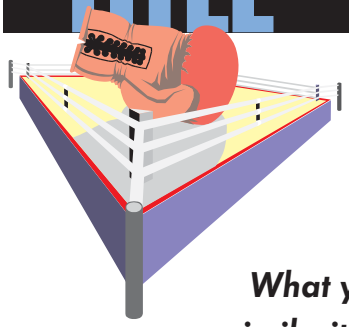
The TITLE

TECHNICAL NOTES



EPOXY vs. POLYUREA

What you should know about the comparative advantages and disadvantages, similarities and differences of these two types of industrial floor joint fillers.

In the 1990's a new type of floor joint filler with different chemistry entered the market dominated for decades by semi-rigid epoxy fillers. Generically these fillers are known as "polyureas," and they are often promoted as being superior to the epoxies. As manufacturers of both polyurea and epoxy fillers, we are very much aware of the inherent advantages and shortcomings of both materials. This article is intended to define the differences to help specifiers, facility owners, and contractors make an informed product selection.

1. Shore A Hardness

The Shore A gauge (figure #1) measures the relative hardness of plastics and rubbers. When the dull needle is pressed against cured material, it yields a reading from 1-100.

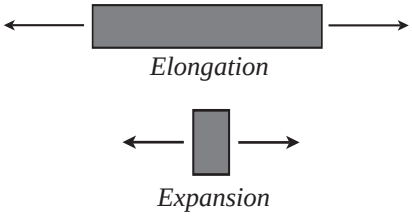
If you press a Shore A gauge against an A80 polyurea and an A80 epoxy you will notice something strange; while both readings are A80, the polyurea will feel much more flexible than the epoxy, and the epoxy will feel stiffer. This is because the needle is also measuring the penetration resistance of the filler surface. The more dense surface matrix of the polyurea gives a reading that distorts its actual relative hardness.

Shore A Gauge

Commentary

An A80 polyurea is more flexible than an A80 epoxy. Logic therefore tells us that the A80 epoxy will likely support greater loads before deflecting than a supposedly comparable A80 polyurea. When choosing a polyurea, be sure it will adequately support the anticipated loads.

2. Elongation (As Relating to Movement Capability)



Many polyureas are promoted on the basis of their high "elongation" reading, implying that the filler will "expand" at a proportionate rate. It won't!

An A80 polyurea with an elongation of 400% will expand only 5-12% laterally (side-to-side) before the bond to the concrete yields. At the same time an A80 epoxy with only 25% elongation will usually tolerate 5-8% expansion. Thus, the high elongation polyurea offers little in expansion advantage over an epoxy.

Commentary

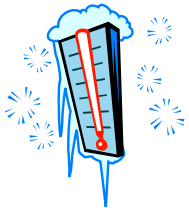
Don't be mislead by elongation. It is a basically irrelevant property. Focus on the fillers' ability to support traffic loads and hard wheels, thus protecting joints from related damage.

3. Adhesion to Concrete

From our evaluations we're convinced that both products have adequate adhesion to concrete.

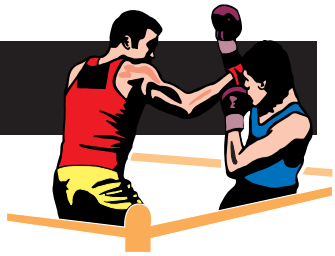
4. Application Temperatures

Below freezing temperatures will generally prevent epoxies from completing their total molecular cure. Thus, epoxies should be used only when the installation temperature is above 32˚F (0˚C). Some (but not all) polyureas will thoroughly cure even in freezing temperatures. It is important to closely read data sheets to be sure that the filler is appropriate for both installation and final operating temperature.



Commentary

Polyureas are the best choice for applications below 32˚F (0˚C). Be sure the product tech data specifically approves freezer installations.



5. Moisture Sensitivity At Installation Time

Most epoxies tend not to be adversely affected by moisture, other than substantial moisture on the joint wall surfaces which may compromise adhesion. Many polyureas are moisture sensitive at dispensing time. Some will react with moisture in the joint and bubble. If the bubbles are small, they will not affect the fillers load-support or performance. Moisture in the joint can also compromise the fillers adhesion, especially since polyureas cure so rapidly that they can't work past the moisture to gain bond.

6. Proper Filler Depth

To be effective in protecting joint edges against hard wheel damage, both polyurea and epoxy fillers must be installed full depth (typically 1 1/2") in saw cuts and 2" (50 mm) deep (minimum) in construction (formed) joints. These criteria comply with American Concrete Institute 302 and 360 and the Portland Cement Association guidelines for filler depth.

7. Dispensing

Both epoxies and polyureas can be dispensed with dual-feed, power pump equipment. Epoxies can also be dispensed with manual bulk-type guns. Polyureas generally cannot be dispensed with manual bulk-type guns because their potlife (a few minutes) is too short. Since power dispensing pumps cost $7,500 to $15,000, smaller contractors are often not able to bid on or perform polyurea installations.

8. Overfill-And-Shave Process

With both products, the overfill-and-shave procedure is recommended to achieve a flush filler profile. There are several significant differences in the shaving process between the materials.

Timing - Filler overfill should not be razored-off until the filler has set into a complete solid. Due to their early set time polyureas can be shaved in the first few hours, some as early as fifteen (15) minutes. Epoxies generally can't be shaved for 4-12 hours. Same-day shaveability is the main reason some installers prefer polyureas. Epoxies are usually easily shaved the second day. If they have gotten too hard to shave smoothly, a slight warming with a torch makes them shaveable. Some polyureas can be smoothly shaved the second day, but some cannot, even with heat. And some polyureas cannot be flame heated since they can release harmful isocyanate fumes or re-liquefy.

Wide Or Uneven Joints - In wider or uneven joints, shaving a material flush is more difficult. Grinding is generally the best option to achieve a truly flush profile, but polyureas do not generally react well to shaving/sanding procedures, and they often re-liquefy or shred like cotton candy in the process. Conversely, nearly all epoxies can be ground or sanded and are thus a better choice in wide/uneven joints.

Commentary

The difficulty in removing a polyurea filler which has been low filled or shallow filled (over debris, backer rod, etc.) may outweigh the benefits offered by a faster and easier shave. Installing the filler properly the first time is critical.

9. Access After Filling

Because polyureas set so fast, the work area can usually be opened to light traffic in an hour or two, sometimes even earlier. Epoxy filled joints generally can't be opened to light traffic for 6-12 hours. While the polyureas are the clear winner in this situation, one must ask if a floor area must truly be open to access so rapidly. Construction schedules are seldom that tight. Thus, the polyurea's advantage may be a moot point.

10. When Fillers Expand

Contrary to popular belief, polyureas with an A80 hardness or greater cannot tolerate expansion greater than 5-12% when installed 3/4" deep or deeper. Epoxies will generally expand 5-8% before debonding. Even 12% of a joint width is so small that normal joint opening due to shrinkage will cause the polyurea to debond. Even if a lower Shore A polyurea expands as the joint widens, it is a hollow achievement. When an elastomer expands and stretches it takes on an hourglass profile, leaving a concave surface that offers reduced edge protection.

Commentary

Do not rely on polyureas to expand with the joint. They generally won't. If by some chance they do, joint edge protection is compromised by the filler's flexibility and reduced load deflection capabilities.

SUMMER 2001

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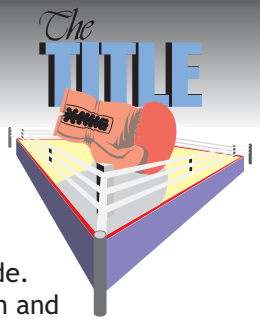

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11. Polyureas and Epoxies Separate Differently

Epoxies tend to separate in a leap-frog manner, with the remaining bond jumping from side to side. Due to the alternating bond, epoxies tend to stay firmly in place and still provide edge protection and load support. Most polyureas tend to separate continually along only one side. When the separated side is subjected to traffic, the filler can "peel" off the opposite side.

Correction of separation voids differs with both products. With epoxies, due to the alternating separation voids, it can be difficult to refill the voids. Most applicators prefer to saw cut out the top 1/2" of epoxy and refill the joint flush. Polyurea separation must be corrected by refilling the voids since most polyureas cannot be saw cut. The heat from the blade causes them to revert into a gooey liquid or shred like cotton candy, gumming up the blade.

12. UV Related Color Changes

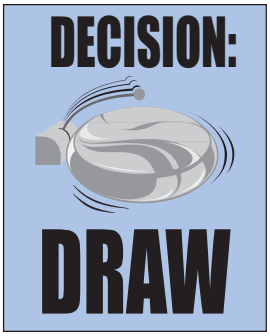
Many newer lighting systems emit a UV spectrum that will cause fillers to turn greenish or yellowish. Both polyureas and epoxies may be affected. The color change, while less than pleasing, will not affect the fillers' performance.

13. Installed Cost

Polyurea and epoxy materials are generally in the same price range. Polyureas require a power dispensing unit, epoxies can be hand gunned or dispensed through pumps. Savings can be achieved applying both materials through pumping due to increased production. Joint preparation, a sizeable part of the installation cost, is the same for both. Overall, we find the installed cost of both polyureas and epoxies to be very similar.

Summary

We find that the use of polyurea fillers is growing, and that the growth is basically applicator-driven. Applicators, especially larger ones who can afford a pump unit, like the idea of power-dispensing, same day shaving, and shaving without heating the joint.



Even though our polyureas are widely used in ambient temperature, new construction projects, we are not thoroughly convinced that polyureas are any better than established epoxy fillers. Perhaps the bottom line is that we see no clear benefit for the facility owner or designer when polyurea fillers are used in ambient temperature, new construction projects.

Unless rapid turnover time of filled areas is critical to the owner, most of the benefits of polyureas accrue to the installers. This is not to say that decision makers should reject out-of-hand a submittal to use a polyurea. It's simply a matter of due-diligence (in comparison with the specified materials), an awareness of the advantages/disadvantages of both polyureas and epoxies, and good old common sense.

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