TAPE JOINT CEMENTS

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1978 SALES TRAINING PROGRAM

TRADE FINISHES

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TAPE JOINT CEMENTS

Wide usage of gypsum wallboard in the building industry necessitates a large amount of material to cover and provide a smooth surface over wallboard joints and nailhead indentations. Tape joint cements (TJC) are low-cost compositions formulated to fill this need and to meet other necessary economic and performance properties required by modern building methods. Tape joint cements are supplied as a ready-mix or as a dry powder which is mixed with water at the construction site. The convenient ready-mix eliminates many construction site problems caused by mixing water into dry mix formulations. As a result, ready-mix usage has grown rapidly at the expense of dry mix compositions.

Ready-mix joint cements are highly filled compositions generally consisting of blends of a calcium carbonate filler, a clay filler, a platy filler such as mica, a polyvinylacetate latex binder, a water-soluble cellulosic thickener, and various minor ingredients such as preservatives, freeze-thaw agents, and dispersing aids. The fillers contribute over 90 percent by weight of the solids in the formulation with calcium carbonate forming the largest part of the filler mix. Latex solids contribute approximately 3.0 to 5.0 percent by weight of the solids. Cellulosic thickeners are vital to performance properties but contribute less than one-half percent by weight to the solids. Water content, which depends on the choice of fillers, thickener,

and the necessary application viscosity, varies from 25 to 35 percent by weight of the finished ready-mix.

The tape joint cement market is highly competitive and extremely cost conscious. The major raw material costs in ready-mix are the latex binder, the cellulosic thickener, and the various additives. As a result, raw material suppliers are under competitive pressure to reduce costs of these materials.

Union Carbide currently supplies polyvinylacetate latex and cellulosic thickeners to TJC manufacturers. Several CELLOSIZE thickeners are suitable for use in TJC manufacture with CELLOSIZE TJC-500 especially designed for this area. UCAR 131 currently enjoys the position as the dominant latex binder in the ready-mix market. However, this position is constantly being threatened by new competitive binders.

TAPE JOINT CEMENT

PROPERTY REQUIREMENTS

LOW COST

WORKABILITY

LOW SHRINKAGE

CRACK RESISTANCE

SUFFICIENT OPEN TIME

ADHESION UNDER A VARIETY OF CONDITIONS

SAG RESISTANCE

TJC FORMULATION

INGREDIENTS	PARTS BY WEIGHT	RMC
WATER	27.25	0.000
ETHYLENE GLYCOL	.35	.091
"CELLOSIZE" QP-52M	.42	.672
AMMONIUM HYDROXIDE	.07	.006
"UCAR" 131	4.89	1.027
DOWICIL 75	.07	.105
DAXAD 30	.56	.196
LIMESTONE	60.80	.638
TALC	3.49	.061
MICA	2.10	.099
	100.00	2.895

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TAPE JOINT CEMENT INTERMEDIATES

TPX-6307

"UCAR" 134

"UCAR" 131

"UCAR" 130

"CELLOSIZE" TJC-500

"CELLOSIZE" QP-4400

"CELLOSIZE" QP-15,000

"CELLOSIZE" QP-52,000

"CELLOSIZE" QP-100,000

PROPYLENE GLYCOL

ETHYLENE GLYCOL

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TAPE JOINT CEMENT

COMPETITIVE BINDERS

LATEX	₱	COMPOSITION
AIRFLEX 527BP	55	ETHYLENE - VINYL ACETATE
AIRFLEX 526BP	55	ETHYLENE - VINYL ACETATE
AMSCO 4104	49.7	STYRENE - BUTADIENE
ELVACE 1875	55	ETHYLENE - VINYL ACETATE
PLYAMUL 40-375	58	PLASTICIZED VA
PLYAMUL 40-376	60	PLASTICIZED VA

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TAPE JOINT CEMENT

COMPETITIVE THICKENERS

METHOCEL J75MS

METHOCEL 228

NATROSOL 250H

TYPICAL PROPERTIES OF TPX-6307 (a)

Total Solids	59.0%
pH	5.5
Viscosity (b)	4000 cps
Minimum Filming Temperature	1.5°C
Glass Transition (T_g)	8°C
Weight Per Gallon of Latex	9.2 lbs.
Reaction to Borax	Stable
Reaction to Heavy Metallic Ions	Coagulates

(a) Should not be regarded as specifications.

(b) 60 RPM, Brookfield.

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TYPICAL PROPERTIES OF "UCAR" 134

TOTAL SOLIDS	59.8%
VISCOSITY	490 CPS
pH	5.0
MINIMUM FILMING TEMPERATURE	15.5°C
GLASS TRANSITION	15°C
WEIGHT PER GALLON OF LATEX	9.2
REACTION TO BORAX	STABLE
REACTION TO HEAVY METAL IONS	STABLE

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TJC FORMULATION 2-WDM-29

Ingredients	Parts by Weight
Water	455.0
Ethylene Glycol	15.0
Ammonium Hydroxide	2.0
Dowicil 75	1.0
Latex (a)	89.5
Daxad 30	10.0
Limestone #9 White	780.0
Mica P-80-F	175.0
ASP-400	80.0
Attagel 40	10.0

(a) Latex weight adjusted to provide equal latex solids in each formulation.

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PERFORMANCE PROPERTIES IN TJC FORMULATION 2-WDM-29

Latex	% S	Viscosity[a]	Workability[b]	R.T. Adhesion	Crack Resistance
TPC-6307	68.0	520	8	62%	93%
UCAR 131	68.3	540	8	96%	95%
UCAR 134	68.2	550	8	81%	100%
14-TRS-71[c]	67.4	510	8	78%	88%

(a) Brabender Units, 80 rpm.

(b) Rating Scale 1-10 with 10 an excellent rating.

(c) Laboratory run of TPX-6307.

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TJC FORMULATION 7-WDM-78

Ingredients	Parts by Weight
Water	370.0
Ethylene Glycol	5.0
QP-52,000	6.0
Ammonium Hydroxide	1.0
Dowicil 75	1.0
Latex (a)	70.0
Daxad 30	8.0
Limestone #9 White	810.0
Talc T-50	100.0
ASP-400	40.0

(a) Latex weight adjusted to give equal latex solids in each formulation.

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PERFORMANCE PROPERTIES IN TJC FORMULATION 7-WDM-78

Latex	% S	Viscosity	Workability	R.T. Adhesion	Crack Resistance
UCAR 131	70.8	540	9	97%	74%
UCAR 134	70.8	540	9	90%	77%
TPX-6307	70.7	545	9	81%	82%
Dupont JCM	70.3	560	9	96%	74%
Airflex 526BP	70.1	560	9	93%	90%

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TAPE JOINT CEMENT

FORMULATION STUDY

SUMMARY

Ingredients used in manufacture of tape joint cement were evaluated in several asbestos-free formulations. An experimental design with talc, mica, and clay levels and CELLOSIZE thickener types as variables was used to minimize the number of formulations made and tested.

The variables chosen provide a possible 81 formulations of which nine were made and evaluated. Data analysis establishes an order of influence for each variable on measured performance properties. For example, room temperature adhesion decreases with increasing talc content; crack resistance and workability improve with increasing talc content.

This approach allows selection of ingredient levels within the design limits which maximizes any desired performance property.

Formulations were based on total solids. Latex solids were set at 4.2%, thickener solids at 0.6%, and dispersant solids at 0.2%. Talc, mica, and clay percent solids and thickener type were varied according to the design. Limestone solids varied with each formulation so that solids persent totaled 100. Initial volatiles were adjusted to produce 70% total solids. If the initial viscosity was greater than 550 B.U., water was added to bring viscosity to 500-550 B.U.

EXPERIMENTAL DESIGN

VARIABLES	VARIABLE LEVELS AND DESIGNATION		
TALC T-50	T_1, 5%	T_2, 10%	T_3, 15%
MICA P-80-F	M_2, 0%	M_1, 3%	M_3, 6%
CLAY, ASP-400	A_1, 0%	A_2, 2%	A_3, 4%
CELLULOSIC THICKENER			
• QP-52M		C_1	
• TJC-500		C_2	
• QP-52M/QP-100M (1:1)		C_3	

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DESIGN

74 T_1M_1 A_1C_1	75 T_2M_2 A_2C_3	76 T_3M_1 A_3C_2
77 T_1M_2 A_2C_2	78 T_2M_2 A_2C_1	79 T_3M_2 A_1C_3
80 T_1M_3 A_3C_3	81 T_2M_3 A_1C_2	82 T_3M_3 A_2C_1

EXPERIMENTAL DESIGN

	Order of Influence on Property		
R.T. Adhesion	1 (a)	2	3
Talc	T_1	T_2	T_3
Mica	M_2	M_1	M_3
ASP-400	A_2	A_3	A_1
Thickener	C_3	C_1	C_2
Crack Resistance			
Talc	T_3	T_2	T_1
Mica	M_3	M_1	M_2
ASP-400	A_3	A_1	A_2
Thickener	C_1	C_2	C_3
Workability			
Talc	T_3	T_2	T_1
Mica	M_1	M_3	M_2
ASP-400	A_3	A_1	A_2
Thickener	C_3	C_1	C_2

(a) Variables in Column 1 have the largest influence on measured properties.

SUMMARY OF TJC FORMULATION PROPERTIES

Formulation	Viscosity[a]	% F	% R.T. Adhesion	% Crack Resistance[b]	Workability[c]
7-WDM-74	500	69.9	52	79	8.5
-75	545	69.6	62	80	9.5
-76	525	69.6	20	91	9.5-
-77	340	69.9	70	66	6
-78	460	69.9	58	80	9-
-79	520	69.6	30	77	9
-80	510	69.0	48	78	9.5-
-81	520	69.6	18	89	8.5
-82	530	68.2	25	91	9.5

a. Brabender Units, Pin Style A, 80 rpm

b. 100% Crack Resistance indicates no cracking.

c. Rated from 1-10 with 10 indicating excellent workability.

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TJC FORMULATION 7WDM74

Ingredients	Pounds	Gallons
Water	390.0	46.82
Ethylene Glycol	5.0	.54
QP-52M	6.0	.55
NH_4OH	1.0	.12
UCAR 131	70.0	7.61
Dowicil 75	1.0	.10
Daxad 30	8.0	.84
Limestone # 9	870.0	38.67
Talc T-50	50.0	2.22
Mica P-80-F	30.0	1.29
ASP-400	0.0	0.0
	1431.0	98.76

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TJC FORMULATION 7WDM75

Ingredients	Pounds	Gallons
Water	395.0	47.42
Ethylene Glycol	5.0	.54
QP-52M/QP-100M	6.0	.55
NH_4OH	1.0	.12
UCAR 131	70.0	7.61
Dowicil 75	1.0	.10
Daxad 30	8.0	.84
Limestone # 9	800.0	35.56
Talc T-50	100.0	4.44
Mica P-80-F	30.0	1.29
ASP-400	20.0	.93
	1436.0	99.40

A23425

TJC FORMULATION 7WDM76

Ingredients	Pounds	Gallons
Water	395.0	47.42
Ethylene Glycol	5.0	.54
TJC-500	6.0	.55
NH_4OH	1.0	.12
UCAR 131	70.0	8.61
Dowicil 75	1.0	.10
Daxad 30	8.0	.84
Limestone # 9	730.0	32.44
Talc T-50	150.0	6.67
Mica P-80-F	30.0	1.29
ASP-400	40.0	1.86
	1436.0	99.44

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TJC FORMULATION 7WDM77

Ingredients	Pounds	Gallons
Water	390.0	46.82
Ethylene Glycol	5.0	.54
TJC-500	6.0	.55
NH_4OH	1.0	.12
UCAR 131	70.0	7.61
Dowicil 75	1.0	.10
Daxad 30	8.0	.84
Limestone # 9	880.0	39.11
Talc T-50	50.0	2.22
Mica P-80-F	0.0	0.00
ASP-400	20.0	.93
	1431.0	98.84

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TJC FORMULATION 7WDM78

Ingredients	Pounds	Gallons
Water	390.0	46.82
Ethylene Glycol	5.0	.54
QP-52M	6.0	.55
NH_4OH	1.0	.12
UCAR 131	70.0	7.61
Dowicil 75	1.0	.10
Daxad 30	8.0	.84
Limestone # 9	810.0	36.00
Talc T-50	100.0	4.44
Mica P-80-F	0.0	0.00
ASP-400	40.0	1.86
	1431.0	98.88

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TJC FORMULATION 7WDM79

Ingredients	Pounds	Gallons
Water	395.0	47.42
Ethylene Glycol	5.0	.54
QP-52M/QP-100M	6.0	.55
NH_4OH	1.0	.12
UCAR 131	70.0	7.61
Dowicil 75	1.0	.10
Daxad 30	8.0	.84
Limestone # 9	800.0	35.56
Talc T-50	150.0	6.67
Mica P-80-F	0.0	0.00
ASP-400	0.0	0.00
	1436.0	99.41

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TJC FORMULATION 7WDM80

Ingredients	Pounds	Gallons
Water	408.0	48.98
Ethylene Glycol	5.0	.54
QP-52M/QP-100M	6.0	.55
NH_4OH	1.0	.12
UCAR 131	70.0	7.61
Dowicil 75	1.0	.10
Daxad 30	8.0	.84
Limestone # 9	800.0	35.56
Talc T-50	50.0	2.22
Mica P-80-F	60.0	2.57
ASP-400	40.0	1.86
	1449.0	100.95

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TJC FORMULATION 7WDM81

Ingredients	Pounds	Gallons
Water	395.0	47.42
Ethylene Glycol	5.0	.54
TJC-500	6.0	.55
NH_4OH	1.0	.12
UCAR 131	70.0	7.61
Dowicil 75	1.0	.10
Daxad 30	8.0	.84
Limestone # 9	790.0	35.11
Talc T-50	100.0	4.44
Mica P-80-F	60.0	2.57
ASP-400	0.0	0.00
	1436.0	99.30

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TJC FORMULATION 7WDM82

Ingredients	Pounds	Gallons
Water	425.0	51.02
Ethylene Glycol	5.0	.54
QP-52M	6.0	.55
NH_4OH	1.0	.12
UCAR 131	70.0	7.61
Dowicil 75	1.0	.10
Daxad 30	8.0	.84
Limestone # 9	720.0	32.00
Talc T-50	150.0	6.67
Mica P-80-F	60.0	2.57
ASP-400	20.0	0.93
	1466.0	102.95

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