U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – GROUND VEHICLE SYSTEMS CENTER

Long Term Tire Storage

Steve Bishel

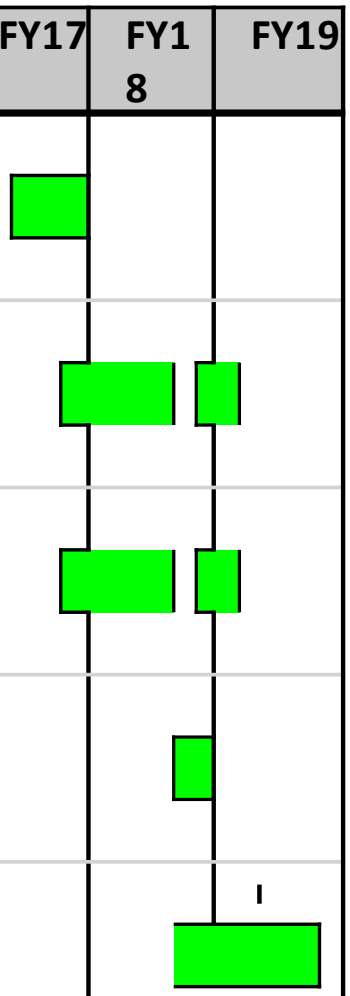
Mechanical Engineer

RDTA-SIE-ES-PEQ-SPECSYS

05 FEB 2019

Long Term Tire Storage

ELEMENTS	FY16	FY17	FY18	FY19
Root Cause Analysis				
Interior Coating Development				
Exterior Coating Development				
Coating Evaluation				
Full Tire Testing				



Purpose:

- Identify and mitigate the causes of tire rubber degradation during storage
- Enable quick asset utilization after storage
- Prolong the life of rubber products in storage

Products:

- Interior and exterior coatings for tires to mitigate the environmental effects that cause rubber decay

Payoff:

- Reduced cost from tire replacement during storage
- Increased readiness for assets with tires
- Potential reduction in frequency of tire failure mode

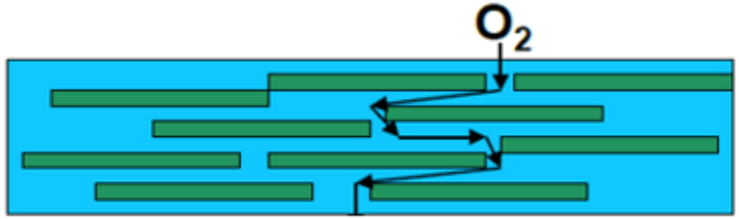
Partners:

- Ground Vehicle Systems Center (formerly TARDEC)
- PPG Industries
- The National Center for Manufacturing Sciences (NCMS)

Long Term Tire Storage

PPG Industries has developed a waterborne, protective coating for spray application to the interior and exterior sidewall tire surfaces.

- The coating is a barrier to oxygen and ozone and blocks the transmission of UV light to the tire rubber



- A 10 mil thick protective coating was applied to tire rubber sheets and slabs and demonstrated a 50% or more reduction in degradation in accelerated oxidative aging and ozone exposure testing.
- The coating also blocked 99% of UV from penetrating through the protective coating.

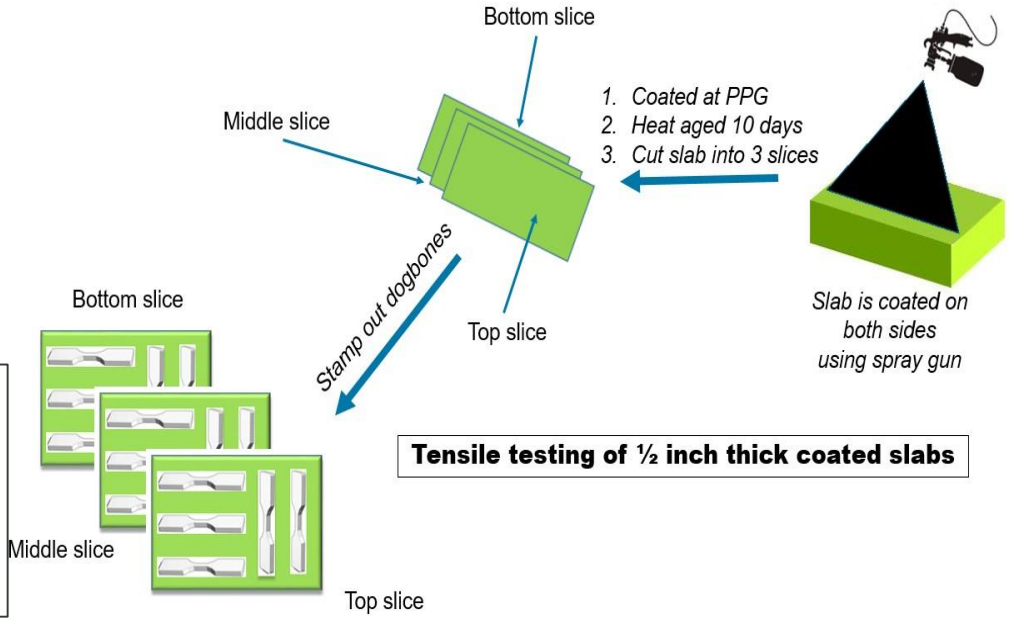
Tire Protective Coating Testing

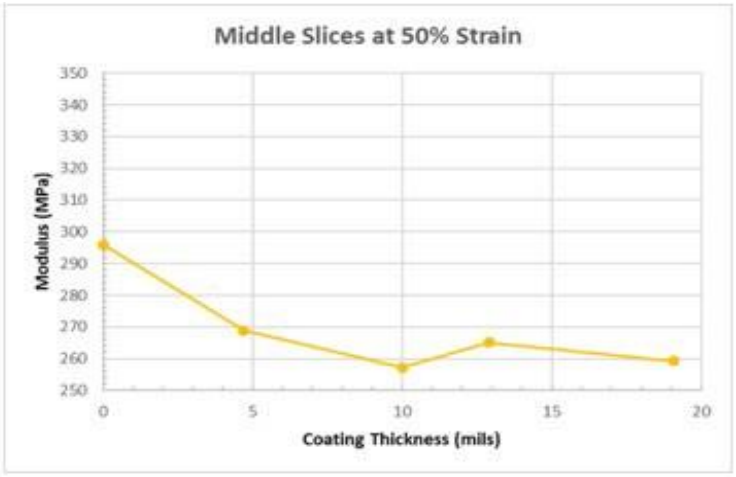
Heat Age Study: Evaluate coating thickness on tire aging properties

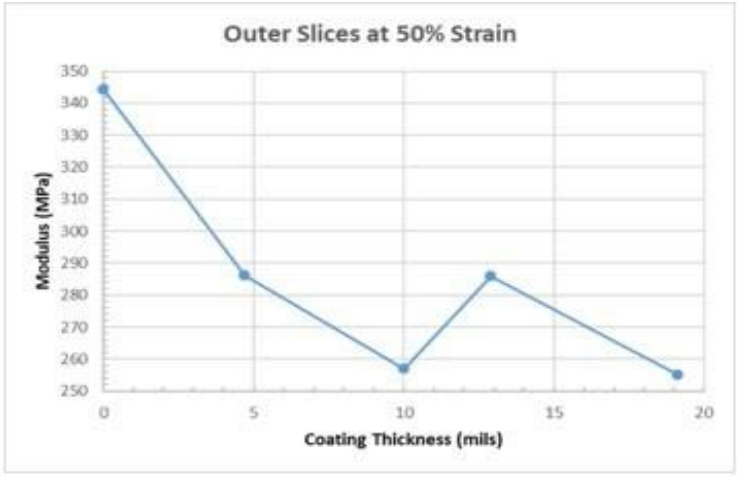
-Coat ½ inch thick rubber slabs

-Heat Age 10 days at 90 Deg C

Results show improvement in Modulus Values due to Age Hardening of coated tire versus non-coated tire

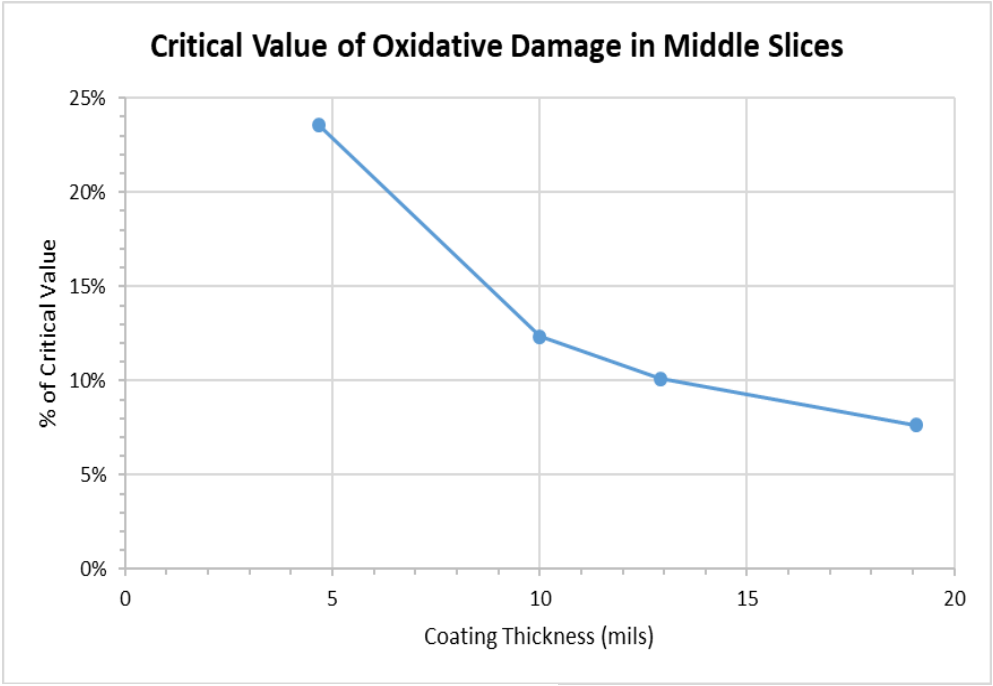






Tire Protective Coating Testing (cont'd)

Evaluation shows improvement in oxidative aging and ozone resistance of coated tire versus a non-coated tire.



Description		Bent Loop ASTM D1149 (40°C/50 pphm ozone)																
		4/21/18	4/22	4/23	4/24	4/25	4/26	4/27	4/30	5/1	5/2	5/3	5/4	5/7	5/8	5/9	5/10	6/5/18
	days --->															**19 Days**		**45 Days**
No Coating	A	start	0	0	0	0	0	0	2	2	2	2	3	3	3	Remove		
	B	start	0	0	0	0	0	0	0	2	2	2	3	3	3	Remove		
5 mils	A	start	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	start	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 mils	A	start	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	start	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20 mils	A	start	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	start	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ASTM D1171: 0 (no cracks), 1 (cracks visible at 7X magnification), 2 (cracks visible by eye), and 3 (large cracks).

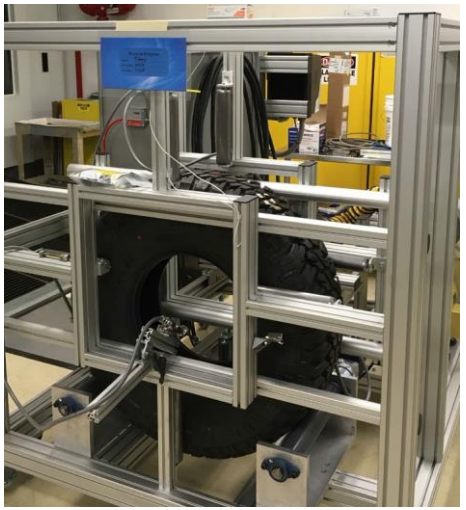
Status of Long Term Storage Project

Phase 1: Feb 2017 –June 2018

Completed.

Phase 2 : April 2018 – Sep 2019

- Tire coating system construction completed to accommodate military-size tires
- New coating system more suitable to tire exteriors under evaluation.
- Accelerated testing and durability evaluation
- Road wheel durability testing on aged tires
- Evaluation of the final coating solution



Benefits /Transition – Long Term Tire Storage Project

Benefits:

- Cost savings from the reduction in new tire purchases, maintenance overhead, and tire disposal expenses.
- Reduction in tire degradation due to age (environmental exposure)

Transition:

- Tactical wheeled vehicle tires are similar in composition to commercial truck and bus tires. Therefore, they face similar degradation challenges over the life of the tire. Tire failure after long-term storage is an important cost driver for both the commercial and military market. The same tire coating solution for military vehicle tires could be effectively used for commercial tires