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JULY 19, 1993

93-2057

SUBJECT: Evaluation of Ameron 3335 and Dow Corning X3-6376 Silicone
Ablative Compounds

RELATED DOCUMENTATION: KSC-SPEC-F-0006

1 .O FOREWORD

At the request of C. J. Bryan, DM-MSL-2, an evaluation was conducted on two candidate silicone ablative compounds for use at KSC. The results of this evaluation will be used to add successful materials to the Approved Products List of KSC-SPEC-F-0006. The evaluation consisted of application of these materials to test panels and exposure of the panels to the effects of launch of the Space Shuttle.

2.0 MATERIALS

- 2.1 The materials used for this evaluation are silicone rubber ablative compounds. They were primerless formulations that did not require special silicone primer application for adhesion to prepared test panel surfaces. The materials are identified as Ameron 3335 manufactured by Ameron Corporation, and Dow Corning X3-6376 manufactured by the Dow Corning Corporation. A material that requires primer, Dow Corning **Q3-6077**, was included as a control material.
- 2.2 The candidate ablative materials were applied to **6" x 6" x 1/16"** carbon steel test **panels** coated with inorganic zinc primer as supplied by KSC. Three test panels of each material were used for the testing. All ablative coating applications were conducted by the respective manufacturers' technical personnel and sent to KSC for further evaluation.
- 2.3 As a control, panels were prepared using the Dow Corning **Q3-6077** material that is presently on the Approved Products List In **KSC-SPEC-F-**

0006. This was done to have a direct comparison of the candidate data with an existing known performance material. The panels were prepared in the DM-MSL-2 laboratories.

3.0 INVESTIGATIVE PROCEDURES AND RESULTS

- 3.1 After the test panels were received from the manufacturers and the control panels prepared at KSC, they were weighed, the coating dry film thickness (DFT) measured with a magnetic pull-off gauge, and temperature monitoring labels (Tempilabels, 150° - 425° F range) were attached to the back face of the panels. The results of the initial weights and thicknesses are included in the data tables.
- 3.2 After the measurements were complete, the panels were mounted on the special carrier plate used for ablative testing. When the panels were mounted, the edges of each panel were caulked with the Dow Corning Q3-6077 material to prevent water intrusion.
- 3.3 The carrier plate was attached to the Mobile Launch Platform (MLP) deck by Lockheed personnel for exposure to the effects of a Shuttle launch. The edges of the carrier plate and hold down bolts were caulked with Dow Corning Q3-6077 by DM-MSL personnel on February 25, 1993, to complete the installation at the pad.
- 3.4 After the launch of STS-55, the carrier plate was removed by Lockheed personnel and returned to the DM-MSL laboratories for analysis. The individual panels were removed from the carrier plate and cleaned to remove loose debris. The panels were reweighed, the remaining coating thicknesses measured and back face temperature was recorded from the Tempilabels for comparison with initial data. A summary of the data for the individual materials are shown in Tables 1 and 2. The back face temperature labels showed no temperature excursion above 150° F for any of the test panels.

TABLE 1

AMERON 3335
(Weights in Grams and DFT in Mils)

Panel #	Panel Wt. Before	Panel Wt. After	Coating Wt. Loss	DFT Before (avg.)	DFT After (avg.)	DFT Loss (avg.)
1	608.37	555.37	53.0	124.3	30.3	94
2	608.69	558.02	50.7	116.7	29.3	77.3
3	614.07	567.09	47.0	134.3	44.3	90.0

TABLE 2

Dow Coming Materials
(Weights in Grams and DFT in Mils)

Panel #	Panel Wt. Before	Panel Wt. After	Coating Wt. Loss	DFT Before (avg.)	DFT After (avg.)	DFT Loss (avg.)
Dow Q3-6077						
1	390.24	342.96	47.3	180	115	65
2	392.20	348.44	43.8	180	120	60
3	384.41	340.95	43.5	158	75	83
Dow X3-6376						
1	374.48	318.75	55.7	178	70	108
2	359.34	309.29	50.1	156	63	93
3	364.00	318.36	45.6	161	70	91

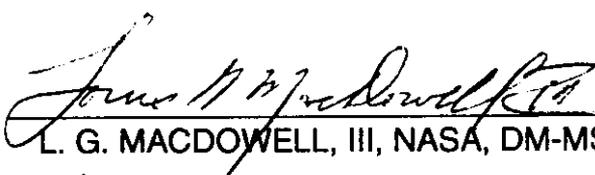
3.5 As can be seen from the tables, the Dow Corning Q3-6077 material performed the best with less material ablation thickness loss after launch. However, the other materials performed well by fully protecting the base metal of the test panel.

3.6 Both of the new candidate materials exhibited excellent adhesion to the inorganic zinc primer used on the surface of the test panels. After the exposure to the STS launch, no areas of coating were found to be loose or easily removable.

4.0 CONCLUSIONS

4.1 Based on the results of these tests, the Ameron 3335 and Dow Corning X3-6376 materials were found to perform well in the STS launch environment. Due to the fact that none of the materials were completely removed by the launch process, and none of the materials allowed back face temperatures to exceed 150° F, the direct STS launch impingement testing requirements were satisfied.

4.2 As a result of this performance, both the Ameron and Dow Corning materials will be added to the Approved Products List in KSC-SPEC-F-0006.

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