 5147-97 are sampling and conditioning methods for modified bitumen sheet products and test methods for determining the products' thicknesses, load-strain properties, tear strengths, moisture contents, water-absorption abilities, dimensional and compound stabilities, low-temperature flexibilities, heat conditioning, accelerated weathering, granule embedment and coating thicknesses.

In addition to providing a means for testing polymer-modified bitumen sheet products, ASTM D 5147 also has served as a primary basis for developing new material standards for these products.

Roofing professionals should realize ASTM D 5147 provides only methods for sampling, conditioning and testing polymer-modified bitumen sheet products. It does not establish minimum or maximum properties for these products. For this reason, establishing product standards, which include minimum and maximum properties, is significant.

Product standards

The six new ASTM material standards for polymer-modified bitumen sheet products are as follows:

- ASTM D 6162-97, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements"
- ASTM D 6163-97, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements"
- ASTM D 6164-97, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements"
- ASTM D 6222-98, "Standard Specification for Atactic Polypropylene (APP) Modified Bituminous

ASTM D 6162, Type II, Grade S	
Manufacturer	**Product**
Johns Manville*	Dynaply
Siplast*	Paradiene 20 PR

ASTM D 6162, Type II, Grade G	
Manufacturer	**Product(s)**
Johns Manville*	Dynakap Dynakap FR
Siplast*	Parafor 50 LT

ASTM D 6162, Type III, Grade S	
Manufacturer	**Products**
Garland*	Stressply "E" Stressply "E" FR

ASTM D 6162, Type III, Grade G	
Manufacturer	**Products**
Garland*	Stressply "E" Mineral Stressply "E" FR Mineral
Johns Manville*	Dynamax Dynamax FR

Figure 4

ASTM D 6163, Type I, Grade S	
Manufacturer	**Product(s)**
GAF*	Ruberoid 20
IKO	Armourbond 95
Siplast*	Paradiene 20 Paradiene 20 HV Paradiene 20 TG Paradiene 20 HV TG

ASTM D 6163, Type I, Grade G	
Manufacturer	**Product(s)**
Firestone	SBS Glass SBS Glass FR SBS Glass FR Torch
GAF*	Modified Cap Sheet 601+ Ruberoid 30 Ruberoid 30 FR
Johns Manville*	Dynaglas Dynaglas FR Dynaglas 30 FR
Malarkey*	Paragon SBS 625
Siplast*	Paradiene 30 Paradiene 30 TG Paradiene 30 FR TG
U.S. Intec*	Intec/Flex FR 4.5 Intec/Flex G4 Cap

ASTM D 6163, Type II, Grade S	
Manufacturer	**Products**
Siplast*	Paradiene 20 HT Paradiene 20 EG Paradiene 20 HT TG Paradiene 20 EG TG

ASTM D 6163, Type II, Grade G	
Manufacturer	**Product(s)**
Malarkey*	Panoply SBS 650
Siplast*	Paradiene 30 HT Paradiene 30 HT FR Paradiene 40 FR Paradiene 30 HT TG Paradiene 30 HT FR TG

ASTM D 6163, Type III, Grade S	
Manufacturer	**Products**
Garland*	Stressply Stressply FR Versiply 40 Versiply 60 Versiply 80 Stressply Plus Stressply Plus FR Stressply IV

ASTM D 6163, Type III, Grade G	
Manufacturer	**Products**
Garland*	Stressply Mineral Stressply FR Mineral Versiply Mineral Stressply Plus Mineral Stressply Plus FR Mineral Stressply IV

Figure 5

Sheet Materials Using Polyester Reinforcements"

- ASTM D 6223-98, "Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements"
- ASTM D 6298-98, "Standard Specification for Fiberglass Reinforced Styrene Butadiene Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface"

All the standards except ASTM D 6298 differentiate between type and grade classifications. The "type" designation (e.g., Type I, Type II, Type III) distinguishes between products governed by the same standard based on dimension, mass and physical properties.

Generally, products designated as Type II are thicker and have higher masses, as well as higher tensile and tear strengths, than Type I products. However, roofing professionals should realize Type II products may not perform better than Type I products—they just have different properties within the same general product designation.

The "grade" designation (i.e., Grade G and Grade S) differentiates between sheet products governed by the same standard based on a product's topside surfacing. Grade G refers to products with topside granule surfacing, and Grade S designates products with smooth topside surfaces (i.e., no granules).

Type and grade classifications are noted after a specific ASTM standard designation. For example, ASTM D 6164, Type II, Grade G refers to a mineral granule-surfaced, SBS-polymer-modified bitumen sheet with polyester reinforcement that has relatively high net mass and physical properties as compared with a material with an ASTM D 6164, Type I, Grade G designation.

Product labeling

Included in each of the new product standards for polymer-modified bitumen sheet products is a stipulation that each product package (e.g., roll wrapper) include the manufacturer and product names; ASTM designation, including any applicable type and grade; net coverage area; and bitumen type if not otherwise evident, such as in a product name.

For polymer-modified bitumen sheet products to comply with ASTM, products must meet the properties indicated in the applicable standard and include the labeling information stipulated. This requirement is included in these standards to facilitate clear identification of products that comply with ASTM standards.

Manufacturers' compliance

To gauge the level of manufacturer participation in ASTM standard compliance, NRCA's Technical Services Department conducted telephone surveys from Feb. 24-March 9 with all manufacturers listed in NRCA's *1999 Low-Slope Roofing Materials Guide* who market polymer-modified bitumen sheet products. The manufacturers were asked whether their products

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What do the new standards mean?

Because the American Society for Testing and Materials (ASTM) product standards for polymer-modified bitumen sheet products have been issued, some roofing professionals may believe that technical development of standards for these particular roof systems is over. Although the new standards may simplify specifying these products, they can lead to a false sense of security by implying that products bearing ASTM labels consistently will perform satisfactorily.

To better understand the concerns with these new ASTM product standards, built-up roof (BUR) systems can be considered as examples. ASTM D 2178, "Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing," is the product standard for fiberglass ply sheets used in BUR systems.

The primary difference between ASTM D 2178 and the new product standards for polymer-modified bitumen sheet products is that there have been long-standing, well-established performance criteria for BUR systems, and none exist for polymer-modified bitumen sheet roof systems.

The National Bureau of Standards Building Science Series 55 (NBS BSS 55), which was published in 1974, established performance criteria for BUR systems pertaining to in-service conditions. One of the most noted criterion was for BUR membrane tensile strength. The conclusion was that if BUR membranes had minimum tensile strengths of 200 Lbf/in (35 kN/m) at 0 F (-18 C), there is reasonable certainty for adequate performance. Roofing professionals have verified this conclusion by 25 years of successful experience since the research was reported.

This information provides a basis for considering the viability of the current ASTM standards for polymer-modified bitumen sheet products. With these standards, there are no universally accepted bases or criteria (such as NBS BSS 55 for BUR systems) to indicate polymer-modified bitumen sheet products will perform adequately in completed roof systems.

Since the first ASTM task force regarding these product standards met in 1988, its intent was to segregate modified bitumen sheets by reinforcement type. Within each of the new standards (except ASTM D 6298), there are at least two types (e.g., Type I, Type II) with two grades (i.e., Grade G and Grade S) of products. In each case, the only distinction between Type I and Type II is that Type II products have somewhat higher tensile and tear strengths than Type I products. Unfortunately, there is little or no correlation between higher tensile and tear strengths and roof system performance.

Also, little credence was given to existing European or Canadian standards for polymer-modified bitumen sheet products. Some major differences between the new ASTM product standards and those of Europe and Canada underscore the need for continuing analysis regarding bitumen materials. Quality and longevity of modified bitumen products are predicated by the polymer-modified asphalt blend composition and sheet material's stability. Neither of these characteristics are addressed adequately by the ASTM standards. European standards address the quality of the polymer-modified bitumen blend component and finished sheets.

Following are some additional concerns with the new ASTM standards:

- Thickness: Currently, ASTM D 5147 requires that the thickness measurement be taken at five points across the width of a modified bitumen sheet. Granule-surfacing thickness is included in the measurement, which can lead to erroneous conclusions about a sheet's quality. Measuring thickness on the selvage edge (i.e., without granules) is more appropriate because the waterproof coating's actual thickness can be determined.
- Dimensional stability: Dimensional stability is directly related to membrane shrinkage. In some European countries, if a product is to be used in a single-layer application, the maximum allowable shrinkage is 0.3 percent. If a sheet is used in a multiple-layer membrane construction, the maximum allowable shrinkage is 0.5 percent. By contrast, ASTM D 6164, D 6222 and D 6223 allow for 1 percent shrinkage; ASTM D 6162 and D 6163 are limited to 0.5 percent shrinkage.
- Elongation at 5 percent maximum load (also referred to as ultimate elongation): Elongation at 5 percent maximum load is a good indicator of bitumen blend quality for most glass-reinforced materials. Generally, glass mat will elongate about 2 percent to 4 percent; glass scrim will elongate about 6 percent to 8 percent. When elongation values of a bitumen blend and glass mat coincide, the sheet material will exhibit little or no elasticity.
- Low-temperature flexibility: The values published in the ASTM product standards are credible when considering results for heat-conditioned (i.e., aged) samples. However, the necessary accelerated heat-aging test requires three months to complete and obtain results. Unaged products with high-quality bitumen blends should exhibit low-temperature flexibility numbers below 0 F (-18 C).

Universally accepted performance criteria for polymer-modified sheet membrane roof systems are necessary. Until criteria are developed, roofing professionals should be skeptical of the correlation between compliance with the new ASTM product standards and roof system performance.

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comply with the new ASTM product standards and whether their package labeling includes required ASTM designations.

The following manufacturers were surveyed: Allied Signal Inc. Commercial Roofing Systems, Cary, N.C.; American Lubricants, Dayton, Ohio; Barrett, Wilmington, Del.; Bitec Inc., Morrilton, Ark.; Celotex Corp., Tampa, Fla.; Consolidated Coatings, Brunswick, Ohio; Danosa Caribbean Inc., San Juan, Puerto Rico; Dermabit Waterproofing Industries Inc., Alexandria, Va.; Dibiten, Denver, Colo.; Firestone Building Products Inc., Carmel, Ind.; GAF Materials Corp., Wayne, N.J.; The Garland Co. Inc., Cleveland, Ohio; GS Roofing Products Co. Inc., Irving, Texas; W.P. Hickman Systems Inc., Solon, Ohio; ICA, Warrington, Pa.; IKO Manufacturing Inc., Chicago, Ill.; Johns Manville Corp., Denver; Koppers Industries Inc., Pittsburgh, Pa.; Malarkey Roofing Co., Portland, Ore.; MBTechnology, Fresno, Calif.; Modbit Corp., Kansas City, Mo.; Monsey Bakor, Kimberton, Pa.; Performance Roof Systems Inc., Kansas City; Polyglass USA Inc., Fernley, Nev.; Siplast, Irving; Soprema Inc., Wadsworth, Ohio; Southwestern Petroleum Corp., Fort Worth, Texas; TAMKO Roofing Products Inc., Joplin, Mo.; Texas Refinery, Forth Worth; Tremco Inc., Beachwood, Ohio; Tri-Ply, Port Arthur, Texas; and U.S. Intec Inc., Port Arthur.

ASTM D 6164, Type I, Grade S

Manufacturer	Product(s)
Firestone	SBS Smooth
GAF*	Ruberoid Mop Smooth Ruberoid SBS HW Smooth
IKO	Armourbond 180
Johns Manville*	Dynalastic 180 S
Southwestern Petroleum Corp.*	SWEPCO UNI + SHIELD II SYS 303
TAMKO*	Awaplan Versa Smooth
U.S. Intec*	Intec/Flex S

ASTM D 6164, Type I, Grade G

Manufacturer	Products
Allied Signal*	Infinitee 30 BMC FR Infinitee 30 GMC
Firestone	SBS SBS FR SBS Torch SBS FR Torch SBS Flashing
GAF*	Ruberoid Mop Granule Ruberoid Mop 170 FR Ruberoid SBS HW Granule Ruberoid SBS HW FR
IKO	Modiflex MP-180-CAP Torchflex TP-180-CAP
Johns Manville*	Dynalastic 180 Dynalastic 180 FR SBS 170
TAMKO*	Awaplan 170 Awaplan 170 FR
U.S. Intec*	Intec/Flex 190 Intec/Flex 190 FR

Figure 6

ASTM D 6164, Type II, Grade G

Manufacturer	Products
Firestone	SBS Premium SBS Premium FR
GAF*	Ruberoid Mop Plus Ruberoid Mop FR Ruberoid SBS HW Plus Ruberoid SBS HW Plus FR
IKO	Modiflex MP-250-CAP Torchflex TP-250-CAP Torchflex TP-250-CAP 5MM
Johns Manville*	Dynalastic 250 Dynalastic 250 FR
TAMKO*	Awaplan Premium Awaplan Premium FR Awaplan Heat Welding
U.S. Intec*	Intec/Flex M Intec/Flex 250 FR

Figure 7

ASTM D 6298

Manufacturer	Product
Siplast*	Veral

Figure 8

The manufacturers who indicated specific polymer-modified bitumen sheet products that comply with ASTM product standards are identified in Figures 1-8. Those manufacturers with asterisks near their names reported that package labeling stating ASTM compliance will be used once their current stocks of packaging are depleted.

Editor's note: *Inclusion or exclusion of specific manufacturers and their products is based solely on manufacturer responses to the telephone survey. NRCA has not independently verified compliance or noncompliance of any manufacturer's products.*

Roofing professionals should note that no manufacturer surveyed had products that comply with ASTM D 6162, Type I, Grade S; ASTM D 6162, Type I, Grade G; or ASTM D 6164, Type II, Grade S.

Closing comments

Now that the new ASTM product standards are available, the authors recommend manufacturers of polymer-modified bitumen sheet materials produce and label their products to meet or exceed the applicable ASTM product standards.

Also, when using polymer-modified bitumen sheet roof systems, building owners and roofing professionals are encouraged to use products that meet or exceed the applicable ASTM standards. PR

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