

POLYFIBROBLAST: A SELF-HEALING AND GALVANIC PROTECTION ADDITIVE

Progress Report #12

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1 Summary

Jason Benkoski visited PPG's Allison Park Research Center to inspect the microcapsules. Despite the challenges of synthesizing them in larger quantities, the PPG microcapsules looked at least as good as the equivalent APL microcapsules. PPG is now making the 5 gallons of paint for the January field test.

2 Project Goals and Objectives

PPG has brought the microcapsule synthesis to a scale sufficient for producing 5 gallons of paint for the January field test in Camp Lejeune, NC.

3 Key Accomplishments

3.1 Coordinating field test with Andrew Sheetz

Jason Benkoski spoke with Andrew Sheetz from the USMC Corrosion Control Team to discuss logistics for the January field test. The plan remains unchanged. We will choose a week in January that does not fall on a holiday weekend to perform the test. PPG will deliver 5 gallons of self-healing paint to Andrew's team at Camp Lejeune. He will then use a similar procedure to paint one half of the truck bed of an MTRV with self-healing paint, and the other half with zinc-rich primer. Andrew and his team will then perform routine visual inspection of the truck bed periodically as it experiences normal wear and tear. Andrew and Jason will speak again in the first or second week of December to determine a more detailed plan of action.

3.2 Visual Inspection of microcapsules

In last month's report, we showed that raising the isocyanate to amine ratio from 1:0.6 to 1:1 appears to accelerate shell-cure to about 4 days. Increasing heat soak temperature and adding an amino-ether catalyst further reduced shell-cure to 2 days. Upon visual inspection, microcapsules made in this fashion look as good as, if not better than, the microcapsules made at APL. Provided that the microcapsules can be filtered, dried, and dispersed into the MIL-P-26915 primer, we would expect good self-healing performance from these microcapsules.

3.3 Filter, dry, and redisperse

An ongoing issue with the microcapsules is the difficulty of taking the aqueous dispersion of microcapsules, purifying them, drying them, and then redispersing them in the MIL-P-26915 primer. Big strides were made last year at APL moving from an expensive freeze-drying process to a simple air-drying process. However, the air-drying process still has reliability issues. Part of the reason that the microcapsules were soaked in water for 14 days was to make the polymer shells thick enough to survive vacuum filtration. Thinner shells deformed under pressure. Once

dried, the deformed microcapsules were difficult to redisperse. The 35% OTS microcapsules tended to filter, dry, and redisperse better than other formulations. The variability in the behavior of the different formulations made it difficult to settle on a single drying protocol for all samples.

PPG is experiencing some of these difficulties. Their strategy so far has been to synthesize excess microcapsules and remove the large aggregates with a sieve. This approach lowers the yield, but with their ability to make 2 kg/hr, they can afford to use this approach until the drying process improves. Based on the relatively low loading of microcapsules, PPG only needs to synthesize a total of 2 kg of microcapsules to make 5 gallons of self-healing primer. After the 5 gallons have been delivered to Andrew Sheetz, PPG will have 3 months to refine the process and improve yields.

4 Next Steps

4.1 Field Test Preparations

Given the urgency of the January field test, PPG will devote most of its resources this month to delivering 5 gallons of self-healing paint.

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