tru seal technologies

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# Memorandum

Research and Development Department

**To:** Elena Kamaeva

**CC:** J. Baratuci

**Subject:** Summary Performance Results - Truspacer Competitor Analysis

**From:** D.L. Pruchenski **Date:** April 29, 2011

A sample of a competitive spacer system brand name "Truspacer", product code 10#-39H-824, appears to be a product from Panjin Zhucheng Plastic Co. Ltd located in China. A preliminary analysis of the competitive spacer system is reported here including: product nomenclature & packaging comparison, component dimensional review /general compositional analysis using basic reverse engineered techniques (subassembly and bulk compound comparison through photo-documentation of stream materials and TGA screening analysis), and competitive product performance benchmarking.

The Truspacer design appears very similar to the Duraseal platform structured on a crimped shim containing a stiffener, MVB, bond line adhesive and a sight-line top coat material. However, this memo will outline several differences which impact both the thermal performance and the product integrity.

**Physical Inspection – Comparison to Duraseal**

The Truspacer sample was disassembled and components identified and measured. See Figure 1. Truspacer uses an undulating Shim and a flat Stiffener component like Duraseal. However, the Stiffener and Shim appear to be the same .007" (.18 mm) thick aluminum based alloys. Although dimensions are similar, the fact that both the shim and stiffener are metallic will give a higher thermal conductivity for Truspacer (poorer insulating thermal performance). The moisture vapor barrier (MVB) in Truspacer appears to contain an aluminum foil coated with plastic similar in design to the Duraseal MVB. However, the coating of Truspacer MVB was very easily separated from the foil. Due to the fragile nature of the Truspacer MVB, it wasn't possible to obtain accurate MVB measurements. This Mvb deformation does raise several questions regarding the actual durability of the Truspacer MVB material.

Another major difference is the Crimps Per Inch (CPI) value which is the number of undulations in the Shim per lineal inch. The Truspacer product only obtains roughly 2.7 CPI where the Duraseal product reaches 3.0 CPI. The higher the CPI, the greater the support to the bondline material which improves overall product stability, application, and wet-out properties.

**Figure 1: Hard Component Measurement Comparison**

**SUMMARY DATA**

| Competitor Analysis - TruSpacer vs. Duraseal<br>Hard Component Measurement Comparison | | |
|---|---|---|
| | **Panjin Zhucheng Plastic Co. Ltd.** | **Truseal Technologies** |
| | **Truspacer 10#-39H-824** | **Duraseal 824-39H-357 (Specification)** |
| Overall Height (in) | 0.237 | 0.250 |
| Overall Width (in) | 0.461 | 0.455 |
| Shim Width (in) | 0.332 | 0.340 |
| Stiffener Width (in) | 0.330 | 0.317 |
| CPI | 2.72 | 3.00 |
| Crimp Height, Overall - outside to outside (in) | 0.181 | 0.155 |

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**Performance Testing Comparison**

A competitive product performance test program was set up per table 1 below. The program evaluated Panjin Zhucheng Plastic Co. Ltd. Truspacer 10#-39H-824, Sample ID 240a. The Truspacer units were assembled 16Dec2010, argon filled, and aged per the ASTM E2190 standard (at least the minimum 28 days rest before testing). The units were placed in weathering exposure evaluations on 14Dec2011 after taking an initial argon fill reading. Two, additional units were built 1/18/11 to conduct a dew point development analysis including a unit made with Duralite spacer as a control. (870-37H-357 Campaign 2325250040 K070).

**Table 1: Competitive Test Program**

**Competitive Test Program**
Panjin Zhucheng Plastic Co. Ltd.
Truspacer 10#-39H-824

| # Samples | Performance Measure | Conditions | Study Length |
|---|---|---|---|
| 4 | High Humidity Exposure | Argon filled units placed in 140° ASTM HH cabinets. Check Argon retention (and if dew point obtained dew points) on a monthly basis | Run until failure or 6 months max exposure |
| 4 | Dew Point Development | Used the 4 HH units and check dew point 24hrs and 7 days from construction date | verify |
| 4 | CSZ | Argon filled units placed in cycling CSZ exposure chamber. Check Argon retention (and if dew point obtained dew points) on a monthly basis | Run until failure or 6 months max exposure |
| 4 | Fog Exposure | Per ASTM conditions | 7 days |
| 6 | DI Immersion Coupons | Construct Immersion coupons per standard Truseal practice. Visually evaluate wet-out and adhesion on a monthly basis | Run until failure or 6 months max exposure |
| 6 | SLS Immersion Coupons | Construct Immersion coupons per standard Truseal practice. Visually evaluate wet-out and adhesion on a monthly basis | Run until failure or 6 months max exposure |
| 2 | QUV exposure | Expose two 3" strips in standard 60°C, 0.78 irradiance QUV chamber against a control of similar size. Record time to crack and/or discoloration | Run until failure or 12 months max exposure |

**Dewpoint Development**

Dewpoint development for the Truspacer product was very slow. Dewpoint was measured at 24 hour intervals. See Table 2. At 3 days the dewpoint of Duralite units were below -70°F where the Truspacer units required 28 days to reach the ASTM minimum dew point of -40°F. A thermogravimetric analysis of the Truspacer topcoat showed a similar level of inorganic materials, as the topcoat of Duraseal/Duralite. However, the slow dewpoint development of the Truspacer units suggests that the Truspacer may contain less desiccant and more inert inorganic materials such as clay, talc or calcium carbonate compared to Dura products.

**Table 2. Dewpoint Development**

**Dew Point Development**

**Airspace 1** | Testing Summary | Units Build 1/18/11

| Date Tested | | 1/19/2011 | 1/20/2011 | 1/21/2011 | 1/27/2011 | 2/15/2011 | | |
|---|---|---|---|---|---|---|---|---|
| Unit ID | Initial | Reading 1 | Reading 2 | Reading 3 | Reading 4 | Reading 5 | | Comments |
| Truspacer sample 240-a | | 8 | 3 | -3 | -13 | -45 | | |
| Truspacer sample 240-b | | 8 | 3 | -3 | -13 | -50 | | |
| Duralite Control-a | | -60 | -66 | -70 | | < -80 | | did not test at 7 days because the unit wasalready at -70 after 72 hrs and final dew point is much slower |
| Duralite Control-b | | -60 | -66 | -70 | | < - 80 | | did not test at 7 days because the unit wasalready at -70 after 72 hrs and final dew point is much slower |

**Durability**

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Truspacer weathering performance was also poor (see Figure 2).

**Figure 2: Truspacer Performance Summary**

| | High Humidity<br>60C, 100%RH | Temperature Cycling<br>-15C to 55C 4 hr cycle w/100%RH |
|---|---|---|
| Truspacer Sample 240a | 4 of 6 failed at 2 weeks | 6 of 6 failed at 2 weeks |

All units in humidity and temperature cycling exhibited severe top coat anomalies after even this short exposure period. The top coat anomalies, Figure 3, were originally thought to be some sort of Argon blistering. However, a similar phenomena occurred in the QUV chamber, see Figure 4 after 1,283 hours. QUV regimen used is UV radiation exposure at 60C for 6 hours and then 40C without UV for 2 hours. Since the samples in the QUV were not exposed to Argon, it appears that this top coat blistering or degradation is heat related. The Truspacer product may not use UV or heat stabilizer additives.

**Figure 3: Top Coat Anomalies**

**Figure 4: QUV Exposure Samples - 1,283 exposure hours**

The sample on the left in each picture is Truspacer. The middle sample is standard Duraseal. The sample on the right is an experimental low volatility topcoat developed for future Dura products.

**Summary**

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It can be concluded that although the competitive Truspacer material (Panjin Zhucheng Plastic Co. Ltd.; Truspacer product code 10#-39H-824) visually appears to have replicated the Duraseal product in packaging, nomenclature, and design; competitive benchmark testing and analysis suggests that the overall performance (both thermal performance and seal durability/integrity) is inferior when compared to the Truseal Duraseal. Due to Truspacer's greater use of metallic alloys throughout the product, the Duraseal product should have a clear thermal performance advantage. The Truspacer product tested had an extremely slow dew point development. The seal durability in accelerated weathering performance was extremely poor with 4/6 high humidity units failing after just 2 weeks exposure and 6/6 units failing after 2 weeks in temperature cycling exposure. The performance in accelerated heat and UV exposure also suggests the stabilizer package is inadequate to protect the sight line top coat from degradation which would affect the aesthetics of the spacer and could eventually impact the seal integrity.

DLP/dlp