

Rubber Linings in 2017

Technical Update and Qualifications
Requirements

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Rubber linings have a long history of exceptional corrosion protection and performance in tank cars. The technology is sometimes viewed as “old” and “out-dated” and certainly is not considered sexy. Over the years there have been a number of products developed that may be considered for use in place of rubber for tank cars.

However, where rubber works, it works very well and can be counted on to protect your rail car assets. It is a “known known”

That said, rubber has also evolved in both formulation design, manufacturing methods, understanding of and how it can be used to line rail cars.

Most common linings and cement system products being utilized for rail cars are long term, decades old formulations. We likely all recognize the basic names and terms –

- Natural rubber
- Chlorobutyl
- Bromobutyl
- Blended formulations
- Chemical cure
- Steam / pressure cure
- 3 part cement systems



Not a lot has changed in this regard as linings last many years or even decades in certain services so engineers want to know they can buy or specify exactly what they bought the last time.

Don't fix what isn't broke?

Of course, just because engineers and specifiers want the same materials utilized 10, 20 or even 30 years ago, that doesn't mean they should not be improved or new materials designed and formulated.

What engineers want is the same level or better, *corrosion* protection that they have always had.

They also want improvements to the mechanical characteristics of the rubber linings without compromising the chemical resistance.

There is also a change in industry needs...

- Dual service cars – cars that can haul different commodities with the same lining
- Switching commodities – run a car for 5 years in one commodity and then switch it to something different for the next 5 years
- Car utilization changes – companies are trying to right size their fleets and maintain higher utilization rates
- New chemicals created to meet our ever changing demands as consumers
- Higher loading temperatures – to assist with the transport and offloading of product

Rubber technology improvements exist that improve the performance or application of the materials.

New products to overcome certain issues

- Blended materials to overcome ceiling chipping in hydrochloric acid cars.
 - No acid absorption, allows for repair when necessary
 - No chipping



Improvements in manufacturing and processing to increase adhesion values and improve surface finishes of materials.

- Better understanding of what processing variables affect the lining quality after cure and in turn improved quality
 - Thinner top plies to reduce or eliminate fish eyes
 - Slower calender manufacturing times to reduce shrinkage
 - Blended layers next to the bonding layer to improve adhesion values

- Dual chemical cure and steam cure materials for greater flexibility in usage.
 - Materials have been developed that can be chemically cured or steam cured depending on the requirements.
 - This increases the usefulness and flexibility of the rubber stock and no compromises are required.

Adhesives being developed to offset VOC's emissions, improve in-car safety, reduce overall costs in material application;

- 2 part systems to eliminate or reduce the VOC's – improve safety and costs
 - Water based solutions have been reviewed
 - Rubber sheets bonded to steel with calender applied bonding layers – eliminate VOC's altogether
 - Rubber sheets bonded without adhesive or bonding layer – holy grail

Better understanding of which linings can be used in various services. Clearly, linings last many years and it is not really feasible to do a full term test before going to market or using linings in certain commodities

- Immersion testing
 - Severe testing – commodity surrounding all 8 sides of test coupon
 - utilized more frequently to determine the suitability of linings and commodities
 - Use of altered standard tests to more closely match the service conditions – ie: higher temperature, use of customer supplied commodity
- Atlas cell testing
 - Commodity in contact only with face stock as would be seen in service
 - Longer term immersion testing providing – 6 month+
 - Helps makes better decisions on lining / commodity interactions

What's next?

- Materials with higher abrasion resistance characteristics to overcome cleaning or mechanical damage
- Materials with higher temperature resistance
- Improvements in rubber filler technology to offset higher permeation rates of chemicals and extraction of formulation ingredients
- Longer service life materials

Qualification Needs

Hardness Testing

- Hardness test
 - quick and reliable means to determine the quality and age of the lining.
- Should be used every time that entry into the car is available.
- It will tell you if the lining has been contaminated or compromised from chemicals, heat aging
 - Softer or harder than the specification or expectation could mean contamination or irreparable damage
- A “status report” of the lining performance.
- Checked in several places throughout the car – heads, ceiling / vapour space, floor, walls – areas tested should be documented

Spark Testing

- Checks for pin holes or other discontinuity due to age, damage or even workmanship
- Should be completed at every opportunity to be in the car
- Should be completed with an approved, calibrated piece of equipment
- Should be completed at the maximum allowable voltage for the specific rubber
- All passes over the lining should be overlapped
- Typically, the flexible “T” probe is used for the entire lining or a wire “fan”.
- Recommended test rate is 4 ft/second



Proper spark testing is 4 feet per second, which is a lot slower than what you may think



Visual Inspections

- The visual inspection is as important as the spark test or hardness testing.
- Should be done in conjunction with the spark test – sparking testing is not 100% as it cannot find all potential leak paths due to spark length
- An experienced inspector with a knowledge of rubber lining application, manufacturing and service should conduct inspections as many decisions get made during the inspection
- Visual inspections should concentrate on seams, overlays and any repair areas where leak potentials may be
- 100% of the lining must have a close inspection – marking any questionable areas for further review or alternate opinion

Documentation

- A significant part of our work lives and in the case of rail cars the regulatory requirements demand it.
- Outside of the typical needs it is suggested that a complete visual / picture documentation be made for future reference.
- Investigative or learning tool. This full lining picture set can provide valuable information from a comparative standpoint in learning how an individual lining ages over time.
- Particular attention should be paid to minor cracking or other physical damage and any concerns at seams. Areas that do not require repair but may appear out of the norm should be noted.

Repairs

- Appropriate repairs can take place after all inspections and documentation of the existing lining have been undertaken
- Repairs should follow material manufacturers guidelines for application of the materials
- All repairs should be made with the designated repair material for a given product or following the lining owners guidelines for repair
- Properly completed repairs should last until the next scheduled inspection period



Thank you!

Questions???