Calcium Carbonate Fillers in Silyl-terminated Polyether Sealants

IMERYS supplies a wide range of fine ground calcium carbonates (GCC) for use in sealants. These are available both with and without stearate coating.

In silyl-terminated polyether sealants, fine coated carbonates such as **Polcarb 60S** and **Carbital 110S,** and ultrafine coated carbonates such as **Polcarb S** or **SB** and **Carbital SB** are recommended for use. These high performance minerals can be used to engineer sealant properties, e.g. modify rheological and general physical properties.

Carbital 110S is particularly suitable for use in low modulus silyl-terminated polyether sealants where its contribution to sealant whiteness and its effect on rheology are of value. Ultrafine **Carbital SB** can impart additional thixotropy and viscosity and can offer increased modulus.

Evaluations of the effects of **Carbital 110S** and **Carbital SB** on the properties of silyl-terminated polyether sealants containing a blend of precipitated calcium carbonate (PCC) and Carbital products have shown that the choice of GCC can impact on sealant performance, and potentially on sealant cost-effectiveness. Results showed that,

- Sealants containing **Carbital SB** or **Carbital 110S** gave excellent slump resistance
- **Carbital SB** gave a higher sealant viscosity and thixotropy than Carbital 110S
- Sealants prepared with Carbital SB gave reduced elongation and increased modulus than those containing **Carbital 110S**
- **Carbital SB** can replace more PCC than **Carbital 110S** whilst maintaining sealant rheological and mechanical properties

In summary, sealants formulated with **Carbital SB** or **Carbital 110S** exhibited excellent combinations of colour, slump, rheological and tensile properties. **Carbital SB** has additional potential for reducing the level of thixotrope and/or TiO_2 to provide cost-effective sealant reformulation possibilities.

Three sealants were prepared containing the following filler mixtures:
1) 70:30 PCC : **Carbital SB**
2) 70:30 PCC : **Carbital 110S**
3) 85:15 PCC : **Carbital 110S**

Sealant mixes were carried out under vacuum in a Molteni Planimax mixer. The rheological properties of the sealants were measured after the 7 days conditioning period, using a Carrimed rheometer (2 cm cone and plate, 20°C). Sag resistance was assessed with a Boeing jig. Tensile strengths were measured after curing for 2 weeks in a moist atmosphere.

Table 1 Carbonate Properties

	Carbital SB	Carbital 110S
Particle size (wt.%)		
-10 µm	99	99
- 5 µm	98	93
- 2 µm	88	55
- 1 µm	61	30
- 0.75 µm	51	20
- 0.5 µm	38	10
Surface Area (m^2g-1)	10	5
Stearate Level (wt.%)	1.2	0.9
Brightness (ISO)	95.0	94.5

Table 2 Sealant Formulations

	70:30 PCC:GCC Weight (g)	85:15 PCC:GCC Weight (g)
PCC (d_{50} = 0.07µm)	252.0	306.0
Coated GCC	108.0	54.0
TiO2	60.0	60.0
Polymers	300.0	300.0
Plasticiser	150.0	150.0
Thixotropic agent	12.0	12.0
Stabilisers	6.0	6.0
Dehydration agent	9.0	9.0
Adhesion promoters	7.5	7.5
Catalyst	3.0	3.0
Total	907.5	907.5

Table 3 Sealant Properties

	70:30 PCC:Carbital SB	85:15 PCC:C110S	70:30 PCC:C110S
Colour L*	95.5	94.6	95.0
a*	- 0.1	- 0.2	- 0.1
b*	2.7	3.5	2.8
Hardness (Shore A)	43	39	40
Area of Thixotropy (kNm-2s-1)	40	41	26
Sag (mm)	< 1	< 1	< 1
Peak Tensile Strength (MPa)	1.02	1.09	1.06
Modulus at 100% (MPa)	0.54	0.48	0.47
Elongation at Peak (%)	346	481	436

Figure 1: Viscosity profiles of sealants

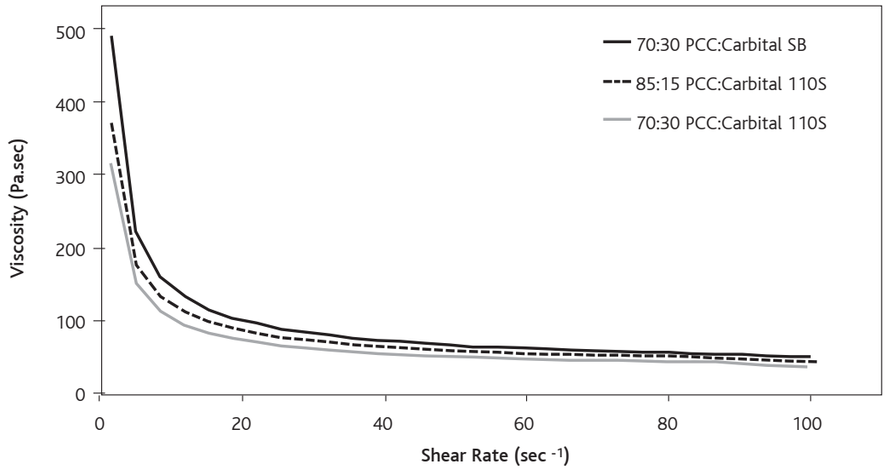
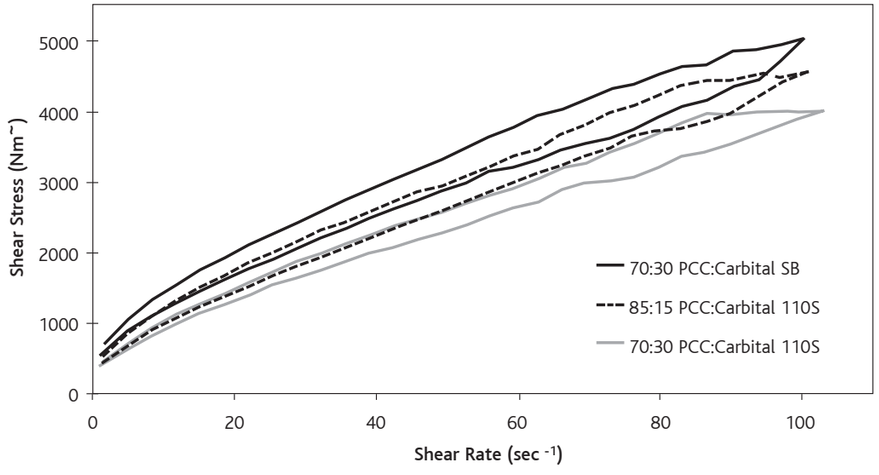


Figure 2: Shear stress profiles of sealants



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Benefits:

- **Reduce** formulation cost
- **High** sealant whiteness
- **Reduce** precipitiated carbonate

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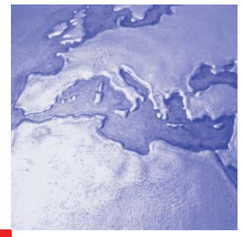

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