

# Performance Benefits of Lining Versatility for Rail Tankcars



## By James R. DeChant, Advanced Polymer Coatings

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For owners, operators and lessors of rail tankcars, the most discussed high-performance coating feature is 'lining versatility,' according to the transportation coating experts at Advanced Polymer Coatings (APC), headquartered in Avon, Ohio, USA.

How best can lining versatility be explained? In essence, it is the capability of a lining to internally protect the tank asset against corrosion and degradation from the widest range of chemicals, including aggressive acids, alkalis, solvents, CPPs and edible oils, and to easily switch between these cargoes after cleaning and decontamination.

Consider one lining with the capability to transport such varied types of cargo — from concentrated 98-percent sulfuric acid to hot crude/crude water mixtures, sodium compounds or food-grade cargoes. This lining versatility is what rail transport operators consider the holy grail of performance: a lining that can maximize the use of their rail tankcar assets and enhance profitability.

## CHOOSING THE RIGHT LINING

There are many different types of linings and liner materials on the market today, according to APC. Each one has key attributes that make it worthwhile; however, most of these linings can only handle limited types of cargo, as they are not engineered for a wider range of chemical service.

Lining choices can include rubber; neoprene; Teflon; high-bake phenolics; epoxy amines; epoxy polyamides; novolac epoxies and high-performance, polymer-based linings. Often, one of these linings is specially selected to provide suitable service



**Rail tankcar**

for a specific cargo, but that particular lining can limit the broader use of the transportation unit. For example, a railcar lined with a coating resistant to crude oil may not work for other commodities.

To be able to handle multiple cargo types, rail tankcar owners, operators and lessors should consider versatility in lining selection. A highly impermeable lining that can carry different cargoes allows for easy cleaning of the transportation unit and the flexibility to change cargoes of varying types as market conditions change, maximizing asset utilization and revenue streams.

According to industry studies, the top seven most frequently carried cargoes in rail tankcars are, from most to least:

- petroleum/crude
- ethyl alcohol
- sodium compounds
- petroleum by-products
- LPG and
- sulfuric acid 93-100 percent

Other products carried can include:

- high-fructose corn syrup (HFCS)
- super phosphate

- sulphur liquid/molten
- soybean oil
- petroleum lubricating
- nitrogen fertilizer
- organic acids or salts
- benzene/toluene/other cyclic
- chemical products
- hydrochloric acid
- industrial inorganic acids
- fatty acids

Safe carriage of all these chemicals hinges on the selection of the right tank lining.

## WHAT TO LOOK FOR IN A LINING

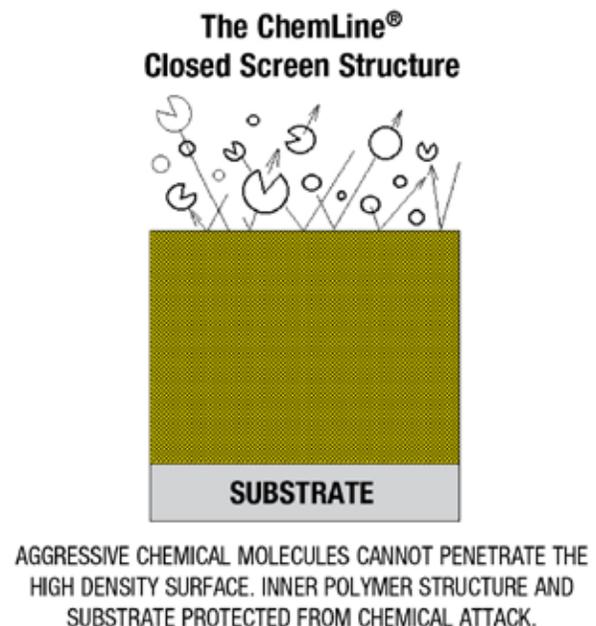
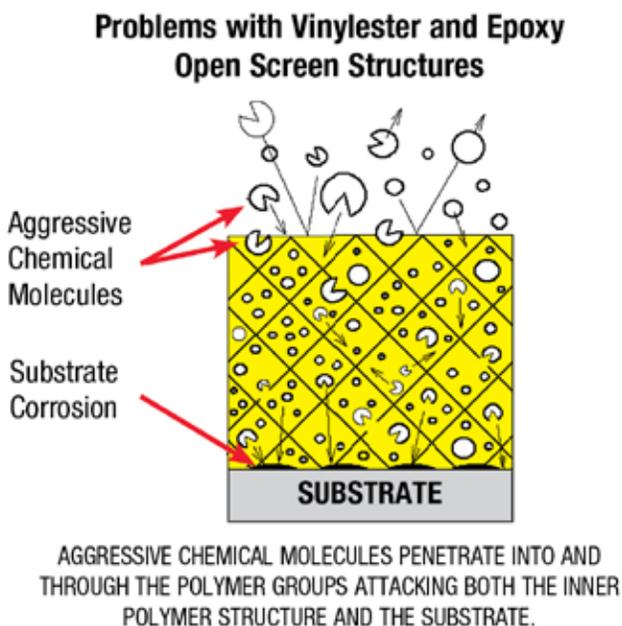
Various factors influence the lining selection for transportation equipment — whether it's a truck tanker trailer, railcar, barge or product tank container — but the most important factor is knowing all the different types of cargoes that may be carried. Then there are a number of performance features that help determine the versatility of a lining and should be factored into the selection of any rail tankcar lining.

Using APC's polymer-based ChemLine coating as an example, APC outlined key considerations for making the decision.

**Chemical Resistance.** Can this tank lining truly handle a wide range of cargoes — and not just in one class or one type of chemical? The lining must be able to handle the entire range

of chemical exposures and temperatures that the tankcar may carry during its service life.

ChemLine coating meets this criterion with resistance to more than 5,000 chemicals and thermal shock resistance from -40 F to 350 F (-40 C to 176 C). Its formulation is based on a chemical matrix that crosslinks an organic polymer and an inorganic polymer with high multi-functional capability. The end result is a three-dimensional ladder-like structure where high crosslinking is achieved by the formation of ether groups C-O-C (carbon-oxygen-carbon), one of the strongest linkage bonds in chemistry. This technology eliminates high concentrations of hydroxyl groups (found in phenol epoxies) and precludes the formulation of ester groups that are subject to hydrolysis and acid attack.



**(Left)** Aggressive chemical molecules penetrate into and through the polymer groups attacking both the inner polymer structure and the substrate. **(Right)** Aggressive chemical molecules cannot penetrate the high-density surface. Inner polymer structure and substrate are protected from chemical attack.

APC engineered chemistries to enhance crosslinking capability (number of crosslinks per unit of volume) into a very tight structure with high chemical and high temperature resistance. The patented formula allows the ChemLine coating to effectively withstand a wide range of chemicals with virtually no absorption of the cargo and with resistance to 98 percent of all corrosive acids, alkalis, solvents, gases and materials at various temperatures.

**Food-Grade Approval.** Can the lining handle food-grade cargoes? The lining should be FDA-compliant and BPA-free. And various food and beverage producers may even have additional criteria and requirements. For example, ChemLine is generally recognized as safe (GRAS).

**Product Purity.** Can the lining resist permeation (absorption) from its cargoes to virtually ensure outstanding product purity? Again, for certain linings that specialize in carrying particular cargoes, this is possible; however, versatility is sacrificed if the goal is to also carry a wider range of cargoes. A number of independent lab tests found APC's linings offered high chemical resistance with near impermeability and superb corrosion protection, greatly reducing the risk of any cargo contamination. (Note: A complete Chemical Resistance guide from APC highlights approved chemicals.)

**Easy Cleaning.** Does the lining clean easily and quickly? ChemLine's high crosslinking creates a nearly impermeable, hard, and ultra-smooth surface with low surface energy that allows tanks to be cleaned more easily than with conventional tank coatings. The lining is steam cleanable, making it simple to remove any residue and to decontaminate the tank surface so cargoes can be easily switched and the tank asset can return to service faster.

**Proper Application, Professional Service.** When benchmarking what a versatile coating needs to be, check into the application and curing recommendations, environmental considerations, lining performance and toughness of the lining.

ChemLine is a high-volume-solids content (98 percent) lining with low VOCs — durable, yet flexible enough to be crack

resistant. The lining can be applied in a single coat using plural-component spray equipment to achieve high-film-build dry-film thickness from 10 to 12 mils. The lining is then low-temperature forced-air cured to enhance the high crosslinking chemistry, which delivers high chemical and corrosion resistance. This offers a tough, abrasion-resistant solution to withstand the rigors of transport, cleanings and mechanical damage.

**Proven Field Performance.** How do the linings being considered perform in different conditions and environments? Ask your coatings provider for case histories in myriad services. See how the linings have performed in a range of transport equipment — from rail tank and hopper cars, to tanker trucks, barges and interbulk tank containers. Ask what chemicals they have carried and at what temperatures. (Note: APC can provide a wealth of case studies and real-world examples of cargo sequencing for its linings.)



**Spraying inside a tank**

## IT'S OBVIOUS WHY VERSATILITY LEADS IN DISCUSSIONS

These points illustrate that many factors should be considered when choosing the optimal rail tankcar lining for transporting a wide range of chemicals. For tank owners, operators and lessors looking to gain the maximum versatility and a long service life for their assets, they need to look at a coating system that can handle the widest range of chemicals used in transport, has superior chemical resistance and product purity, cleans easily and is a proven performer in the transport market.