ANALYSIS AND TESTING OF POLYETHYLENE SHEETING

Various sections of polyethylene were supplied to the institute for Polymer Science, University of Stellenbosch to evaluate the physical properties of the material.

Tensile Testing

Ten tensile dumbbells were milled out on a Tensilkut instrument of the white (natural) sheets supplied. The dimensions of these dumbbells at the neck section were approximately 4.7mm by 2.7mm thick, each dumbbell was however, individually measured. The pull rate of the tensile test was 250mm per minute and all samples were pulled until break. The strain was measured at necking as well as at break the elongation was only measured at break. The results are tabulated below.

TENSILE TEST OF NATURAL COLOURED ROOF SHEETS

Thickness (mm)	Width (mm)	Force (N)	Tensile Strength (MPa)	Elongation @ Break (%)	Tens. Strength @ Break (MPa)
2.64	5.13	301.69	22.28	94	13.02
2.89	4.81	272.88	19.63	38	2.07
2.83	4.38	300.00	24.20	148	13.13
2.68	4.33	267.80	23.08	115	13.58
2.74	4.68	294.92	23.00	110	13.09
2.84	4.86	303.39	21.98	146	13.14
2.89	4.68	311.86	23.06	97	13.03
2.58	4.20	242.37	22.37	61	13.14
2.63	4.98	288.14	22.00	58	7.76
Average					
		287.01	**22.40**	**105***	**12.41***

- **The lowest values discarded due to experimental error.**

The stress required to break the sheeting is less than required to stretch or cause the sheet to yield. It must thus be taken into account that if a stress equal to the final breaking stress is applied to the sheet it does not mean that the sheet will break, since a higher stress (equal to the stress at yield) must be applied.

CONTROL TENSILE VALUES FOR THE VARIOUS PIGMENTS

Ave values for 10 control samples	Tensile strength @ yield (MPa)	Tensile strength @ break (MPa)	Elongation @ break (%)
White	22.40	12.40	105
Brown	21.80	9.50	38
Green	21.80	11.70	118
Blue	21.10	9.10	50

It can be seen that little or no difference in tensile strength can be seen due to the various pigmentation.

ACCELERATED AGEING

Samples of the various colours supplied, namely natural, blue, brown and green were placed in an accelerated ageing weatherometer for a period of 2000 h with the following cycle. Eleven hours UV exposure at 35℃ followed by one hour condensation at 45℃. This type of accelerated weathering could be equated to an approximate outdoor exposure of ten years in South Africa. The decreases in tensile and impact strengths were measured during the age mg process.

DECREASE IN TENSILE STRENGTHS MEASURED DURING ACCELERATED AGEING @ 20 OC

Ave values for 10 UV aged samples at 20℃	Tensile strength @ yield (MPa)	Tensile strength @ break (MPa)	Elongation @ break (%)
0h	22.40	12.40	105
500h	25.11	13.68	91.84
1000h	24.79	13.42	86.98
1500h	22.95	15.68	40.01
2000h	21.25	19.13	11.18

The tensile strength at yield did not appreciably change during the accelerated ageing period, which shows that his physical property is virtually unaffected during a simulated ten-year outdoor exposure.

DISCOLOURATION

The natural coloured materials hardly yellowed during the accelerated ageing period equivalent to ten year outdoor exposure.

CANTILEVER PROPERTIES

The cantilever properties were will be measured by exposing a one end supported roof sheet at a temperature of 50°C for a period of time measuring the amount of sagging. 50°C is the maximum temperature that could ever be achieved by a dark section when exposed to the outdoor environment.

From the table below it can be seen that a 380mm overhang will not sag and therefore it is also estimated that support structures can easily be placed 1 meter apart without experiencing any sagging. Longer sections have not been measured due to the size constraint of ovens available but will be tested shortly.

SAGGING OF OVERHANGS AT 50°C

Sagging at 50°C	Overhang of 775mm	Overhang of 380mm
After 8 days	17mm	0mm
After 7 days	18mm	0mm

GLASS TRANSITION TEMPERATUES

The glass transition temperatures was measured by means of differential thermal analysis (DSC) and found to be less than -60°C. The glass transition temperature will not change appreciable for the various colours. This means that the material maintains a rubbery state beyond 40°C and hence the material will not be shatter at impact.

ENVIROMENTAL STRESS CRACKING

The environmental stress cracking was evaluated by stressing 150m strips and placing them in a ten percent Teepol solution. No appreciably environmental stress was notice.

FIRE RETARDANCY

The material burns but does not emit toxic gasses during burning.

I trust that the above information is of value to you.

Yours faithfully

Dr AHA Roediger

PLEASE NOTE: THIS REPORT WAS RETYPED VERBATIM FOR THE SOLE PURPOSE OF THIS PRESENTATION. A COPY OF THE ORIGINAL CAN BE OBTAINED FROM:

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SHOULD YOU HAVE ANY QUERIES REGARDING THE TECHNICAL DATA CONTAINED IN THIS REPORT PLEASE DO NOT HESITATE TO CONTACT DR. ROEDIGER DIRECTLY.