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VANDERBILT Minerals Laboratory Report

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TITLE: **VANSIL® W-30** Wollastonite for TiO_2 Spacing in an Interior Latex Flat Paint

INTRODUCTION: Various levels of **VANSIL W-30,** a 4 Hegman fineness platy talc or blends of the two minerals were tested as TiO_2 spacers in an interior latex flat paint formula. 50/50 blends were found to maximize the positive aspects of each mineral and minimize the negative ones.

DISCUSSION and RESULTS: Every inert filler brings a unique set of properties to the coatings to which it is added. Talc is known to be an effective TiO_2 spacer in latex paints, but because of its softness, talc-filled paint can have low scrub resistance. Wollastonite, being significantly harder than talc, contributes to improved scrub resistance, but optical properties may suffer. The NYTAL® products have been found over the years to offer the best of both worlds because of their unique multi-morphous mix of hard and soft minerals. With regard to the replacement of NYTAL products,
Vanderbilt Minerals, LLC has recommended the blending of talc and wollastonite to somewhat replicate this multi-morphous mineral mix. In the current study, a series of interior latex flat paints was prepared with various amounts of **VANSIL W-30** or a 4 Hegman fineness platy talc, such as Talcron 35 LOA from Specialty Minerals, Inc., or 50/50 blends of each. For each paint type, three levels of TiO_2 and inert filler were employed. The trials were as follows:

Formula Number	TRIAL Number	Gallons TiO_2	Gallons VANSIL W-30	Gallons Talcron® 35 LOA talc
112908 A	I	3.8	0.0	7.8
112908 B	II	3.0	0.0	8.6
112908 C	III	2.3	0.0	9.2
112908 D	IV	3.8	7.8	0.0
112908 E	V	3.0	8.6	0.0
112908 F	VI	2.3	9.2	0.0
112908 G	VII	3.8	3.9	3.9
112908 H	VIII	3.0	4.3	4.3
112908 I	IX	2.3	4.6	4.6

See Table 1 for the formulas as run.

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The paints were tested for viscosity, Hegman fineness, dry brightness, L a b color, gloss, opacity, scrub resistance and ASTM Hiding Power. The results are given in Tables 2 and 3 and the accompanying graphs. As anticipated, blending the two minerals took advantage of the strong points of each mineral and minimized the weaknesses. The following observations were made:

1) Hegman fineness: All paints were at 5.
2) Viscosity: Paints made with Talcron® 35 LOA had lower viscosity than those made with **VANSIL® W-30** Wollastonite. The viscosity of the paints made with blends of both minerals was higher than that of the paints made with each mineral alone. This could be a result of the finer talc particles packing between the larger wollastonite particles.
3) Dry Brightness: The brightness of the paints was not affected by the specific TiO_2 spacer. The quantity of TiO_2 had more effect on the brightness than the particular inert filler. The paints made with blends had a slightly lower brightness than those made with each mineral alone.
4) Gloss: Paints made with **VANSIL W-30** had lower 85° sheen than those made with Talcron 35 LOA. The 85° sheen of paints made with blends was slightly higher than that of paints made with **VANSIL W-30**, but lower than that of paints made with Talcron 35 LOA.
5) Scrub Resistance: Paints made with **VANSIL W-30** had significantly better scrub resistance than those made with Talcron 35 LOA. The scrub resistance of paints made with blends was worse than that of paints made with **VANSIL W-30**, but better than that of paints made with Talcron 35 LOA.
6) ASTM Hiding Power: Paints made with Talcron 35 LOA had higher spreading rates than those made with **VANSIL W-30**. The Hiding Power of paints made with blends was worse than that of paints made with Talcron 35 LOA, but better than that of paints made with **VANSIL W-30**.

These results show that blends of the fillers **VANSIL W-30** and Talcron 35 LOA in an interior latex flat paint can yield the good TiO_2 spacing and hiding power of Talcron 35 LOA and the good low angle sheen and scrub resistance of **VANSIL W-30**.

EXPERIMENTAL: The interior latex flat paints were prepared according to the formulas given in Table 1. The paints were tested for Hegman fineness, Stormer viscosity and Brookfield viscosity. Drawdowns were made onto plain white cards at 8 mil clearance and dried at ambient conditions. G. E. Brightness, L a b color and gloss were measured. Drawdowns were made at 4 mil, 6 mil and 8 mil clearance onto black and white opacity cards and air dried at ambient conditions. Opacity was measured as the ratio of the brightness over the black area to the brightness over the white area. Scrub Resistance was measured according to ASTM D 2486-06 on 8 mil clearance drawdowns. Hiding Power was measured according to ASTM D 2805-96a.

CONCLUSION: This study shows that blends of **VANSIL W-30** and 4 Hegman fineness platy talc such as Talcron 35 LOA can give improved performance to an interior latex flat paint, as compared to either mineral alone.

Table 1

Formula 112908
50 PVC Interior Latex Flat Paint
TiO_2 Spacing Study

		112908 A TRIAL I		112908 B TRIAL II		112908 C TRIAL III		112908 D TRIAL IV		112908 E TRIAL V		112908 F TRIAL VI	
		pounds	gallons	pounds	gallons	pounds	gallons	pounds	gallons	pounds	gallons	pounds	gallons
DISPERSION													
2% Cellosize® QP 4400 [1]		202.0	24.1	202.0	24.1	202.0	24.1	202.0	24.1	202.0	24.1	202.0	24.1
Drewplus® L 475 [2]		2.0	0.3	2.0	0.3	2.0	0.3	2.0	0.3	2.0	0.3	2.0	0.3
DARVAN® 7-N [3]		10.0	1.0	10.0	1.0	10.0	1.0	10.0	1.0	10.0	1.0	10.0	1.0
Triton® CF 10 [1]		2.0	0.2	2.0	0.2	2.0	0.2	2.0	0.2	2.0	0.2	2.0	0.2
Ti-Pure® R 706 [4]		125.0	3.8	100.0	3.0	75.0	2.3	125.0	3.8	100.0	3.0	75.0	2.3
Satintone® W [5]		150.0	6.9	150.0	6.9	150.0	6.9	150.0	6.9	150.0	6.9	150.0	6.9
VANSIL® W-30 [3]		0.0	0.0	0.0	0.0	0.0	0.0	185.0	7.8	205.0	8.6	220.0	9.2
Talcron® 35 LOA talc [6]		185.0	7.8	205.0	8.6	220.0	9.2	0.0	0.0	0.0	0.0	0.0	0.0
Disperse at high speed for 15 minutes. Reduce speed for let down.													
LET DOWN													
Water		80.0	9.6	80.0	9.6	80.0	9.6	80.0	9.6	80.0	9.6	80.0	9.6
Drewplus L 475		2.0	0.2	2.0	0.2	2.0	0.2	2.0	0.2	2.0	0.2	2.0	0.2
UCAR® 300 Latex [7]		315.0	35.5	315.0	35.5	315.0	35.5	315.0	35.5	315.0	35.5	315.0	35.5
Preblend next two items and add:													
Water		80.0	9.6	80.0	9.6	80.0	9.6	80.0	9.6	80.0	9.6	80.0	9.6
Optiflo® H 370 [8]		15.0	1.0	15.0	1.0	15.0	1.0	15.0	1.0	15.0	1.0	15.0	1.0
Mix at slow speed for 10 minutes.													
Totals		1168.0	100.0	1163.0	100.0	1153.0	99.9	1168.0	100.0	1163.0	100.0	1153.0	99.9
PAINT PROPERTIES													
Weight per gallon		11.7		11.6		11.5		11.7		11.6		11.5	
% Solids	by weight	54.6		54.4		54.0		54.6		54.4		54.0	
	by volume	37.2		37.2		37.2		37.2		37.2		37.2	
PVC		50		50		50		50		50		50	
Pigment to binder ratio		2.66:1		2.63:1		2.57:1		2.66:1		2.63:1		2.57:1	
Calculated VOC	lbs/gal	0		0		0		0		0		0	
	g/L	0		0		0		0		0		0	

Raw Material Suppliers

[1] **Dow Chemical Company, Midland,MI**
[2] **Ashland Specialty Chemical Company, Columbus, OH**
[3] **R.T. Vanderbilt Company, Inc., Norwalk, CT**
[4] **E.I. du Pont de Nemours & Company, Wilmington, DE**
[5] **BASF, Florham Park, NJ**
[6] **Specialty Minerals, Inc., Barretts, MT**
[7] **Arkema Emulsion Systems, Cary, NC**
[8] **Southern Clay Products, Austin, TX**

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Table 1 (con't)

Formula 112908

50 PVC Interior Latex Flat Paint

TiO_2 Spacing Study

		112908 G TRIAL VII		112908 H TRIAL VIII		112908 I TRIAL IX	
		pounds	gallons	pounds	gallons	pounds	gallons
DISPERSION							
2% Cellosize® QP 4400		202.0	24.1	202.0	24.1	202.0	24.1
Drewplus® L 475		2.0	0.3	2.0	0.3	2.0	0.3
DARVAN® 7-N		10.0	1.0	10.0	1.0	10.0	1.0
Triton® CF 10		2.0	0.2	2.0	0.2	2.0	0.2
Ti-Pure® R 706		125.0	3.8	100.0	3.0	75.0	2.3
Satintone® W		150.0	6.9	150.0	6.9	150.0	6.9
VANSIL® W-30		94.0	3.9	104.0	4.3	113.0	4.6
Talcron® 35 LOA talc		91.0	3.9	100.0	4.3	108.0	4.6
Disperse at high speed for 15 minutes. Reduce speed for let down..							
LET DOWN							
Water		80.0	9.6	80.0	9.6	80.0	9.6
Drewplus L 475		2.0	0.2	2.0	0.2	2.0	0.2
UCAR® 300 Latex		315.0	35.5	315.0	35.5	315.0	35.5
Preblend next two items and add:							
Water		80.0	9.6	80.0	9.6	80.0	9.6
Optiflo® H 370		15.0	1.0	15.0	1.0	15.0	1.0
Mix at slow speed for 10 minutes.							
Totals		1168.0	100.0	1162.0	100.0	1154.0	99.9
PAINT PROPERTIES							
Weight per gallon		11.7		11.6		11.5	
% Solids	by weight	54.2		54.0		53.6	
	by volume	37.2		37.2		37.2	
PVC		50		50		50	
Pigment to binder ratio		2.66:1		2.62:1		2.58:1	
Calculated VOC	lbs/gal	0		0		0	
	g/L	0		0		0	

Table 2

Formula 112908
50 PVC Interior Latex Flat Paint
TiO_2 Spacing Study

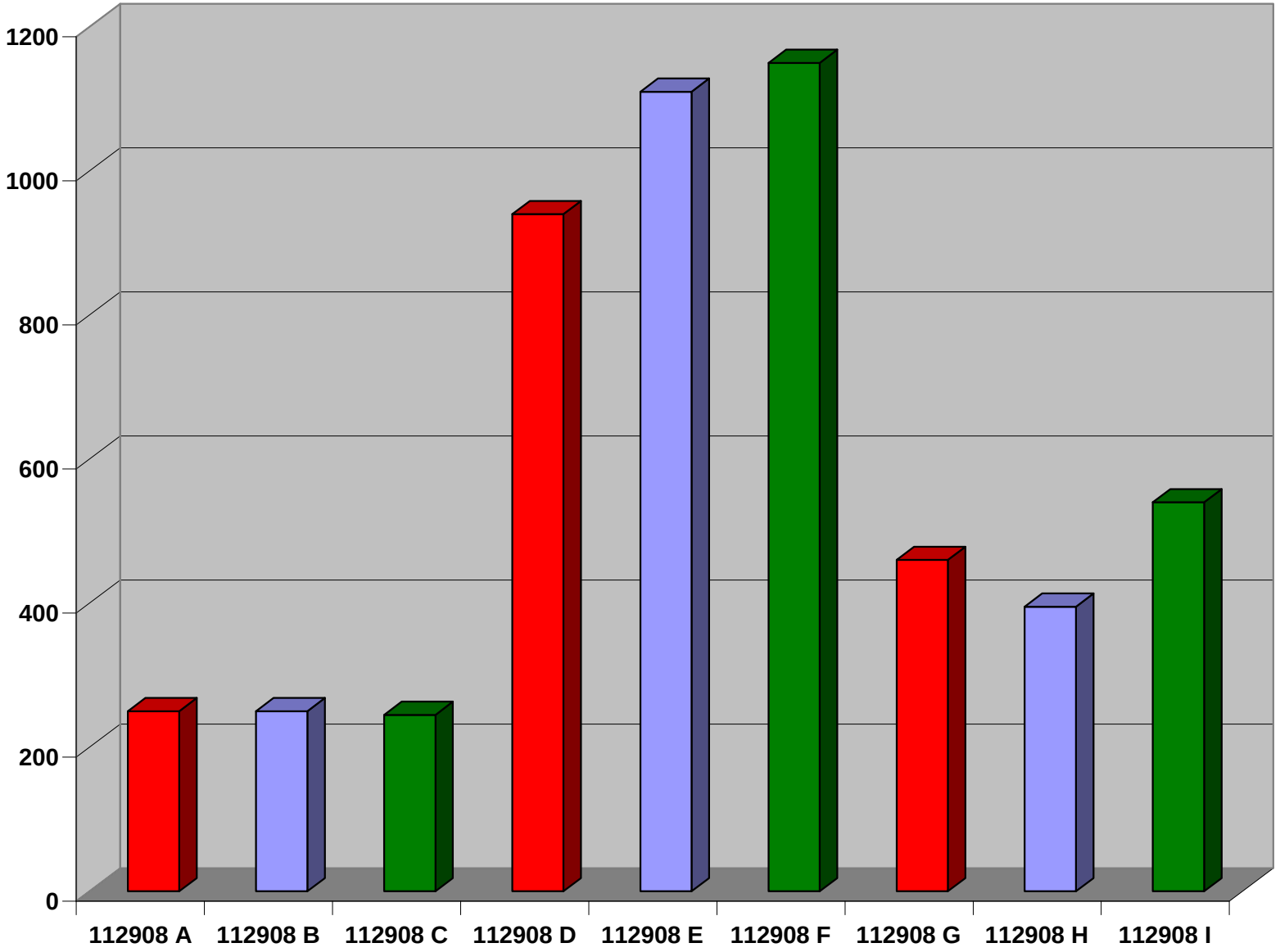
		112908 A TRIAL I	112908 B TRIAL II	112908 C TRIAL III	112908 D TRIAL IV	112908 E TRIAL V	112908 F TRIAL VI	112908 G TRIAL VII	112908 H TRIAL VIII	112908 I TRIAL IX
Gallons TiO_2		3.8	3.0	2.3	3.8	3.0	2.3	3.8	3.0	2.3
Gallons VANSIL® W-30		0.0	0.0	0.0	7.8	8.6	9.3	3.9	4.3	4.6
4 Hegman fineness platy talc		7.8	8.6	9.3	0.0	0.0	0.0	3.9	4.3	4.6
Hegman fineness		5	5	5	5	5	5	5	5	5
KU		99	98	102	106	104	105	108	105	106
Brookfield viscosity										
	10 rpm	8100	7300	8400	10800	10400	10500	12800	111000	12000
	20 rpm	5100	4900	5700	7000	6700	6900	7900	7100	7500
	50 rpm	3100	2900	3500	4000	3900	4000	4500	4100	4300
	100 rpm	2100	2100	2400	2700	2600	2700	3000	2700	2900
G. E. Brightness		89.6	88.7	87.6	89.4	88.5	87.3	88.6	88.6	87.2
L		95.2	94.8	94.3	95.4	95.0	94.5	94.9	94.9	94.3
a		-0.3	-0.4	-0.4	-0.5	-0.5	-0.5	-0.3	-0.3	-0.3
b		1.1	1.2	1.4	1.6	1.8	1.9	1.5	1.5	1.6
ΔE			0.42	0.95		0.45	0.95		0.00	0.61
Gloss	20 ^{o}	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	60 ^{o}	2.6	2.5	2.5	2.3	2.3	2.3	2.4	2.4	2.4
	85 ^{o}	6.1	5.5	4.6	2.8	2.5	2.0	3.7	3.3	3.1
Opacity	4 mil cl	0.958	0.948	0.947	0.961	0.940	0.926	0.953	0.950	0.919
	6 mil cl	0.984	0.981	0.978	0.983	0.974	0.965	0.983	0.972	0.964
	8 mil cl	0.995	0.993	0.990	0.994	0.988	0.984	0.993	0.992	0.987
Scrub Cycles to failure [See Graph 1]	8 mil cl	250	250	245	940	1110	1150	460	395	540

Table 3

Formula 112908
50 PVC Interior Latex Flat Paint
TiO_2 Spacing Study
Hiding Power

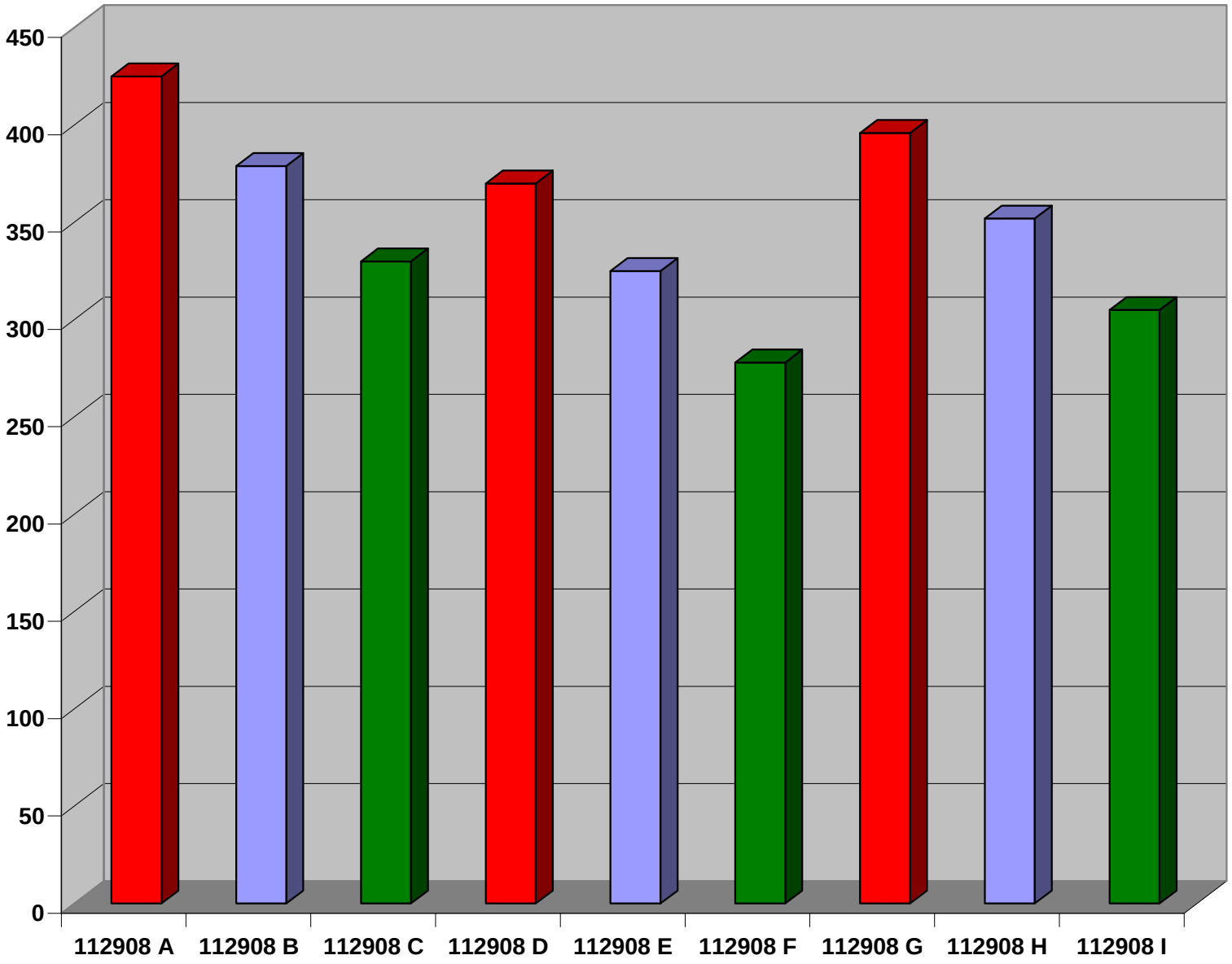
		112908 A TRIAL I	112908 B TRIAL II	112908 C TRIAL III	112908 D TRIAL IV	112908 E TRIAL V	112908 F TRIAL VI	112908 G TRIAL VII	112908 H TRIAL VIII	112908 I TRIAL IX
Gallons TiO_2		3.8	3.0	2.3	3.8	3.0	2.3	3.8	3.0	2.3
Gallons VANSIL® W-30		0.0	0.0	0.0	7.8	8.6	9.3	3.9	4.3	4.6
4 Hegman fineness platy talc		7.8	8.6	9.3	0.0	0.0	0.0	3.9	4.3	4.6
Hiding Power (H0.98)	m^2/L	10.45	9.31	8.10	9.07	7.99	6.83	9.71	8.65	7.49
[See Graph 2]	ft^2/gal	425	380	330	370	325	280	395	350	305
Reflectivity (∞)		0.903	0.894	0.884	0.896	0.890	0.879	0.901	0.891	0.879
[See Graph 3]										
Scattering Coefficient (S)		96.6	83.4	70.1	81.8	70.4	58.0	89.0	77.0	63.5
[See Graph 4]										
Applicator Clearance		6 mil	6 mil	6 mil	6 mil	6 mil	6 mil	6 mil	6 mil	6 mil
Contrast Ratio (CW)		0.984	0.980	0.974	0.983	0.976	0.964	0.983	0.981	0.969
[See Graph 5]										

Graph 1
Scrub Resistance

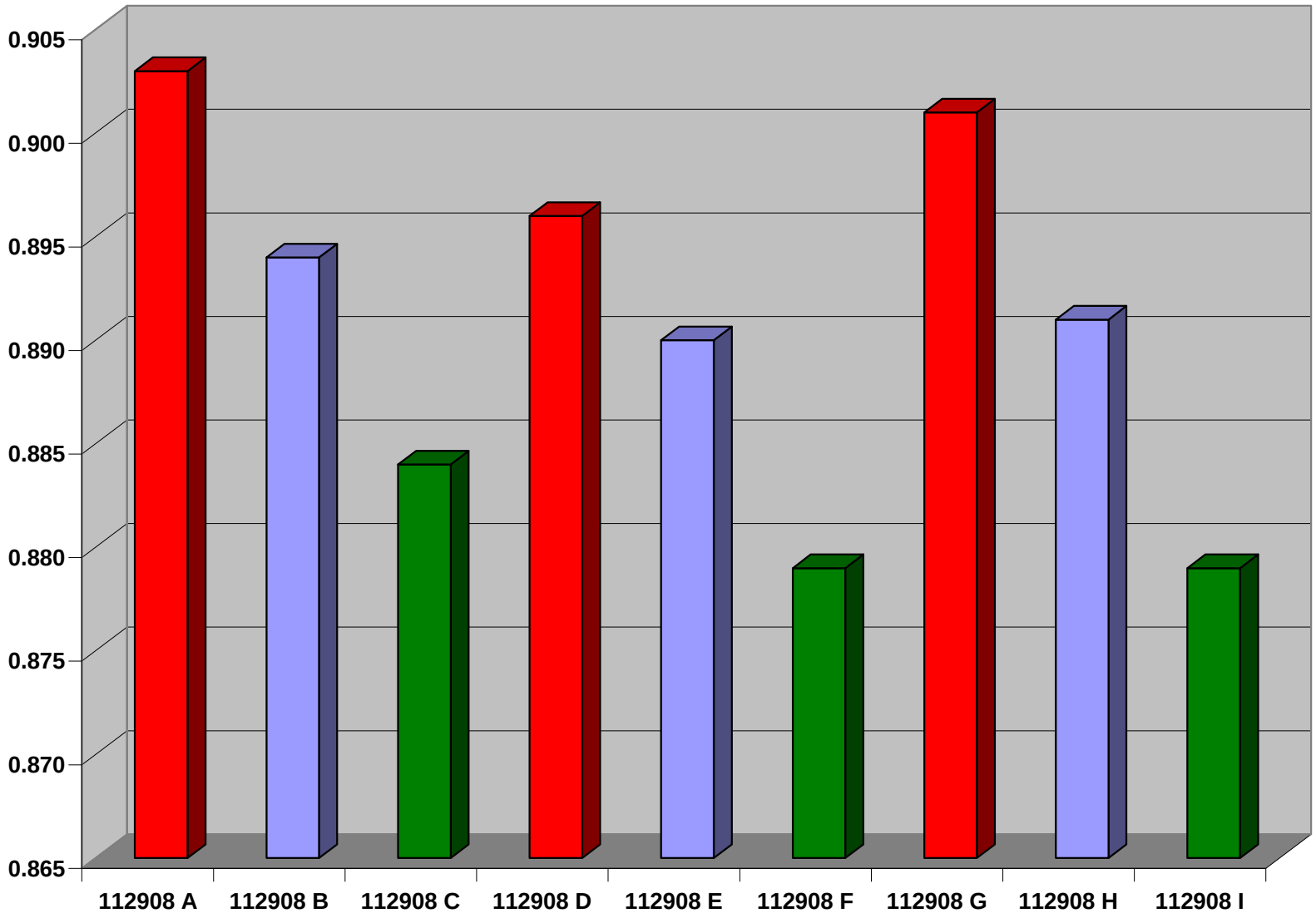


Graph 2

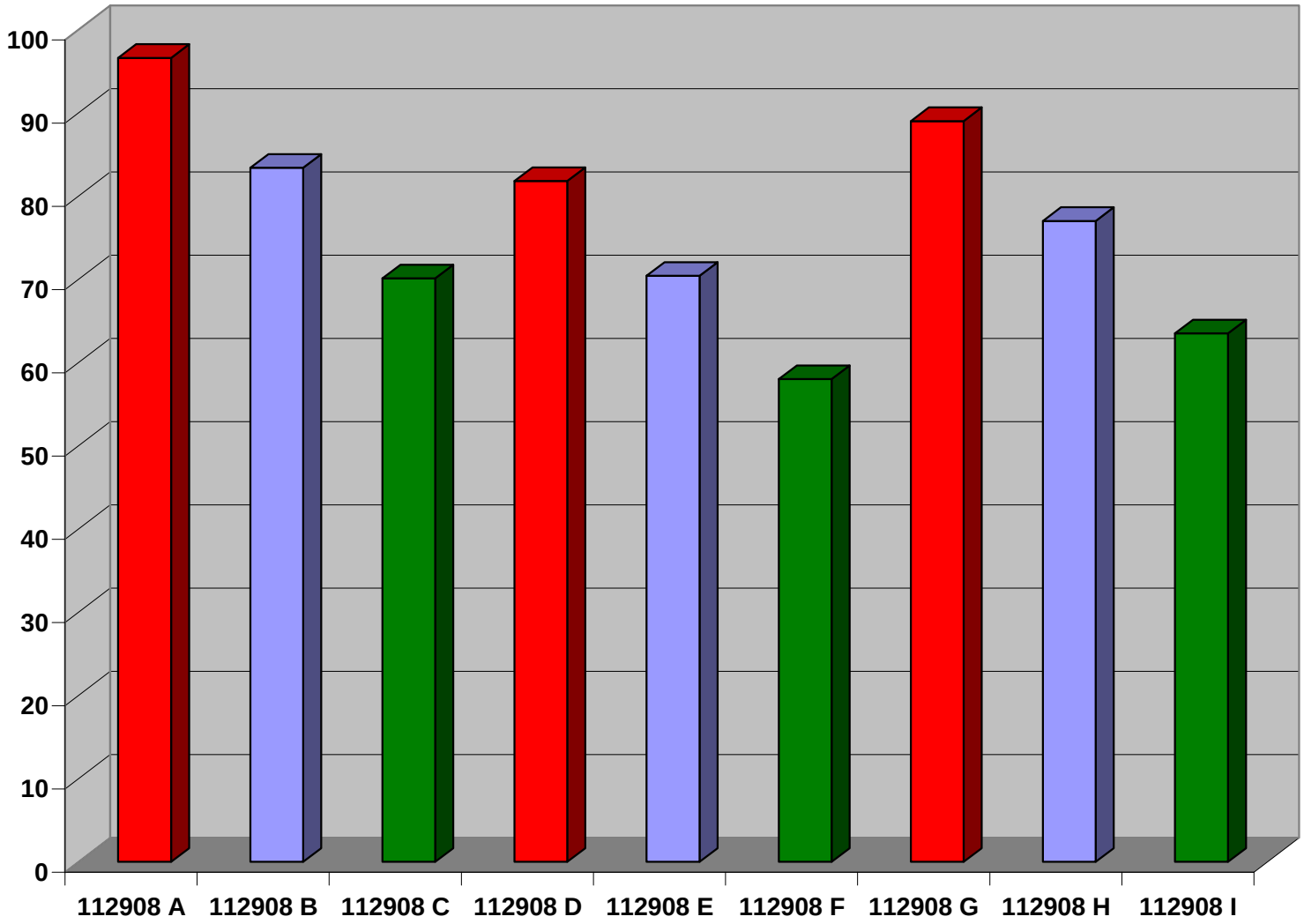
Hiding Power (ft^2/gal)



Graph 3
Reflectivity



Graph 4
Scattering Coefficient



Graph 5
Contrast Ratio