

CFR The Commercial Flooring Report

For the Commercial Floor Covering Industry

Volume 205 - May 2026

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NON-PVC Chemistry in Resilient Flooring Get Ready!

This issue of the Commercial Flooring Report is written by our associate, Sim Crisler, with additional comments and elaboration by Lew Migliore.

A lot has changed in the flooring industry over the past few years, and manufacturers are moving quickly toward PVC - FREE RESILIENT FLOORING. This is not a trivial change, and it will have significant impact on any flooring contractor or installer who will be tasked to install these products. The shift is driven by sustainability goals, regulatory pressure, and the desire to avoid chlorine based polymers and plasticizers.

We'll delve more deeply into the next phase of hard surface flooring products you must know about to prevent yourselves from being drawn into the quagmire of PVC free products that will challenge your installations. Ridding hard surface flooring products of polyvinyl chloride (PVC) and orthophalates (plasticizers) is another green movement. This change, which isn't exactly new as it began in the late 1980's, introduces hard surface products that behave differently and must be installed differently.

Here we go—There is a widespread and increasing trend among flooring manufacturers to move away from traditional PVC based chemistries. This move is prompted by a combination of regulatory and sustainability issues such as Proposition 65 and the Leed "Red List" and the need to avoid chlorine-based polymers and phthalate plasticizers.



Manufacturers have gravitated to five chemistries to replace PVC:

Polyolefins

The fastest growing of the PVC replacements:

1. The most used chemistry involves polyolefins such as polypropylene and polyethylene.
2. Polypropylene (PP) – rigid, stable, lightweight, and easy to mineral fill.
3. Polyethylene (PE) – used in flexible backings or layers.
4. Propylene based elastomers – added to PP to improve flexibility and toughness.
5. PP/elastomer/mineral composites – engineered to mimic PVC backed LVT performance without chlorine or phthalates.

These chemistries are popular because Polyolefins are non-polar, recyclable, low VOC, and can be “tuned” to behave like vinyl. Polyolefins are the chemistry behind the majority of “PVC free resilient” lines.

Bio Based Polymer Systems

These appeal to manufacturers targeting sustainability certifications. Products such as:

1. Linoleum (oxidized linseed oil + rosin + wood flour)
2. Cork composites
3. Cast bio polyurethane (plant-based polyols) + mineral fillers)

These are all longstanding products with well understood and proven installation procedures

Rubber Based Chemistries

Products such as:

1. Natural rubber
2. Synthetic rubber blends (e.g., SBR, EPDM)

Why they're used: Rubber is durable, resilient, and PVC free by nature. These are common in commercial and institutional environments. Again, the installation procedures involved with these products are well understood or should be as the installation procedure can be unique, such as having to weight the seams with bricks to hold them down with some sheet rubber flooring products.



THE COMMERCIAL FLOORING REPORT

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Mineral Polymer Hybrid Systems

These mimic the rigidity of SPC and would typically be used in floating installations where adhesive is not used.

High mineral content composites with a small amount of non-PVC binder (often polyolefin based) These products offer dimensional stability, rigidity, and low VOCs.

TPU (Thermoplastic Polyurethane)

TPU (thermoplastic polyurethane) products have a slightly higher surface energy than the polyolefins but still do not reach level of PVC. This level of surface energy is also not stable over time but is slightly more stable than the TPO/POE/MINERAL FILLER Products. Thermoplastic polyurethane surfaces reorganize after placement and exposure to traffic and maintenance.


TPU chains reorient at the surface to minimize free energy, meaning:

- Soft segments migrate outward
- Additives (lubricants, processing aids) can “bloom”
- **The surface becomes more hydrophobic over time**

This is the killer: Even if you initially raise TPU’s surface energy, it tends to drift downward. The same is true with TPO (Thermoplastic Polyolefin) based chemistries. On top of that Polyolefin is hydrophobic, which means it does not like water and will push it away. Water is the carrier in adhesive. Do you see a problem here?

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What does this mean? The installation, through no fault of the installer, can fail in the future because the product itself is changing and as it changes it will release from the adhesive. This is sure to be an issue as virtually no one is going to recognize that the flooring product itself has changed – but now you know.

It is very important that flooring dealers, contractors and installers understand that this change in chemistry is not a trivial change and brings some significant issues that will have impact on the way these products are handled and installed. The major issue directly impacting the flooring contractor involves the basic properties of polyolefin/polyurethane chemistry. Again, these materials are hydrophobic by nature and are difficult for any adhesive to sufficiently “wet” the backing of the product being installed to achieve an acceptable bond to the substrate.

In all situations, when comparing the “affinity” of these products for adhesives PVC is described as “naturally cooperative”, while polyolefins and polyurethanes are described as “notoriously stubborn”.

This affinity is quantified in a solid material as the “surface energy.” The higher the surface energy of a product the easier it is for the adhesive to ‘wet’ the backing and properly adhere the product. PVC intrinsically has a much higher surface energy than any Polyolefin or Polyurethane construction.

It is possible to increase the surface energy of a Polyolefin/Polyurethane by introducing elastomers, modifiers and mineral fillers that attempt to mimic the surface energy and polarity intrinsic in a PVC construction. This does increase the surface energy **but does not** raise the surface energy to the same level as a PVC construction. Equally important is that the artificially elevated surface energy obtained by these modifications is not stable and tends to slowly degrade with time and traffic. Again, with the inherent potential for an installation failure.

CHALLENGES FOR THE FLOORING CONTRACTOR

The majority of the issues that you need to be prepared for involve finding adhesive systems that will provide successful and trouble-free installations. The adhesive manufacturers are currently struggling with what will work best for these products.

These products inherently have less affinity for adhesive and will be more difficult to adhere to any substrate.

What this means is that the installation of the flooring may be fine but fail at some point afterwards, and this could be years. The failure would be blamed on the installation when the flooring product itself is to blame due to the change that occurs with it that will break the adhesive bond to the substrate. Since almost no one knows this, and if they do, they’re not going to tell you, you’ll get blamed for the failure. If you’re unfortunate enough to have someone sent by the manufacturer to evaluate your claim that is clueless as to what the actual cause of the installation failure is, and that the chemistry of these products can cause the failures, your screwed.

Both Flooring and adhesive manufacturers are aware of this or hopefully should be. It is incumbent on the manufacturer of any non-PVC product to

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work with adhesive manufacturers and determine and rigorously test what adhesive will adhere the product to the substrate both initially and for the life of the product. The Flooring contractor should work closely with the manufacturer of the non-PVC product until comfortable with the products and procedures required to properly install this product to whatever substrate is present. And since the products will vary, depending on where they come from, who's making them and what's being used in them, you must adhere to the adhesive the manufacturer is telling you to use that should be compatible with the product you're installing.

Two unfortunate things you must be aware of are that manufacturers have introduced products by the shoot, ready aim principle for years, which means you are often the guinea pigs. They learn by your failures. Second, most of these PVC free products won't be made in the US and quality control is going to be an issue as well as who is using what in the construct of the product. They are not all going to be the same.

Surface Tension and Surface Energy – What you Should Know

- Surface tension controls how a liquid behaves.
- Surface energy controls how a solid interacts with liquids (like adhesives).

Why This Matters for Adhesive Bonding

- When you're bonding PVC vs. a Polyolefin:
- PVC has high surface energy, so adhesives wet it easily.
- Polypropylene has very low surface energy, so adhesives bead up unless modified or the substrate is primed or textured.

This is why surface energy—not surface tension—is the key property when evaluating how well an adhesive will wet and bond a flooring product to a solid substrate.

Again:

- Surface tension controls how a liquid behaves.
- Surface energy controls how a solid interacts with liquids (like adhesives). This is the main concern for flooring contractors tasked with installing non-PVC flooring.

These products will be more difficult to adhere to than PVC.

When you're bonding an Olefinic Polymer based flooring (PE, PP and various elastomers) versus PVC to a substrate, this large difference in surface energy significantly impacts the ability to bond to whatever substrate is present. This is why surface energy-not surface tension-is the key property when evaluating how well an adhesive will be able to wet and properly bond a flooring product to a solid substrate such as concrete.

As manufacturers shift from PVC to Olefin and other NON-PVC based systems to achieve an adequate bond, adhesive manufacturers must use LSE (Low Surface Energy) tackifiers. Standard vinyl adhesives often fail on PVC free products.

Some flooring manufacturers blend the Polyolefin with various elastomers with the addition of mineral fillers like Calcium Chloride to improve adhesion. This is effective in increasing surface energy and improving the adhesion but does not make the systems equal to PVC in that regard.

Primers or surface treatments may become a required part of the installation process, increasing labor costs for the flooring contractor.

All of the existing pre-installation requirements – acclimation, floor preparation, moisture testing, floor flatness, use of the manufacturer’s recommended or labelled adhesive etc. are just as - if not more - important on NON-PVC products as they are on the PVC products that have been in the market for years.

Every flooring manufacturer will have – hopefully – before bringing a product to market - evaluated the specific NON-PVC formulation being used to determine the best adhesive product and application methods that should be used to achieve a successful installation of their product that goes down and performs properly. The best path forward to protect your business and ensure your customers get the best finished product possible is to embrace your relationship with the manufacturer of the flooring and buy reputable brands. When you are tasked to do your first installation with a NON-PVC flooring product, you should strongly request - as a condition of sale- that a manufacturer supervised start-up of the project be provided.

Manufacturers are, hopefully, working to create the best formulations for NON-PVC products. Regardless of their best efforts, these products will intrinsically be more challenging to adhere to the substrate than the products you have been working with for years. Be aware of this and proceed with caution. And remember, there are swarms of manufacturers around the world making this stuff, so it’s not going to be uniformly the same. We warn you that everybody and his brother is going to want to sell this type of “green” product and you’re not going to know who’s doing what to it. When and if there’s a failure, it’s your ass on the line.

To repeat: A TPO+POE+elastomer backing cannot intrinsically achieve and maintain the same surface energy as PVC just by compounding; you can approximate PVC like surface energy only with aggressive use of polar fillers/modifiers and, more reliably, with surface treatments or back coatings. Without those, it will remain a lower energy, more adhesive sensitive substrate than PVC.

As a flooring contractor you are at the bottom of the hill in the process of creating a successful installation that meets the end users’ requirements and expectations. We all know what runs downhill. Proceed with caution and get the support from the manufacturer until you are comfortable and confident with what it takes to successfully adhere NON- PVC products.

You’re going to be dealing increasingly with the challenges of installing these PVC free products and the failures you’re going to get blamed for. What we’ve found in testing current PVC products, with the normal ASTM tests, being that they are short term under laboratory conditions, and we’re only testing two pieces of a product that requires hundreds or thousands of pieces be installed on a job, is that it does not replicate job site conditions. Also, the longer the test is conducted, outside the norm for the test requirements, the more response we see from the samples being tested and how they truly react, which is more like what you’re seeing occur on the job site. We expect to see far more issues with PVC free products because we’re already seeing them.

To make you feel even better, you’ll be dealing with PVC free products that don’t like to stick down being installed on Type 1L cement/concrete that isn’t receptive to things being stuck to it. A double whammy. What could go wrong?

Fortunately, LGM is deeply involved in these issues, and we have access to information and individuals no one else does. When you need help or an answer, we’re here for you. And, unfortunately, you’re going to need a lot of help.

If you need help, have a question, aren't sure of a situation you're in, want to avoid a problem, or need guidance on a project or product, contact us. We always have the answers, always. It's what we do, from the substrate to what goes on it.

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