ZeeMail

Zeeospheres® Ceramics, LLC

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Third Party Testing Confirms Zeeospheres' Claims

Zeeospheres Ceramics, LLC contracted with Specialty Coating Services, Inc. to test and quantify important properties provided by Zeeospheres Ceramic Microspheres in applications in the coatings, adhesives, sealants, and elastomeric markets. Specialty Coating Services, Inc. has over 50 years of experience formulating and testing products in the paints and coatings industry and all testing is conducted in their own state-of-the-art laboratory, which is equipped to compound, apply, and fully evaluate a wide variety of coating technologies. Results of this study validated Zeeospheres Ceramics, LLC's claims of increased solids, lower VOCs, and cost reduction by lowering epoxy resin demand (by about 20%)!

The following is a summary of testing conducted to determine the vehicle, or binder, demand of (4) grades of Zeeospheres and a low viscosity (LV) magnesium silicate (talc) in a 100% NV epoxy blend. The approach employed in this study was to determine the maximum loading level, or P/B ratio, achievable with a given extender pigment and to then determine the reduction in viscosity achieved with incremental increases in resin content and subsequent decrease in the P/B (pigment to binder) ratio. Often times, the generation of this data will show a much greater difference in vehicle demand than one might expect based on oil absorption alone.

Project Overview

The 100 % NV epoxy resin blend employed in this study consisted of 80 % D.E.R. 331 liquid epoxy resin and 20 % Epoxide 8 mono-functional epoxy resin. The epoxide 8 was utilized to lower the viscosity of the base epoxy resin, thus allowing for higher initial pigment to binder (P/B) ratios.

The epoxy resin blend was selected as the binder for this study due to the poor pigment wetting characteristics of epoxies, and the vast usage of epoxy resin in high solids and 100% NV coatings, adhesives, and composites.

The grades of Zeeospheres and low viscosity talc were as follows:

Extender Pigment	Supplier
• Zeeospheres G-200	Zeeospheres Ceramics
• Zeeospheres N-200	Zeeospheres Ceramics
• Zeeospheres G-400	Zeeospheres Ceramics
• Zeeospheres N-400	Zeeospheres Ceramics
• Nicron 402 LV Talc	Imerys (formerly Luzenac)

As previously noted, the talc employed in this study is a grade that is referred to as a low viscosity (LV) talc due to its low oil absorption relative to more platy grades. (O.A.= 27)

As such, this talc is recognized as a grade that will allow for the formulation of epoxy coatings with a higher loading level, accompanied by an increase in coating solids, and or a reduction in VOC.

In this study, the epoxy resin blend was initially loaded with Zeeospheres G-200 ceramic microspheres, to a pigment to binder (P/B) ratio of 1.75 to 1. This was determined to be the maximum loading level attainable while still retaining an acceptable degree of mobility. We attempted to utilize the same P/B ratio with the competitive talc. However, the highest P/B attainable was 1.35 to 1 due to excessively high viscosity, despite the relatively low oil absorption of this talc (27).

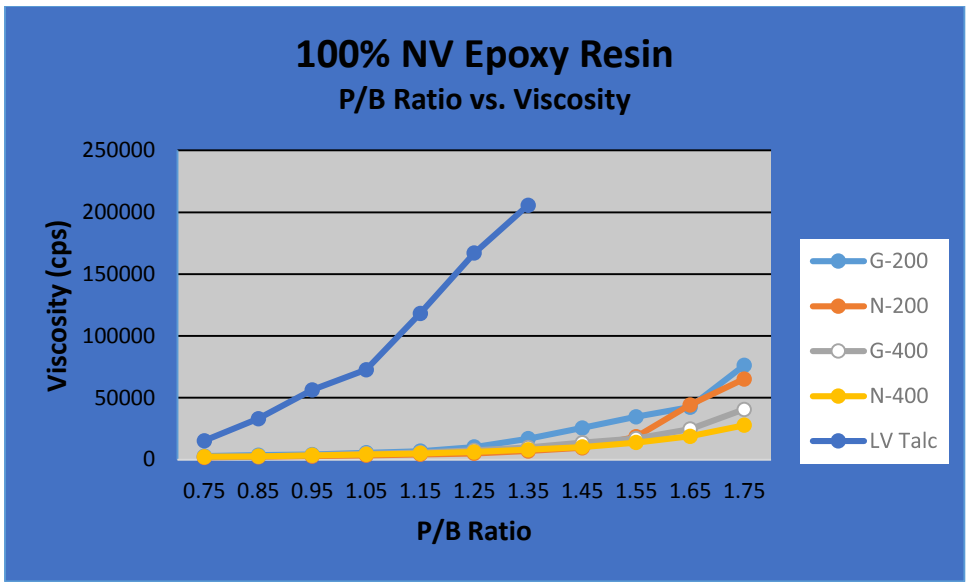
The base formulations for all test samples were as follows:

Formula Number

Material		**3112-1**	**3112-2**	**3112-3**	**3112-4**	**3112-5**
DER-331		203.6	203.6	203.6	203.6	238.3
Epoxide 8		50.9	50.9	50.9	50.9	59.6
Zeeospheres G-200		445.5	------	------	------	------
Zeeospheres N-200		------	445.5	-------	------	------
Zeeospheres G-400		------	------	445.5	------	------
Zeeospheres N-400		------	------	------	445.5	------
Nicron 402 LV Talc		------	------	------	-------	402.1
Totals		700.0	700.0	700.0	700.0	700.0
Pigment to Binder Ratio		**1.75 to 1**	**1.75 to 1**	**1.75 to 1**	**1.75 to 1**	**1.35 to 1**

In preparation of the test samples, each extender filled resin was dispersed on a high speed disperser for 20 minutes @ 2500-3000 RPM. After 20 minutes dispersion, the Hegman grind of the Zeeospheres G-200 and N-200 samples was a 5-6 N.S., as opposed to a Hegman of 3.5 N.S. for the competitive talc.
The samples were then allowed to cool to room temperature for 24 hours prior to determination of the initial viscosity using a Brookfield viscometer @ 20 RPM.
Each reduction in P/B ratio was conducted at 0.10 increments with the appropriate addition of the 80:20 DER-331 /epoxide 8 blend (see above)
At this point, all blends prepared with Zeeospheres had been loaded to a level of 63.64% pigment of total solids with viscosities varying from a high of ~73,000 cps with Zeeospheres G-200 to a low of 27,600 cps for Zeeospheres N-400. The Nicron 402 talc containing sample had a very high viscosity of ~205,000 cp.

At this point, the P/B ratio of each test sample was gradually reduced with incremental additions of the epoxy resin blend to allow for the determination of viscosities at P/B ratios ranging from 1.75 down to 0.75 to 1 with the Zeeospheres and P/B ratios ranging from 1.35 down to 0.75 to 1 with the competitive talc. In each case, the P/B ratio was reduced by 0.10 increments with viscosities being measured after each resin addition.



Summary

The following is a summary of the findings.

- In all cases, the data generated indicates that far less vehicle/binder is required to wet-out all grades of Zeeospheres evaluated than it is for the competitive LV talc evaluated, and as such, the Zeeospheres all have a notably lower vehicle demand relative to the LV talc. This lower resin demand results in much lower base viscosities at all P/B ratios ranging from 1.75 to 1 down to 0.75. Even at the lowest P/B ratio (0.75 to 1) studied, the viscosity of the LV talc is still over 5 times higher that of the G-200.

- The Zeeospheres G-200 had the highest vehicle demand of all Zeeospheres samples tested. This was expected since the G-200 has the smallest particle size and the highest surface area, of all grades of Zeeospheres evaluated in this study. The resulting data also correlates well with surface area of the other grades of Zeeospheres given that the surface area of the N-200 is greater than G-400, which is greater than that of the N-400.

- The low vehicle demand of the Zeeospheres thus allows the formulator to produce coatings with higher solids and/or lower VOC relative to that achievable with a LV Talc. In additions, some notable cost savings may be achievable in highly filled coatings, such as primers or intermediate coatings, due to the high P/B ratio characteristic of these types of coatings.