EFFECTS OF TACKY MAT CONTAMINATION ON BOND DEGRADATION FOR CHEMLOK/LINER AND NBR/LINER BONDS

FINAL REPORT

JUNE 1989

Prepared for:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812

Contract No. NAS8-30490
DR. No. 5-3, Type 2
WBS. No. HQ 301

MORTON THIOKOL, INC.
Aerospace Group
Space Operations
P.O. Box 707, Brigham City, Utah 84302-0707 (801) 863-3511

FORM TC 4677 (REV 1-88)
EFFECTS OF TACKY MAT CONTAMINATION ON BOND DEGRADATION
FOR CHEMLOK/LINER AND NBR/LINER BONDS

FINAL REPORT
MAY 1989
PREPARED BY:
A. M. Padilla/Norma LaBau

APPROVED BY:
J. F. Twohy
Project Engineer

T. D. Hanson
RSRM Manufacturing Engrg

L. M. Seidner, Supervisor
Inert Processing

E. L. Gray
Program Management

MORTON THIOKOL, INC.
Aerospace Group
P.O. Box 524, Brigham City, Utah 84302 (801) 863-3511

I. N. Black
Test Plans and Reports

PC Tudgeck 6-30-89
Release
ECS No. SS 1638
INTRODUCTION AND SUMMARY

It is desirable to place tacky mats by the entrance ways to the rubber layup areas for the SRM segments. The purpose of the tacky mat is to remove dust, lint, etc., from the operator's shoes prior to entering the platform where the layup work is performed. It is possible that a tacky mat could be touched with gloved hands prior to handling the uncured NBR. Due to the potential for inadvertent contamination on bonding surfaces, we were requested to determine if tacky mats are acceptable for use in the M-111 rubber layup workstation. A formal test plan was not issued. Based on the test results of this investigation, tacky mats (Sticky Mate D-1100 Series Model No. D2436-20T) from Clean Room Products Inc., can be used in the M-111 rubber layup stations without causing adverse contamination problems.

The tacky mats were judged solely on the basis of bond degradation caused by either direct or indirect contamination. Test results all indicate that there was no notable NBR/Chemlok or liner/NBR bond degradation on samples contacted with the tacky mat material. NBR/Chemlok test data can be seen in Table I. Figure 1 illustrates the specimen configuration for these tests. Attachment I shows the results for the liner/NBR lab tests. Both direct and indirect contamination was used to test for bond degradation. An explanation of testing procedures for testing of the tacky mat can be read in the Technical Section of Attachment I.

The tacky mat adhesive composition does not contain fluorocarbons or release agents that would affect bonding. To determine whether or not the tacky mat adhesive is soluble in MEK, methyl chloroform, or isopropyl alcohol, a tacky mat was divided into three sections. Each section was subjected to one ounce of one of the fluids to be tested. This fluid was left on until it had evaporated and then the application of solvent was repeated. The tacky mats are also manufactured according to MIL specs to ensure that every mat is identical in construction.
2.0 CONCLUSIONS

1. No NBR/Chemlok or liner/NBR bond strength degradation was noted on samples contacted with the tacky mat. It is concluded that the bond strengths of the tacky mat contaminated surfaces are at least as strong as the cohesive strength of the liner or of the NBR.

3.0 RECOMMENDATION

Based upon bond degradation test results, it is recommended that tacky mats be used in M-111 for shoe dust removal prior to operators entering the rubber layup work area.
<table>
<thead>
<tr>
<th>CONTAMINATION MODE</th>
<th>PANEL #1 - CONTROL (NO CONTAMINATION)</th>
<th>PANEL #2 (DIRECT CONTAMINATION; TACKY MAT DIRECTLY ON NBR THEN REMOVED)</th>
<th>PANEL #3 (INDIRECT CONTAMINATION; GLOVES ON TACKY MAT-THEN GLOVES PRESSED ON NBR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TENSILE FAILURE STRESS (PSI)</td>
<td>714, 601, 731, 614, 647, 666, 660</td>
<td>779, 738, 767, 760, 749, 770, 773, 703</td>
<td>608, 719, 682, 703, 784, 735, 776, 605</td>
</tr>
<tr>
<td>45% PEEL STRESS FAILURE MODE</td>
<td>85% COH, 90% COH, 100% COH, 100% COH, 100% COH, 98% COH, 98% COH</td>
<td>100% COH, 100% COH, 100% COH, 100% COH, 95% COH, 100% COH, 97% COH</td>
<td>95% COH, 100% COH, 100% COH, 100% COH, 95% COH, 100% COH, 80% COH</td>
</tr>
<tr>
<td>AVERAGE TENSILE STRESS (PSI)</td>
<td>661.9</td>
<td>749.96</td>
<td>701.6</td>
</tr>
<tr>
<td>COEFF. OF VAR.</td>
<td>6.7</td>
<td>3.31</td>
<td>9.66</td>
</tr>
</tbody>
</table>

**NOTE:** IF FURTHER TEST DATA ARE REQUIRED, THEY MAY BE OBTAINED THROUGH THE M-53 LABORATORY, LWR NO. 566439
Figure 1. Tacky Mat Contamination
Attachment I. Liner/NBR Test Results

Morton Thiokol Inc.
Wasatch Operations
Support Services

Interoffice Memo
30 August 1988
2435-8Y89-M081

TO: D. L. Staples
CC: R. R. Hendrickson, L. W. Poulter
FROM: K. A. Madsen
Bonding & Subscale Processing

SUBJECT: SRM STS-3224 Liner To NBR - Tacky Mat Tests

Introduction
Tacky mats are placed by the rubber lay-up areas for the SRM segments. These mats dust off the shoes prior to entering the platform where the lay-up work is performed. The possibility exists that a tacky mat could be touched with gloved hands prior to handling the uncured NBR. Tests were requested to determine if NBR was accidentally touched would there be any degradation of the liner/NBR bond.

Objective
These tests were conducted to determine the bond strength of liner to NBR after direct or indirect contact with a tacky mat.

Conclusions
No liner/NBR bond strength degradation was noted on samples contacted with the tacky mat.

Discussion
All peel and adhesion samples were liner failure (Table I). Peel values varied from 24.5 to 27.2 lb/in. and adhesion values varied from 175 to 187 psi.

Technical
1. Uncured NBR (7232-0268) was placed on a table and a tacky mat placed on top of it. A roller was used to provide a good contact the tacky mat and NBR.

2. Clean vinyl gloves were placed on a tacky mat and then placed on the NBR several times.
Attachment I. Liner/NBR Test Results (Continued)

3. The treated NBR and a control piece were all vulcanized using Dacron cloth on the treated surface.

4. The Dacron cloth was removed from the NBR and discs cut out and bonded to steel adhesion discs. NBR strips were cut and bonded to steel peel strips.

5. STWS-3224 (296447) was vacuum mixed and used to bond the samples together using 60-mil glue lines.

6. Adhesion samples were tested at 0.5 in./min and 180 degree peel samples at 12.0 in./min.

R. A. Madsen
Attachment I. Liner/NBR Test Results (Continued)

<table>
<thead>
<tr>
<th>NBR Surface Treatment</th>
<th>180° Peel (lb/in.)</th>
<th>Adhesion (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>27.2</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>26.6</td>
<td>177</td>
</tr>
<tr>
<td></td>
<td>27.0</td>
<td>174</td>
</tr>
<tr>
<td></td>
<td>27.5</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td>27.2</td>
<td>177</td>
</tr>
<tr>
<td></td>
<td>27.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>27.2</td>
<td>134</td>
</tr>
<tr>
<td>Tacky mat directly on NBR - then removed</td>
<td>28.4</td>
<td>188</td>
</tr>
<tr>
<td></td>
<td>26.2</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>27.0</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>27.1</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td>27.1</td>
<td>186</td>
</tr>
<tr>
<td></td>
<td>27.0</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>27.1</td>
<td>175</td>
</tr>
<tr>
<td>Gloves on tacky mat - then gloves on NBR</td>
<td>25.1</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>24.2</td>
<td>196</td>
</tr>
<tr>
<td></td>
<td>24.1</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>24.3</td>
<td>182</td>
</tr>
<tr>
<td></td>
<td>24.2</td>
<td>184</td>
</tr>
<tr>
<td></td>
<td>25.5</td>
<td>207</td>
</tr>
<tr>
<td></td>
<td>24.3</td>
<td>187</td>
</tr>
</tbody>
</table>

All samples were liner failure