FINAL REPORT

on

ASBESTOS ENCAPSULANT EVALUATION

to
"SERPIFLEX"

INTERNATIONAL PROTECTIVE COATINGS, CORP.
1915 Hwy. 35
OCEAN, NEW JERSEY 07712

from

BATTELLE
Columbus Laboratories

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INTRODUCTION

International Protective Coatings, Corporation has acquired manufacturing and distribution rights for an asbestos encapsulant "Serpiflex" which is currently being marketed in Europe. I.P.C. Corporation would like to market this product in the United States for a similar purpose. Formulation modifications were made to increase the fire resistant properties of the original encapsulant. This report covers the second modification of the encapsulant which was received late August 1983.

PROGRAM OBJECTIVES AND APPROACH

The purpose of this research program was to determine if the Serpiflex properties meet or exceed the requirements established

for an acceptable encapsulant during the U. S. Environmental Protection Agency program on asbestos encapsulants.

OBJECTIVES

The objectives of the program were to:

(1) Evaluate the fire resistance, smoke generation and toxic gas release properties of the modified Serpiflex.

(2) Determine if the modified Serpiflex could be used as a penetrating encapsulant when reduced fifty percent with water.

RESEARCH APPROACH

The modified bridging encapsulant was received at Battelle near the end of August 1983. This material was the second modification received from Serpib and is the encapsulant discussed in this report. The encapsulant was applied, using an airless spray gun, at a ratio of 1.4 kg/m2 (0.8 lb/ft^2) to the 1.22 x 1.22 meter (4 x 4 foot) test matrix. The encapsulant was allowed to cure for seven days before sectioning the panel into specimens for the fire resistance and smoke generation evaluations. The toxic gas release was determined by measuring the smoke from the smoke chamber.

Another test matrix was coated with the Serpiflex reduced 50 percent with water. The reduced encapsulant was applied at a rate of 1.24 kg/m^2 (0.24 lb/ft^2).

RESULTS AND DISCUSSIONS

The Serpiflex encapsulant modification number 2 passed the fire resistance evaluation with a flame spread index of 20, qualifying it as a class "A" material, the material's flame spread index should range from 0 to 25. The lower the number, the better the flame spread resistance.

Smoke generation was determined by igniting the sample of encapsulant to be evaluated in a closed smoke chamber and then

measuring the change in percent of light transmitted between a light source and a photoelectric cell as a result of the smoke generated while burning. The test specimen is mounted at a 45 degree angle and ignited at the lower corner. Two methods of ignition are used to evaluate the amount of smoke generated: (1) a flame at approximately 880C (1600F)and (2) a glow wire heated to the same temperature using an electric current.

The modified Serpiflex number 2 (two coat application) exhibited a maximum of 41 percent smoke in the flame mode and 18 percent in the glow wire mode. The allowable level is a maximum of 50 percent in either the flame mode or glow wire mode.

To evaluate the toxic gas generation, samples of the smoke were withdrawn from the smoke chamber and analyzed. Any encapsulant exceeding the recommended levels given by the National Academy of Science is considered unsatisfactory. The gasses analyzed and the danger levels are listed below along with the results of the evaluation of the Serpiflex encapsulant.

Gas	Danger Level	Serpiflex
CO	0.1-0.2 percent	0.1 percent
$NO + NO_2$	100-200 ppm	20 ppm
HCL	1000-2000 ppm	4-8 ppm
HCN	100-200 ppm	2-10 ppm

The encapsulant is well below the danger levels and, therefore, would be considered to have passed this requirement.

There is no standard method of evaluating the amount of surface dusting. The method used for the evaluation is judgmental and consisted of brushing the encapsulated surface by hand and visually observing whether or not any material was being brushed loose. No dusting was observed from the Serpiflex encapsulant from either the full strength or reduced (50 percent with water) application. It can be concluded from this subjective evaluation that the encapsulant has sufficient surface integrity to meet the requirements of a satisfactory encapsulant.

Direct impact measurements were made (1) on the uncoated test matrix to establish a base line, (2) on the encapsulated (full strength) matrix to determine the increase in impact resistance and (3) on the encapsulant diluted 50 percent with water. The impact measurements were made using a modification of the Gardner impact tester. The modification consisted of removing both the sample holder and the anvil. The material to be evaluated was then placed directly under the dropping load. The data are recorded in inch-pounds required for the dropping load to penetrate 1.3 cm (0.5 inch) into the test specimen. Impact strength of an encapsulant was considered acceptable if it increased the load required to penetrate 1.3 cm (0.05 inch) by 50 to 100 percent over the untreated test matrix. The untreated test matrix could only withstand 6 to 10 inch-pounds whereas the full strength encapsulant required 43 inch-pounds to penetrate and the diluted encapsulant required 27 inch-pounds. It was concluded from these studies that both the undiluted and diluted encapsulants exhibited sufficient improvement in impact strength of the test matrix to satisfy the requirements established during the E.P.A. program.

A sample of the treated (encapsulated) mineral wood matrix was observed at 1000 x magnification to determine if the individual fibers were wet by the encapsulant. These observations were made using polarized light. The results of the observations showed that improved wetting of the individual fibers was accomplished using the diluted Serpiflex. The full strength encapsulant tended to bond clumps of fibers together without completely wetting the individual fibers. This does not appear to be a major defect since it was extremely difficult to separate individual fibers from the clump.

The adhesive/cohesive strength of the encapsulant to the test matrix was measured. The test procedure was to mount a 4-inch diameter metal cap (from gallon jars) to the uncoated test matrix and also to the encapsulated matrix. The cap was affixed using a two-component urethane foam. After the foam had cured, weights were hung from the hook mounted in the center of the matrix until delamination or separation occurred. Separation of the untreated

test matrix occurred with 1.8 kg (4 pounds) applied. The Serpiflex (full strength) required 3.2 kg (7 pounds) of weight before delamination occurred. The diluted Serpiflex separated after 3.8 kg (8.4 pounds). The modes of failure were different for the full strength and diluted Serpiflex. As noted the full strength material delaminated from the surface of the test matrix, whereas the separation of the diluted Serpiflex occurred inside.

The Serpiflex encapsulant was evaluated to see if it would serve as a penetrating encapsulant when reduced 50 percent by volume with water. Immediately after application two core samples were taken and analyzed for the amount of penetration of the wet encapsulant. Observations showed complete wetting of the matrix through to the substrate (5 cm). This complete wetting of the matrix is common in many cases and is generally the result of improved water penetration due to the surfactants used to manufacture the encapsulant. An additional four core samples were removed from each section after the encapsulant had cured for 7 days. These core samples were placed in individual vials and the vials filled with water. Two core samples were removed after 4 hours and the other two after 24 hours. The thickness of the core that was still intact was considered to be the degree of penetration.

It was observed that the diluted encapsulant had bonded 1.3 cm (9.5 inch) to 1.6 cm (0.63 inch) of the mineral wool. Based on this observation it was concluded that the diluted encapsulant meet the requirements of a penetrating encapsulant.

CONCLUSIONS

Based on the above evaluations, it has been concluded that the modified Serpiflex number 2 meets or exceeds the established minimum requirements from an acceptable encapsulant. Further, it was concluded that, when reduced 50 percent by volume, the Serpiflex encapsulant would serve as a penetrating encapsulant.

The table is divided into twelve columns; a brief explanation of each column is given below.

1) indicates whether the encapsulant was classified by Battelle as a bridging encapsulant (B) or a penetrating encapsulant (P).

2) shows the brand name of the encapsulant. The number in parentheses after the name is the code number given to the encapsulant by Battelle.

3) shows the name, address, and telephone number of the encapsulant's manufacturer.

4) shows the viscosity of the encapsulant in centipoises as measured by Attelle.

5) shows the encapsulant's percent solid content by weight as determined by Battelle.

6) shows the penetration in inches achieved by the encapsulant when it was applied by airless spray to the mineral wool test matrix.

7) and 8) show the minimum and maximum impact resistance of the encapsulated test matrix, measured in inch-pounds. For this test, the sample holder and anvil were removed from a Gardner impact tester, and a small block of encapsulated mineral wool was placed directly under the dropping load. The figures in columns 7 and 8 show the minimum and maximum number of inch-pounds required to penetrate 0.5 inches into the encapsulated test block.

9) indicated the amount of smoke generated when the encapsulated matrix was subjected to an open flame. In this test, a flame of approximately 1500°F was applied to the lower edge of a specimen of encapsulated mineral wool for ten minutes. The density of the resultant smoke was measured with a General Electric CR7505 Smoke Density Indicator. The number given in the table shows the percent opacity caused by the smoke which the burning test matrix generated; the higher the percentage the greater the generation of smoke.

10) also indicates the amount of smoke generated by a specimen of the encapsulated mineral wool. In this test, however, a heated electrical coil of approximately 1000°F, rather than an open flame, was applied to the sample for ten minutes. The density of the resultant smoke was measured in the same manner as in the test described in #9.

11) shows the flame spread index of the encapsulated test matrix as determined by Battelle in a test based on ASTM method E162. A high flame spread index indicates a lower fire resistance classification; the scale runs from 0 to 200, with an index of less than 26 yielding a fire rating of Class "A" and an index between 26+75 yielding a fire rating of Class "B."

12) shows the heat evolved from the test matrix in Battelle's tests for encapsulant flammability, measured in British thermal units per minute per square foot during the test described in #11.

The requirements for a rating of "acceptable"are as follows:

1. A Class "A" fire resistance rating (i.e., a flame spread index of 25 or less); see column 11.

2. A maximum of 50% capacity resulting from smoke generation in the flame smoke generation test, and a maximum of 50% capacity resulting from smoke generation in the glow-wire smoke generation test; see columns 9 and 10.

3. Toxic gas release on burning less than the "possible problem" levels set by the National Academy of Sciences. All products which appear on this list had toxic gas releases well below NAS's "possible problem" levels.

4. Good surface integrity capable either of sealing the fibrous surface (as a bridging encapsulant) or of binding the fibers together by penetrating 0.5 inches or more into the test matrix (as a penetrating encapsulant).

ENCAPSULANTS FOUND TO BE ACCEPTABLE ON THE BASIS OF BATTELLE'S TESTS

1	2	3	4	5	6	7	8	9	10	11	12
P	Serpiflex 101	International Protective Coatings, Corp. 1915 Hwy. 35 Ocean, NJ 07712 201-531-3667	10	21%	.667	43	60%	41%	18%	20	29
B	Serpiflex 102	International Protective Coatings, Corp. 1915 Hwy. 35 Ocean, NJ 07712 201-531-3667	60	48%	.250	43	60%	41%	18%	20	29