



POLCARB™ SB & POLCARB™ 60S IN uPVC EXTRUSIONS

Polcarb™ SB and Polcarb™ 60S, calcium carbonate products from IMERY'S northern UK chalk deposit, are widely used in uPVC extrusions. Their fine particle size and controlled stearate coating give good processability and excellent optical and mechanical properties. The choice of which product to use and the level of incorporation are both application and formulation dependant.

The properties of Polcarb™ SB and Polcarb™ 60S are given in Table 1.

EXPERIMENTAL

Polcarb™ SB and Polcarb™ 60S have been compared with a widely used coated ground whiting in a uPVC specified pipe formulation (Table 2) at 15 phr filler loading. Table 9 shows the effect of varying the Polcarb™ SB level from 0 and 50 phr in the same resin systems.

Dry Blends were prepared in a Henschel mixer at 3000 rpm until a temperature of 120°C was reached and then cooled to 40°C. After ageing for two days they were extruded using a Brabender twin screw extruder fitted with a 75 x 1.5 mm die. The strips were then tested for optical and mechanical properties.

TABLE 1: TYPICAL PRODUCT PROPERTIES

	Polcarb™ SB	Polcarb™ 60S
Brightness (ISO)	87	85
+ 53 µm (% max)	0.01	0.01
+ 10 µm (% max)	0.5	1.0
- 2 µm (%)	88	60
Moisture as produced (% max)	0.2	0.2
Stearate (%)	1.2	1.1
Other Typical Properties		
Specific Gravity (g/cm ³)	2.7	2.7
Surface Area (BET; m ² /g)	9	5
pH	9	9

CONCLUSIONS

Our results, shown in Tables 3 - 8, confirm that the use of Polcarb™ SB gives good processability and excellent optical and mechanical properties, especially good toughness and high tensile strength. Table 9 shows the change in mechanical properties with increasing Polcarb™ SB loading. Impact strength shows a maximum at about 20 phr. As loadings increase the flexural moduli show a small almost linear increase but tensile strength drops slightly.

In some applications, the exceptional properties obtainable from the ultra-fine particle size of Polcarb™ SB are not required. Here coarser fillers can be used although mechanical properties, especially impact strength, and surface roughness or gloss are adversely affected. However, Polcarb™ 60S has a very low level of coarse particles and our results show that the use of this product gives significantly better mechanical properties and gloss than those obtained from conventional ground whittings.

TABLE 2: uPVC FORMULATION

Formulation	phr
PVC(K68) resin	100
Lead stabiliser composite	2.4
Filler	15

TABLE 3: BRABENDER PROCESSING CONDITIONS

	Fusion Conditions	Extrusion Conditions
Charge weight (g)	58	-
Temperature (°C)	170	180-195
Speed (rpm)	12	8

TABLE 4: BRABENDER PROCESSING PROPERTIES

	Polcarb™ SB	Polcarb™ 60S	Coated Ground Chalk
Fusion Time (mins)	2.5	3.7	4.6
Fusion Torque (Nm)	48	46	44
Extrusion Torque (Nm)	181	155	140
Die Pressure (p.s.i.)	1120	880	740

TABLE 5: COLOUR (CIELAB) / GLOSS (ISO 2813) OF uPVC EXTRUSION

	Polcarb™ SB	Polcarb™ 60S	Coated Ground Chalk
Colour L*	73	72	73
a*	-0.3	0.1	0.3
b*	18	18	19
Gloss at 20°	11	6	5
60°	63	49	44
85°	97	93	90

TABLE 6: MULTIAXIAL IMPACT PROPERTIES (ISO 6603-2) OF uPVC EXTRUSIONS

	Polcarb™ SB	Polcarb™ 60S	Coated Ground Chalk
Peak Energy (-20°C: J/mm)	28	22	15

TABLE 7: TENSILE PROPERTIES (SIMILAR TO ISO 527) OF uPVC EXTRUSIONS

	Polcarb™ SB	Polcarb™ 60S	Coated Ground Chalk
Tensile Strength (Mpa)	50	49	48
Elong at Break (%)	96	94	84

TABLE 8: HEAT STABILITY (CONGO RED - ISO 182-1) OF uPVC EXTRUSIONS

	Polcarb™ SB	Polcarb™ 60S	Coated Ground
Heat Stability (Mins at 200°C)	21	21	21

TABLE 9: EFFECT OF INCREASING THE LOADING LEVEL OF POLCARB SB ON THE MECHANICAL PROPERTIES OF UPVC

Filler Loading (phr)	0	10	20	50
Charpy Notched Impact Strength (J)	0.2	0.4	0.5	0.3
Tensile Strength (MPa)	56	53	50	43
Flexural Modulus (GPa)	2.2	2.4	2.6	2.8

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