ZeeMail

Zeeospheres® Ceramics, LLC

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May 15th, 2012

Use of **ZEEOSPHERES®** in External Fusion Bonded Epoxy (FBE) Pipe Coatings

Recently Zeeospheres Ceramics LLC contracted with Alan Kehr to provide a technical and marketing report for the external pipe coatings market. Mr. Kehr was formally the global technical manager for 3M's corrosion protection division and is the author of *Fusion Bonded Epoxy (FBE): a Foundation for Pipeline Corrosion Protection*. Zeeospheres® is currently supplying product to customers in this market segment. In terms of dollars, the current market for FBE pipe coatings is about $1,000,000,000. The cost per unit volume is included in the attached spreadsheet. Using $0.15/lb.* for wollastonite (a common filler in pipe coatings), $0.25/lb. for barites (a common filler for deco coatings and used in some pipe coatings), and $0.30/lb. for N-600 Zeeospheres®, the formulation containing Zeeospheres® has the lowest total formulation costs.

Specific Gravity Benefit

The N-600 spheres have a lower specific gravity compared to wollastonite and substantially lower than barites. Using a generic pipe coating formulation and maintaining a specific gravity of 1.44 (common for pipe coatings, but it varies substantially from supplier to supplier), then the cost per unit volume, which translates to cost per square meter of coating, is better for the N-600 spheres. Based on this, we can argue that the Zeeospheres® are the most economic filler.

To understand that given the earlier argument based on cost per unit volume, we are able to use more Zeeospheres® on a volume basis to achieve the same density or specific gravity as an equivalent formulation utilizing wollastonite or barites. We also have to understand that increasing the volume loading will affect performance characteristics, and those characteristics will be tested by the formulators

*Wollastonite is currently selling for $.25/lb. in high volume

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Loading benefit

Because spheres have a lower surface area than particles of any other dimensions, we are able to load systems to a higher level and still get wet out – that is, the filler is encapsulated by the organic component of the pipe coating. That means we can achieve higher loading levels of Zeeospheres® than other fillers and still maintain a good appearance. Since the cost of the organic component is significantly more expensive than Zeeospheres®, the higher loading results in lower cost for the coated pipe.

Performance

The type and amount of filler significantly affects performance of an FBE pipe coating. The minimum requirements for performance are spelled out in such industry standards as CSA Z245.20, [i] or NACE RP0394-02. [ii] Most end users have more stringent requirements. What this means is that we (or pipe coating suppliers) can develop coatings utilizing the information above, but they have to optimize performance to demonstrate that it is as good as or better than the requirements in these or other industry standards and customer specifications.

Value proposition summary

The pipe coating industry is conservative and mostly accepting of the current offerings in the market. That means pipeline owners will only consider new offerings that show significant improvement in performance or equivalent performance at significantly lower cost. Bringing out a new or improved product is an expensive and time-consuming process for the coating supplier. That means they will likely use Zeeospheres® in coatings that are under development and will be introduced in the future. Our success depends on convincing research people that the opportunity for either improved cost or improved performance makes it worth adding Zeeospheres® to their current or future research programs.

***SEE ATTACHEMENTS FOR FORMULATIONS AND ASSOSCIATED COST ESTIMATES**

[i] CSA Z245.20 Series-10 PDF, "*Plant-applied external coatings for steel pipe,"* Canadian Standards Association, Toronto, 2010.
[ii] NACE RP0394- 02, "*Application, Performance, and Quality Control of Plant-Applied, Fusion-Bonded Epoxy External Pipe Coating*", NACE International, Houston, 2002.

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All formulations have a 1.44 sp gr

Zeeospheres

MATERIAL	PHR	% weight	RM Cost lb	$/lb	sp gr	cc	% volume
EPOXY RESIN	100.00	63.85%	$1.500	$0.9577	1.2	83.33	76.60%
Curing agent	2.20	1.40%	$3.000	$0.0421	1.4	1.57	1.44%
Catalyst	1.00	0.64%	$5.000	$0.0319	0.98	1.02	0.94%
Zee N600	51.40	32.82%	$0.300	$0.0985	2.3	22.35	20.54%
TiO2	2.00	1.28%	$1.300	$0.0166	3.9	0.51	0.47%
Organic pigment	0.02	0.01%	$8.000	$0.0010	2.05	0.01	0.01%
			Raw Mat				100.00%
	156.62	100.00%	Cost/lb=	$1.1479		108.8	= cc
			Cost/cc	$0.00364		1.440	= sp gr

Wollastonite

MATERIAL	PHR	% weight	RM Cost	$/lb	sp gr	cc	% volume
EPOXY RESIN	100.00	69.68%	$1.500	$1.0452	1.2	83.33	83.62%
Curing agent	2.20	1.53%	$3.000	$0.0460	1.4	1.57	1.58%
Catalyst	1.00	0.70%	$5.000	$0.0348	0.98	1.02	1.02%
Wollastonite	38.30	26.69%	$0.150	$0.0400	2.9	13.21	13.25%
TiO2	2.00	1.39%	$1.300	$0.0181	3.9	0.51	0.51%
Organic pigment	0.02	0.01%	$8.000	$0.0011	2.05	0.01	0.01%
			Raw Mat				100.00%
	143.52	100.00%	Cost/lb=	$1.1852		99.7	= cc
			Cost/cc	$0.00376		1.440	= sp gr

Barytes

MATERIAL	PHR	% weight	RM Cost	$/lb	sp gr	cc	% volume
EPOXY RESIN	100.00	74.73%	$1.500	$1.1209	1.2	83.33	89.66%
Curing agent	2.20	1.64%	$3.000	$0.0493	1.4	1.57	1.69%
Catalyst	1.00	0.75%	$5.000	$0.0374	0.98	1.02	1.10%
Barytes	28.60	21.37%	$0.250	$0.0534	4.4	6.50	6.99%
TiO2	2.00	1.49%	$1.300	$0.0194	3.9	0.51	0.55%
Organic pigment	0.02	0.01%	$8.000	$0.0012	2.05	0.01	0.01%
			Raw Mat				100.00%
	133.82	100.00%	Cost/lb=	$1.2816		92.9	= cc
			Cost/cc	$0.00406		1.440	= sp gr

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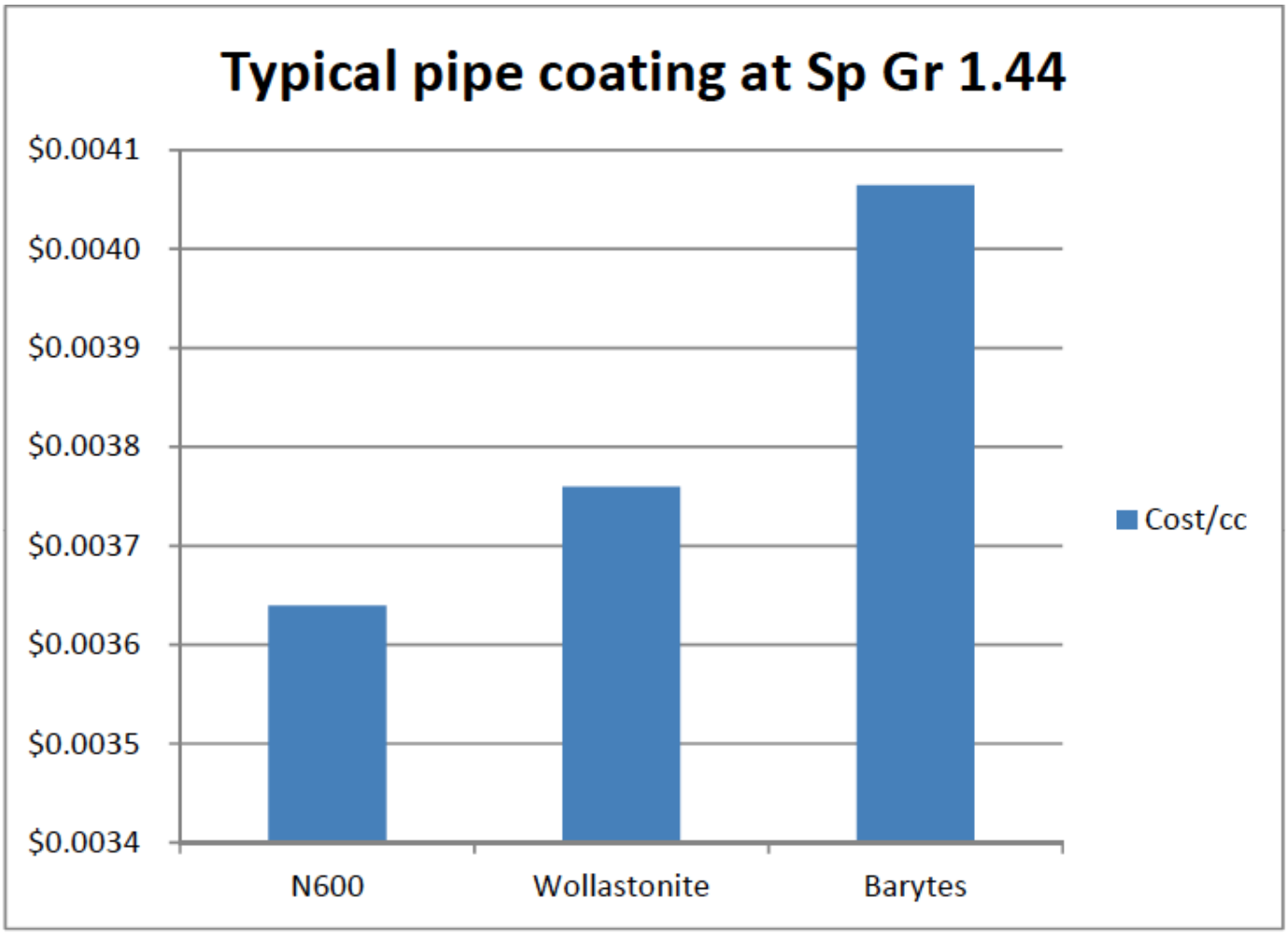

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