# Polymer-modified bitumens offer broad product diversity

## Careful analysis is necessary when comparing mod bit products

by **Mark S. Graham**

During the past decade, the use of polymer-modified bitumen membrane roof systems has grown substantially. According to NRCA's 1996 Annual Market Survey, use of such roof systems is 18.1 percent of the total roofing market (calculated on a dollar volume basis) in the United States.

Roofing professionals and building owners have a large number of polymer-modified bitumen membrane products from which to choose. According to NRCA's *1997 Commercial Low-Slope Roofing Materials Guide*, there are 359 different modified bitumen sheet membrane products available on the market from 36 different manufacturers. Of these products, 95 are identified as APP-modified bitumen sheets, and 258 are SBS-modified. Six products are identified as "other" modified bitumen sheets.

The materials guide also identifies 932 different roof system specifications that use modified bitumen sheet membrane products.

This article will briefly explain the history of polymer-modified bitumens, discuss a number of important considerations to evaluate when comparing these products and explain the status of material standard development for polymer-modified bitumen sheet roofing products.

### Additional information

The following will help roofing professionals obtain the information in which they are interested:

- ASTM D 5147 can be purchased in single-standard version from ASTM, 100 Barr Harbor Drive, West Conshohocken, Pa. 19428-2959; telephone (610) 832-9585. The standard also is published in ASTM's *Annual Book of ASTM Standards*, Volume 04.04, "Roofing, Waterproofing, and Bituminous Materials."
- CGSB 37-GP-56M can be purchased from The Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, Canada K1A 0S9.
- NRCA's Annual Market Survey (document No. 1501) is available through NRCA's Fax-On-Demand; telephone 1-888-455-6722.
- NRCA's *1997 Commercial Low-Slope Roofing Materials Guide* can be purchased from NRCA's Marketing Services Department; telephone (800) 323-9545.

### History

Polymer-modified bitumen roofing technology, as it is known today, was developed in Europe in the 1960s. Products first were introduced into the market predominantly in Italy and Belgium.

The first recorded use of polymer-modified bitumen sheet membrane products in the United States was in 1975. Early product introductions often were categorized as single-ply membrane roof systems. This was partly due to the single-layer application method often used at that time—a polymer-modified bitumen membrane sheet was applied directly to a substrate without a base sheet or membrane base plies.

Also, because the product was introduced at nearly the same time as conventional single-ply membranes, polymer-modified bitumen membranes and single-ply membranes often were classified together, largely because they were viewed as different from built-up membrane systems. In fact, the first edition of *The NRCA Roofing and Waterproofing Manual* (1981) categorized polymer-modified bitumen roof systems and most single-ply membrane roof systems as synthetic or special membrane systems.

As the use of these products became more widely accepted in the U.S. market in the early to mid-1980s,

polymer-modified bitumen products were differentiated from single-ply membranes. Also, the need to apply a polymer-modified bitumen membrane to a base sheet or base membrane plies was recognized. At this point, the product began to be considered its own membrane type. The second edition of *The NRCA Roofing and Waterproofing Manual* (1985) listed it in a polymer-modified bitumen roofing category, separate from single-ply membranes.

During the late 1980s and early 1990s, the use of polymer-modified bitumen membrane roof systems had grown significantly. By this time, polymer-modified bitumen membrane products were used in two roof system configurations: as polymer-modified bitumen membrane roof systems and topmost layers in multiple-ply built-up membrane roof systems, also known as hybrid roof systems. (For more information about hybrid roof systems, roofing professionals should refer to "The hybrid system is created by merging roof system features," October 1995 issue, page 20.)

## Product differences

With the large number of polymer-modified bitumen sheet products on the market, it is important to realize there are significant product differences to consider. Following is a list of some factors that should be considered when evaluating polymer-modified bitumen membrane sheet products:

1. *Bitumen modifier.* Polymer-modified bitumen membrane sheets are different from most other membrane types because the waterproofing bitumen in the membrane sheet is chemically altered. The specific type of polymer modifier employed also can be used to differentiate between polymer-modified bitumen membrane products themselves.

One of two polymer modifiers, APP or SBS, is used in a vast majority of the polymer-modified bitumen products currently on the market. The most noticeable difference between polymer modifiers is the manner in which the membrane sheets are applied. APP-modified bitumen sheets typically are torch-applied, and SBS-modified sheets generally are mopped in place. Both types also can be adhered with a cold-applied adhesive.

However, the most significant difference between polymer modifiers relates to the materials' chemistry and its resultant effect on the product. APP-polymer modification creates bitumen molecules that are encapsulated with the polymer modifier. This gives the resultant membrane plasticized properties and raises its softening-point temperature. Conversely, SBS-polymer modification creates molecular bonds between bitumen molecules. This gives the resultant membrane rubberized properties.

For these reasons, the physical properties of APP- and SBS-polymer-modified bitumen sheets will vary significantly—this is intentional and inherent in the different polymer modifiers. Therefore, direct comparisons between APP- and SBS-polymer-modified bitumen products are not practical.

2. *Bitumen.* Asphalt is the only roofing bitumen used in compound polymer-modified bitumen sheet products. However, in the mid-1990s, one manufacturer did produce a coal tar-based polymer-modified product. Because of the inherent differences between asphalt and coal tar bitumen chemistry, direct comparison between products based on different bitumens is not practical.

3. *Reinforcement type.* Most polymer-modified bitumen sheets contain reinforcement of some form of fiberglass or polyester fabric or a combination of both fiberglass and polyester. Because different types of reinforcement give membrane sheets different physical properties, careful consideration of the reinforcement type is necessary when comparing products.

Fiberglass reinforcements generally provide a membrane sheet with high tensile strength. Polyester reinforcements typically provide a membrane sheet with increased puncture resistance and some elongation capabilities. Membrane products with a combination (or composite) of fiberglass and polyester reinforcements attempt to capitalize on the attributes of both reinforcements.

Also, the specific type of polyester reinforcement can have an impact on the membrane sheet's physical

## NRCA investigating blistering reports

In April, NRCA's Technical Operations Committee notified NRCA-contractor members of a recent increase in reports to NRCA's Technical Services Section and Project Pinpoint (a data base of baseline and problem jobs reported by NRCA-contractor members) regarding blistering associated with SBS-polymer-modified bitumen membrane roof systems.

Dane Bradford, president of Bradford Roofing & Insulation Co., Billings, Mont., and chairman of NRCA's Technical Operations Committee, says: "It is important that the industry not jump to any conclusions about NRCA's involvement in this issue. Polymer-modified bitumen sheet membrane roof systems have proved to be successful performers. However, we recently have received an increased number of blistering reports and want to determine if this simply is an anomaly in reporting or if there actually is some cause for concern. If there is a concern, we will look into the issue further."

To date, NRCA has heard from a limited number of contractors from throughout the United States. NRCA also has conducted field investigations in the northern, south central and southern regions of the United States to collect additional information.

"We intend to conclude our initial assessment, determine if additional investigation is appropriate and report our initial findings later this year," Bradford says.

properties. For example, a woven polyester reinforcement likely will provide better tensile strength than a nonwoven one. However, woven polyester usually will allow less elongation capacity than nonwoven. For this reason, it is difficult to directly compare membrane sheets that use different reinforcements.

4. *Reinforcement weight.* Many polymer-modified bitumen sheets use similar, if not identical, reinforcement types. However, some sheets employ lighter or heavier reinforcements; this is particularly the case with polyester reinforcements. Because reinforcement weight and its configuration play important roles in the physical properties of polymer-modified bitumen sheets, products with different weight reinforcements should not be considered similar.

5. *Reinforcement placement.* In most polymer-modified bitumen sheets, the reinforcement is positioned in about the middle of the membrane sheet thickness. However, in some products, the reinforcement is positioned toward the membrane sheet's top surface. Reinforcement placement impacts the membrane sheet's handling and installation and may affect the material's physical properties and performance.

6. *Surfacing.* Polymer-modified bitumen products are available either unsurfaced or with a variety of different factory-applied surfacings.

# Dealing with polymer-modified bitumen roof system warranties

by **Stephen M. Phillips**

Warranties offered by polymer-modified bitumen manufacturers are similar to those applicable to built-up roof (BUR) systems. Indeed, several manufacturers of both modified bitumen and BUR materials use the same warranty documents for both products. Just as BUR manufacturers offer 20-year warranties for certain four-ply specifications, 20-year warranties (with no monetary limitations) are offered by several modified bitumen manufacturers.

Similar to other roof membrane warranties, modified bitumen warranties can be divided into two broad categories: warranties covering both materials and workmanship and those covering only the modified bitumen material. For a fee, most manufacturers offer warranties that cover the workmanship of the contractor who installed the modified bitumen membrane, provided the contractor is approved by the manufacturer and follows its specifications.

As with almost all roof membrane warranties, most modified bitumen warranties cover leaks only (i.e., if a leak's cause is covered by the warranty, the manufacturer will pay for the repairs). As long as the roof system is watertight, the manufacturer is not required to take any action.

Warranties covering materials and workmanship are available at no charge or at fees up to $20 per square (1 square equals 9.3 $m^2$), depending on the manufacturer and length of warranty. Most material-only modified bitumen warranties cover manufacturing defects and are available at no cost, though a few manufacturers charge.

The length of coverage for materials and workmanship ranges from five to 25 years, with 15- and 20-year warranties being the most common. The length of coverage varies, depending on the manufacturer, specific modified bitumen product and the roof system composition. Modified bitumen sheets commonly are incorporated into roof assemblies that include underlying BUR felts. The number of plies frequently will determine the length of warranty coverage available.

Careful attention should be given to asphalt selection and application, as well as whether the roof system's bitumen component is included in the warranty coverage. If the modified bitumen warranty truly is a system warranty, bitumen used to adhere an SBS-modified bitumen sheet should be included in the coverage. Many modified bitumen warranties exclude coverage for products not sold by the manufacturer. If a contractor does not purchase asphalt through the modified bitumen manufacturer, there likely will be no warranty coverage if a roof problem occurs due to some incompatibility between the asphalt and modified bitumen sheet or an alleged deficiency in the asphalt.

Even though the modified bitumen manufacturer may not be the asphalt manufacturer, purchasing asphalt through the modified bitumen manufacturer will provide more extensive warranty coverage. If a contractor does not purchase asphalt from the modified bitumen manufacturer, he should obtain written confirmation from both the asphalt and modified bitumen manufacturers that their products are compatible and possess the necessary properties to perform together satisfactorily.

A roof system purchaser should make a similar decision regarding roof insulation. If the insulation is purchased through a modified bitumen sheet manufacturer, there may be warranty coverage. Some manufacturers provide warranty coverage for specific insulation products. If there is coverage for insulation, a manufacturer may warrant that the insulation will provide at least 80 percent of the design thermal resistance in addition to the "watertight" membrane coverage.

Unlike shingle warranties, those for modified bitumen generally are not prorated (i.e., the extent of the manufacturer's liability does not decrease by a certain percentage each year). However, a few are prorated—so the monetary limit of the manufacturer's liability is reduced as each year passes.

If a building owner contemplates selling a building within 10 years of roof system installation, warranty transferability may be an important factor. If there is no provision in the warranty regarding transferability or assignability, then the

Factory-applied surfacings include mineral and ceramic granules, mineral chips and metal foils. Membrane surfacings also can be field-applied as additional components of the roof membrane system.

Because the top surface of an SBS-polymer-modified bitumen roof system must protect the membrane from ultraviolet degradation, many SBS-polymer-modified bitumens contain factory-applied surfacings. In some instances, surfacing material may affect the membrane sheet product's physical properties. For example, a metal foil surfacing likely will enhance the membrane's tensile strength and its resistance to chemical exposure.

For these reasons, surfacing type should be considered carefully when comparing polymer-modified bitumen membrane products.

7. *Other considerations.* A number of other important factors, including the source and quality of raw materials, bitumen and polymer blending, as well as manufacturing tolerances and quality control, can influence the performance of polymer-modified bitumen sheet products. Unfortunately, most roofing professionals and, in some cases, manufacturers, do not have the capability or equipment to evaluate these factors directly.

As a result, roofing professionals often need to rely on the limited applicable material standards and any physical property data available

warranty, like other legal documents, can be transferred or assigned to a subsequent owner.

However, some modified bitumen warranties specifically state they are nontransferable—meaning only the original owner would be entitled to warranty coverage. Other warranties contain specific transferability provisions, generally requiring payment of a transfer fee, a roof inspection and completion of any manufacturer-directed roofing work at the owner's expense prior to the warranty's transfer.

Obtaining a warranty can, in certain circumstances, have the effect of limiting a building owner's remedies. Although a warranty commonly is viewed as a means of obtaining protection in the event of a problem and generally serves this purpose, modified bitumen warranties, like other warranties, frequently contain provisions seeking to make the warranty an owner's sole and exclusive remedy.

For example, if there is a problem during the first few years after roof system installation, an owner might have greater recourse without a specific warranty—which actually may restrict him, depending on the problem's cause and applicable state law. However, if an owner does not purchase a materials and workmanship warranty, a manufacturer typically would not be liable for any deficiency in the modified bitumen membrane application and the length of the manufacturer's liability would be governed by the state statute of limitations.

In most states, the statute of limitations for warranties under the Uniform Commercial Code is four years. In some states (e.g., Florida, New York), an owner cannot make a claim for roof system repair or replacement directly against a manufacturer in the absence of a warranty. The warranty has the effect of establishing privity of contract between the owner and manufacturer.

Although the cost to obtain a materials and workmanship warranty generally will increase as the length of coverage increases, the cost to obtain a warranty for a given period varies considerably among manufacturers. For example, a 15-year materials and workmanship modified bitumen warranty can cost from $5 to $15 per square, and the cost of a 20-year materials and workmanship warranty varies from $7.50 to $20 per square.

Just as the cost will vary, the monetary scope of the manufacturer's liability varies and can become a critical factor if a serious roof system problem arises. The monetary scope of modified bitumen warranties ranges from the cost of the modified bitumen product to no limitation (i.e., a so-called "no-dollar-limit" warranty). Some modified bitumen warranties are limited to the product's original cost or stipulated-per-square dollar amount.

Before deciding on a particular modified bitumen roof assembly and warranty, a specifier should obtain clarification from the manufacturer when the phrase "original cost of the product" is used in a warranty: Does it mean the manufacturer's liability is limited to the modified membrane sheet material's cost, or does "product" refer to the overall modified bitumen roof assembly, which would include labor and materials? A remedy limited to the sheet goods' costs only would cover a fraction of the expense incurred to remove and replace a nonperforming modified bitumen roof assembly.

## Conclusion

A decision regarding what type of roof system to install should be based on a roof system's properties and its suitability for a particular application rather than a warranty. A well-performing roof system makes warranty coverage less significant; conversely, an extensive, long-term warranty provided by a manufacturer who is in bankruptcy or no longer in business is of no value.

Nevertheless, before making a roofing decision, a manufacturer's warranty should be considered and evaluated. Similar to all legal documents, a modified bitumen warranty should be read and understood in its entirety as part of the initial system specification and selection process. Although all manufacturers' warranties generally provide for repair to leaks caused by either materials and workmanship or materials only, there are significant differences regarding such items as monetary limitations, cost to obtain the warranty, exclusions from coverage, wind coverage and transferability. Generally, manufacturers will offer a longer warranty for modified bitumen roof systems incorporating more plies or more durable (and expensive) modified bitumen products.

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when comparing polymer-modified bitumen sheet membrane products.

## Material standards

Even though polymer-modified bitumen membrane products have been used in the United States for more than 20 years, the development of material standards to establish minimum properties and provide a baseline for evaluating these products has been slow.

Up to this point, Canadian General Standards Board (CGSB) Standard 37-GP-56M, "Standard for Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing" has been the only material standard applicable to polymer-modified bitumen sheet products in North America. This standard includes requirements for product strength, water resistance, flexibility and divisibility. It also separates products into two grades (standard and heavy-duty); three classes (Class A—granule surfaced, Class B—metallic surfaced and Class C—plain surfaced); and two types (Type 1—exposed applications and Type 2—covered roofing applications).

CGSB 37-GP-56M is referenced in *The BOCA National Building Code* as a minimum material requirement of polymer-modified bitumen roof coverings.

## Physical property data

Because of the many differences in products, reviewing published physical property data is one practical method of evaluating and comparing polymer-modified bitumen sheet products.

American Society for Testing and Materials (ASTM) Standard D 5147, "Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material," was developed to provide a standardized method for testing and reporting physical property data for polymer-modified bitumen sheets. It includes test methods for thickness, load strain properties, tear strength, moisture content, water absorption, dimensional stability, low-temperature flexibility, heat conditioning, accelerated weathering, granule embedment, compound stability and compound thickness.

Although most manufacturers regularly test their products according to this method, few publish their test data and make it available to roofing professionals and building owners for product comparison. According to NRCA's materials guide, only 19 of the 36 manufacturers listed provide any physical property data.

## New material standards

During the June ASTM D-8 committee meeting in St. Louis, Mo., three new material standards applicable to SBS-polymer-modified bitumen sheet


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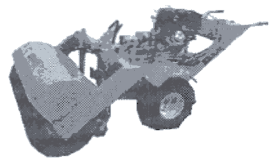
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products were given final approval: "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements," "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements" and "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements."

*Manufacturers have given little quantitative information to compare polymer-modified bitumen sheet products.*

ASTM will publish these three material standards later this year—they will provide minimum requirements for SBS-polymer-modified bitumen sheet products that roofing professionals can use to evaluate SBS products. When the standards are published, SBS-polymer-modified bitumen sheet products' manufacturers are encouraged to clearly represent and label their products in accordance with the standard.

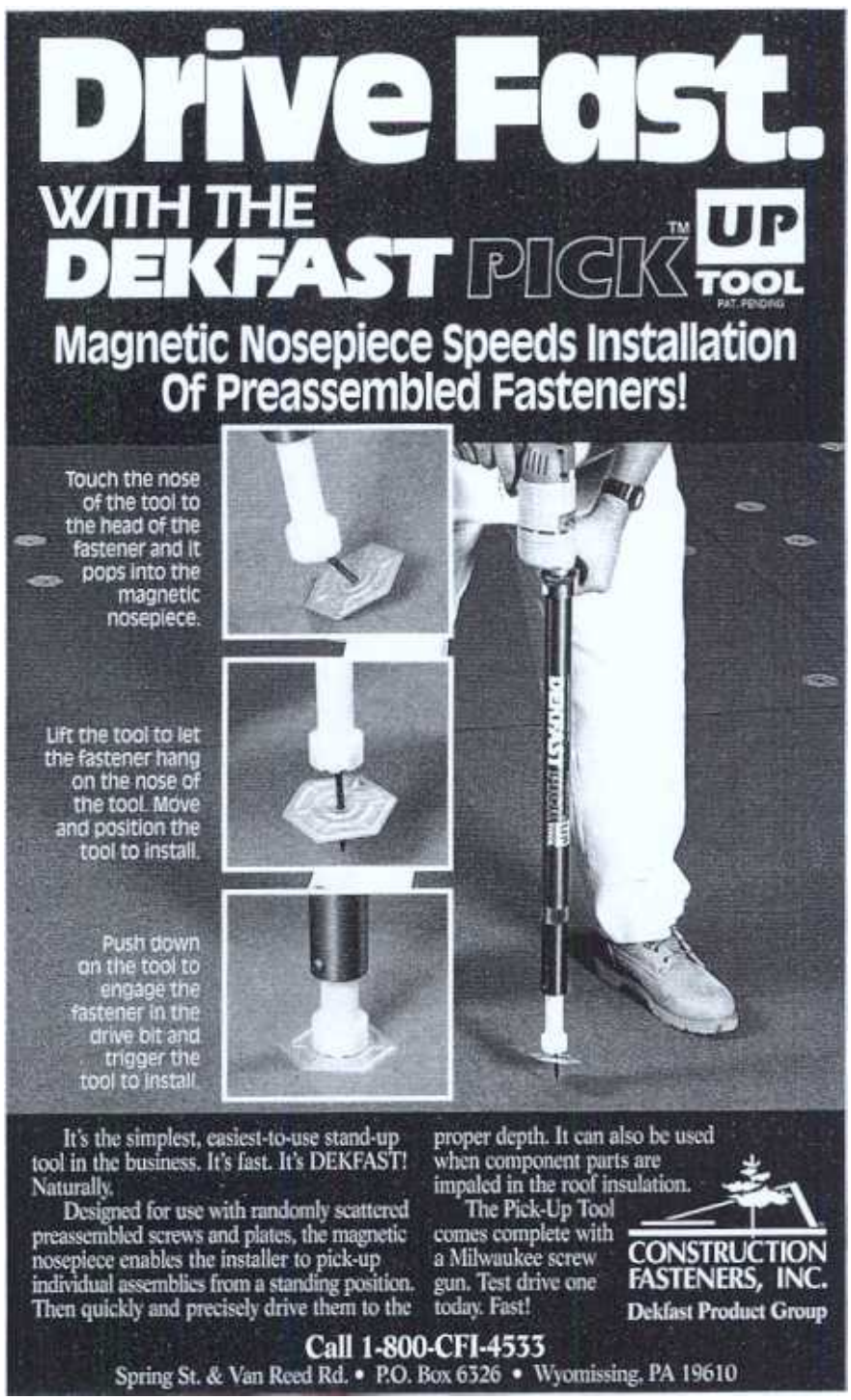
New material standards applicable to APP-polymer-modified bitumen sheet products are in the final stages of development at ASTM. It is hoped these standards will be finalized and published within the next few years.

## Closing thoughts

During the past decade, use of polymer-modified bitumen sheet products has grown tremendously. This has established polymer-modified bitumen roof systems as viable and sometimes preferred choices in many situations. However, up to this point, manufacturers have given roofing professionals and building owners little quantitative information to compare polymer-modified bitumen sheet products.

Polymer-modified bitumen sheet manufacturers are encouraged to make additional technical and physical property data available in their product literature and NRCA's materials guide. This would help roofing professionals and building owners make informed decisions when comparing and purchasing manufacturers' products. PR

*Mark S. Graham is NRCA's associate executive director of technical services.*

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