UV-0008 #2

855-2307-6214
File: 574.000082
Hydrocarbon Resins

PLAINTIFF'S EXHIBIT
tabbies
UC-796

MEMORANDUM TO: Dr. F. L. Steahly

FROM: E. G. Caflisch

DATE: April 8, 1963

SUBJECT: Hydrocarbon Resins - Visit by Mr. Norman Setter to Discuss Coalinga Asbestos on April 3, 1963.

SUMMARY

Great interest was indicated in the use of light-colored prepolymers as binders for Coalinga asbestos. While four factorially designed samples will be sent at a later date, Mr. Setter asked for and will be sent a single sample as soon as it can be prepared. Equipment is being prepared to test this and the Prepolymer U-311 which has already been sent. A sample of E Cut of Unsaturate Oil will also be sent to Mr. Setter.

DISCUSSION

Mr. Norman Setter of Union Carbide Nuclear Company visited with Dr. F. L. Steahly, Mr. W. B. Lanham, Mr. C. W. Schersten and the author on April 3, 1963. Mr. Setter reported that the sample of Prepolymer U-311[1,2,3,4] had been received and that a roll mill and an extruder were being obtained to enable them to blend and process the mixtures of prepolymer and Coalinga asbestos at elevated temperatures (probably below 100°C.). Mr. Setter was shown a sample of 1 part Prepolymer U-311 and 2 parts Coalinga asbestos, which had been blended for the author on a roll mill and then pressed (about 3,000 psi) to a sheet about 0.06 inch thick (both operations at room temperature). He suggested that flexural strength tests, from which the modulus of elasticity could be calculated, would be the most meaningful tests on samples of this material after they had been cured under various conditions. Notched- and unnotched-Izod impact tests would give additional information. Mr. Setter was not sure whether the asbestos served any purpose other than as a filler in the pipe they make.

Sufficient work had not been done at Tuxedo to indicate that the viscosity of the Prepolymer U-311 is too high; however, it was suggested that E Cut of Unsaturate Oil (U-300) might be used in place of the prepolymer if a lower viscosity is desirable. A lower initial curing temperature would probably be required because of the lower nonvolatiles content. A five-gallon sample of E Cut will be sent to Tuxedo for testing.

Mr. Setter indicated great interest in the light-colored prepolymers, of which four one-gallon samples are to be sent to Tuxedo. These might be used for low-cost light-colored asbestos building materials. While additional work will be required before the factorially designed set of four samples can be prepared, the interest warrants the shipment of a single sample as soon as it can be prepared during the next few weeks.

A market survey by Mr. Setter on the use of asbestos in building materials is under way. Eleven sheets of information which he had collected

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[1]Memorandum, February 18, 1963.
[2]Letter to Mr. H. F. Reichard, February 19, 1963.
[3]Memorandum, February 19, 1963.
[4]Memorandum March 7, 1963.

are attached to the file copies of this memorandum. The deposit of Coalinga asbestos has an area of 17 square miles and appears to be over 1,000 feet thick . At the present world consumption of asbestos this would be a 400-year supply. The structure of asbestos was briefly discussed. Dr. Steahly suggested that Mr. Setter present a seminar on asbestos during his next visit to Charleston.

EGC:smr

cc: Mr. B. M. Fonville
Mr. G. W. Harris
Mr. R. S. Hovey
Mr. R. G. Keister
Mr. W. B. Lanham
Dr. J. V. Murray, Jr.
Mr. S. E. Parrish
Mr. R. J. Rasmussen
Mr. R. L. Readshaw
Mr. J. B. Reid
Mr. C. W. Schersten
Mr. C. H. Shields
Mr. J. J. Toslosky
Mr. G. A. Trigaux
Mr. D. R. Vredeveld

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PIPE MARKET SURVEY

Type of Pipe	1958 Data: Value of Shipments ($1000)	1958 Data: Quant of Shipments (Tons)	Unit Values: $/ton	Unit Values: ¢/lb.	1960 Data: Value of Shipments ($1000)	1960 Data: Quant. of Shipments (Tons)	1961 Data: Value of Shipments ($1000)	1961 Data: Quant. of Shipments (Tons)
Asbestos Cement Pipe, conduit, ducts; includes pressure pipe	69,750	366,305	190	9.5				
Vitrified Clay Sewer pipe and fittings	86,900	1,723,503	50	2.5	94,800	1,854,000	89,600	1,737,000
Cast Iron Soil pipe and fittings	119,768	789,000	152	7.6	127,705	782,000	135,515	834,000
Carbon Steel Pipe and tubing all types	1,382,694	6,627,000	208.7	10.4	1,774,306		1,822,000	
Plastic								
Polyethylene	21,273	19,600	1085	54				22,560
PVC Type I) Type II)								7,500
Styrene-Rubber								7,500
ABS								6,000
Butyrate								500
Polypropylene								N.A.
Polyacetals								(est.) 800
Reinforced Thermosets							1961	N.A.
Pipes, Tanks, Ducts							est. 1962	3,250

STRUCTURAL MATERIALS MARKET SURVEY

Type	Unit of Measure	1958 Data: Value of Shipments ($1000)	1958 Data: Quant. of Shipments	1958 Data: Unit Value ¢/ft.^{2}	1960 Data: Value of Shipments ($1000)	1960 Data: Quant. of Shipments	1961 Data: Value of Shipments ($1000)	1961 Data: Quant. of Shipments
Cement-Asbestos:								
Siding Shingles and Clapboard	1,000 squares	45,636	4,208	10.8	45,453		38,433	
Roofing Shingles	" "	4,566	325	13.8				
Flatsheets and Wallboard (1/4" thk. basis)	1,000 sq. ft.	15,916	84,720	18.9				
Corrugated Sheets (1/4" thk. basis)	" " "	4,291	19,869	21.5				
Sheet Metal:								
Roofing, siding and drainage		185,775			231,302		232,145	
Wood:								
Particle Board		17,345						
Softwood Plywood		450,000						
Hardwood plywood		146,000						
Hard Pressed Wood Fiberboard		78,331			88,043		97,290	
Asphalt:								
Roofing and siding		317,437			328,325		334,907	
Floor Tile		77,000			71,705		70,299	
Plastic:								
Vinyl-Asbestos Floor Tile		66,591			99,784		102,582	
Panels and Laminates	tons							41,500

Product Image - UCNC F-100 General Service Pipe

Present F-100 Product Characteristics

The following measurements were obtained on pipe samples -- 3-1/2" I.D. x 0.325" wall:

Lengthwise flexural (psi)	11,000
Lengthwise flexural modulus (psi)	2.5×10^6
Crushing Strength (lbs/ft)	2,300
Crushing Modulus (psi)	$0.9 - 1.0 \times 10^6$
Rupture (instant burst)(psi)	500
Falling Ball Impact (ft. lbs)	5-6

The following measurements were made on 1/8" thick sheet stock:

Flexural Strength (psi)	12,000
Flexural Modulus (psi)	2×10^6
Izod Impact (ft. lbs/in. of notch)	0.6 to 0.8
Heat Distortion (264 psi)	Nil to 500° F
Coefficient of Linear Thermal Expansion	1.05×10^{-5} (-30° C to 60° C)

For an in-service test application at UCNC's King City, California asbestos mill several sizes of pipe will be produced with a somewhat thicker wall to radius ratio to obtain a minimum rupture proof pressure of 500 psi.

Specifications for this pipe are as follows:

1. Outside Diameter - To conform to nominal 1-1/2", 2-1/2", and 3-1/2" steel pipe sizes. Tolerances are expected to be ±.010" on the diameter.
2. Length - Random from 10 feet to 15 feet including coupling.
3. Service Pressure - 100 psig to 200° F. A 12" section from each length shipped will receive hydrostatic proof testing to 500 psig.

4. Dimensions: (Approximate).

	1-1/2"	2-1/2"	3-1/2"
Outside Diameter (in.)	1.900	2.875	4.000
Inside Diameter (in.)	1.500	2.275	3.180
Wall Thickness (in.)	0.200	0.300	0.410
Wt. per foot (lbs.)	0.8	1.8	3.6

5. Couplings: - A Victaulic "Roust-a-Bout" coupling will be supplied with each length of pipe shipped. (The coupling-pipe joint will be hydrostatically tested to 500 psig.)

Note: It is obvious from the pipe dimensions specified here crushing strength, shock impact resistance, and instant burst levels are going to be greater than those listed above. Performance in the field will give valuable data on the general utility of the pipe.

Future F-100 Pipe Characteristics

1. Smooth interior and exterior, no machining required for joining.

2. Couplings and fittings to be manufactured from thermoset resins (either phenolic or epoxy) in two design varieties:

   a. "Ulok" type - for non-permanent installations

   b. Cemented -

3. Sizes: 1" to 6" nominal I.D. (outside diameter to conform to steel pipe standards.)

4. Lengths: 20 to 24 feet.

5. Price range: Difficult to assess for now. Pricing on 4-1/8" O.D. conduit from an engineering cost analysis was 39¢/ft. or approximately 13¢/lb. As a good figure now use 15¢/lb.

SOCIETY OF PLASTICS INDUSTRY - PIPE STATISTICS FOR THERMOPLASTICS IN 1961

Polyethylene	45 million lbs.
Type I and II PVC	15 million lbs.
Styrene - Rubber (Drain and Sewer Uses)	15 million lbs.
ABS	12 million lbs.
Butyrate	1+ million lbs.

Anticipated increase for 1962 - 5% across board.

Actual Plastics Pipe and Fittings Sales in 1962 - $65 million.

ASBESTOS - CEMENT PIPE COSTS

Asbestos-Cement Service Pipe

Size	100 PSI Working Pressure $/ft.	Installation Costs, $/ft
3-inch	0.81	0.38
4-inch	0.98	0.39
6-inch	1.48	0.43

Size	150 PSI Working Pressure $/ft.	Installation Costs, $/ft.
3-inch	0.87	0.38
4-inch	1.05	0.40
6-inch	1.63	0.44

Growth Market Potential

Application	Potential Sales million ft/year
Gas Distribution	107
Water Services (Municipal, pool, etc.)	95
Conduit	58.5

Source: Modern Plastics, April, 1961

TRANSITE AND SEWER PIPE

Sewer Pipe

Size I.D.	Wt./Lineal Ft. lbs/ft	Price/Lineal Ft. F.O.B. Delivered	$/Ton Material	Crushing Strength per Lineal Ft.	Approximate Wt./Cu.Ft.
6 in.	10.1	$1.07	212	2400 lbs.	100 lb.
8	14.2	1.42	200	2400 lbs.	100
10	19.9	2.07	208	2400 lbs.	100
12	25.6	2.65	208	2400 lbs.	100
14	32.2	3.35	208	2400 lbs.	100
16	39.4	4.10	208	2400 lbs.	100
18	46.7	4.85	208	2400 lbs.	100
20	54.4	5.65	208	2400 lbs.	100
24	71.3	7.42	208	2400 lbs.	100

150 lbs/sq. in Pressure Pipe
Carload Price - Delivered

3 inc.	8.3	0.86	100 lb.
4	9.9	1.03	100
6	15.3	1.59	100
8	21.0	2.19	100
10	28.9	2.99	100
12	40.5	4.21	100
14	54.0	5.63	100
16	65.6	6.94	100
18		9.29	100
20		11.40	100
24		16.28	100

Source: Letter from A. Q. Lundquist - July 7, 1961

COMPARATIVE COSTS 3-INCH PIPE

(From "Chemical Engineering", 3/25/59, p. 157)

	$/ft.
Plain Carbon Steel (Sch. 40)	1.00
Stainless Steel (Sch. 40)	
304	9.12
316	14.88
Transite (150 PSI)	0.95
Cast Iron (150 PSI)	0.95
Rigid PVC	1.96
ABS Polymer	1.96
Polyethylene (Virgin)	1.28
Aluminum	1.19
Pyrex (0.2" Wall)	4.30
Karbate (0.5" Wall)	8.00
Hard Rubber (0.375" Wall)	4.00
Porcelain	2.90
Rubber Lined Steel	3.32
Haveg	4.92
F-100 Estimated Pricing (150 PSI)	1.00

"POLYURETHANES MOVE IN ON NEW MARKETS"*

Rigid polyurethane foams have a tremendous potential market in the building construction field. These foams have good insulating properties, can be made in large sections, have good heat and solvent resistance, and can be installed in the form of boards, poured in place, or sprayed.

Unfortunately the relatively high (16-20 cents/bd ft) cost of urethane foams prohibit their wide application in place of polystyrene (9-11 cents/bd ft) or nonplastic materials (as low as 2 cents/bd ft). If this disadvantage could be overcome, a 635 million board feet market is immediately available.

POTENTIAL MARKETS FOR RIGID BOARD INSULATION IN CONSTRUCTION

	Now (Millions of Board Feet)	1966 (Millions of Board Feet)
Low Temperature Space Insulation	200	300
Pipe and Equipment Covering	50	100
Cavity Wall and Insualtion, Plasterbase	60	200
Perimeter and Floor Slab Insulation	40	70
Roof Insulation	200	600
Backerboard for Metal Siding	40	180
Nonresidential Panels	20	125
Residential Panels	Nil	125
Panels for Low Temperature Space Insulation	Nil	150
Thin Shell Construction	Nil	50
Floating Structures	25	80
Miscellaneous	Nil	20
	635	2000

* Chemical and Engineering News, April 3, 1961

CONSUMPTION OF PLASTICS IN CONSTRUCTION

End Use	1961 (1000 lb.)	Increase over 1959 (%)
Flooring	372,000	3
Surface coatings	398,000	6
Adhesives	142,000	8
Electrical Equipment (Mainly insulation)	237,000	14
Molded Specialties (Wall tiles, fixtures)	74,000	19
Panels and laminates	83,000	38
Moisture barrier, thermal and moisture barrier, sealing compounds	141,000	53
Piping	75,000	103

Source: Modern Plastics, January, 1963

NEW NON-FARM HOUSING UNITS STARTED

(1000's)

Year	Area		Type of Structure			Total
	Metropolitan	Non Metropolitan	One-Family	Two-Family	Multi-Family	
1958	827	382	975	39	195	1209
1959*	1076	455	1229	59	244	1531
1960*	888	386	987	51	237	1274
1961*	936	391	952	50	325	1327

* Includes Alaska and Hawaii.

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