

## VISCOLITE®-EL20

### Providing High Elongation for Hybrid Sealants

#### Precipitated Calcium Carbonate



SHIRAIISHI KOGYO KAISHA, LTD.

Precipitated calcium carbonates (PCC) are used in a wide variety of applications. The dimensional stability, uniform dispersion and reliable consistency are the properties that make PCC ideal for adhesives, sealants and coatings. Shiraishi's product consistency gives optimum rheology in the most critical transportation, infrastructure and construction applications.

#### Characteristics

**Low modulus and high elongation** – Viscolite-EL20 provides low modulus and high elongation for hybrid sealants with particle control and surface treatment technology.

#### Formula

Function	Content Parts
Hybrid Pre-Polymer A	60
Hybrid Pre-Polymer B	40
Plasticizer	55
<b>Nano Calcium Carbonate (Viscolite-EL20)</b>	<b>120</b>
GCC (Surface-Treated, D50 = 3 μm)	40
Thixotropic Agent	2
Water Scavenger (Vinyl Silane)	2
Adhesion Promoter (Amino Silane)	3
Catalyst (Sn)	2
<b>Total</b>	<b>324</b>

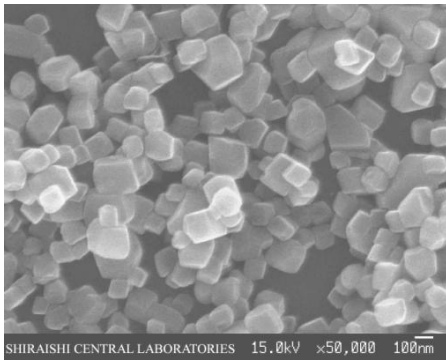
#### Formulation conditions:

- Mixed hybrid pre-polymers with thixotropic agent using a 3-roll mill (3 passes).
- Vacuum mixed at 120 °C for 2 hours, then cooled to room temperature.
- Finally, mixed with water scavenger, adhesion promoter and catalyst.

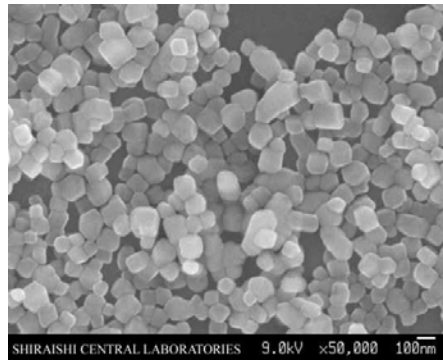
## Powder Properties

Product	Particles			Typical Values			
	Shape	Diameter (nm)	Surface Treatment	Brightness (%)	BET SSA (m <sup>2</sup> /g)	pH	Moisture (%)
Viscolite-EL20	Rhombohedral	100	Fatty acid	98	10.5	10.7	0.4
HAKUENKA <sup>®</sup> CCR	Rhombohedral	80	Fatty acid	94	17.9	9.2	0.3
Viscolite-OS	Rhombohedral	80	Fatty acid	96	17.1	9.5	0.4

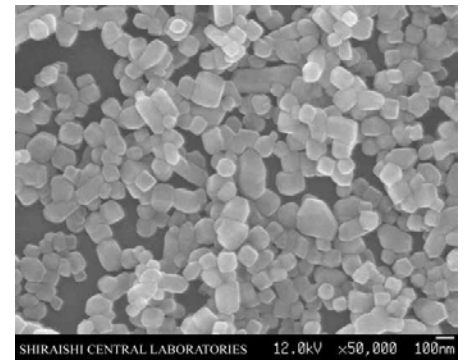
## Scanning Electron Microscope Photos (× 50,000)



Viscolite-EL20

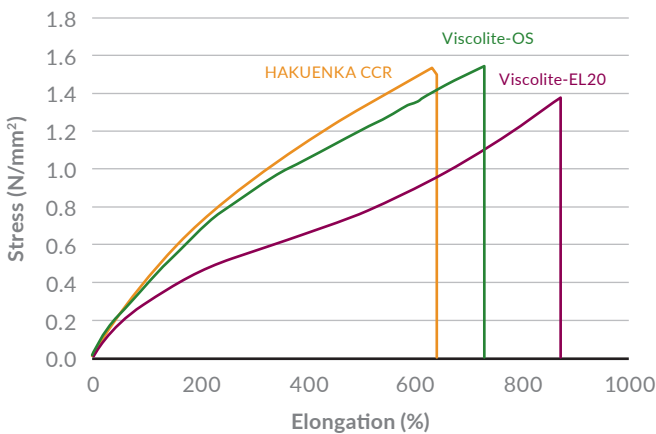


HAKUENKA CCR

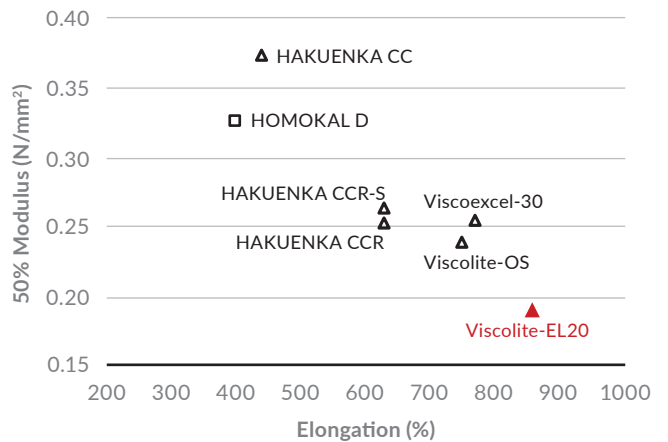


Viscolite-OS

## S-S Curve



## Modulus and Elongation of PCC (1c-Hybrid Sealant)



Curing conditions: 23 °C 14 days → 30 °C and 65% RH 14 days; No. 2 dumbbell measurement conditions: 200 mm/min

## The Properties of 1c-Hybrid Sealant

			Viscolite-EL20	HAKUENKA CCR	Viscolite-OS
Initial Viscosity	1 rpm	Pa·s	1,400	2,240	2,540
	10 rpm	Pa·s	276	356	386
	TI index	-	5.1	6.3	6.6
Viscosity Change (23 °C 14 days)	1 rpm	%	-1	-1	2
	10 rpm	%	6	0	9
T.F.T		Hour	0.5	0.5	0.5
Tensile Test (H-type piece Al-Al)	Modulus 50%	N/mm <sup>2</sup>	0.18	0.27	0.24
	Tensile strength	N/mm <sup>2</sup>	0.79	1.00	0.93
	Elongation	%	750	560	570
	Break style	-	CF70/TCF30	CF80/TCF20	CF100
Tensile Test (H-type piece Al-Al) Standard Curing Conditions + 80 °C 7 days	Modulus 50%	N/mm <sup>2</sup>	0.21	0.30	0.26
	Tensile strength	N/mm <sup>2</sup>	0.79	1.29	1.15
	Elongation	%	650	500	650
	Break style	-	CF100	CF90/TCF10	CF70/TCF30
Tensile Test (Dumbbell-type piece)	Modulus 50%	N/mm <sup>2</sup>	0.19	0.26	0.24
	Modulus 100%	N/mm <sup>2</sup>	0.30	0.42	0.39
	Tensile strength	N/mm <sup>2</sup>	1.37	1.5	1.55
	Elongation	%	870	640	730
Tensile Test (Dumbbell-type piece) Standard Curing Conditions + 80 °C 7 days	Modulus 50%	N/mm <sup>2</sup>	0.21	0.28	0.23
	Modulus 100	N/mm <sup>2</sup>	0.35	0.47	0.39
	Tensile strength	N/mm <sup>2</sup>	1.19	1.64	1.55
	Elongation	%	720	680	740
Asker C Hardness (23 °C 50% RH 14 days)		-	45	52	49

## Low-Plasticizer Formulation

**Reduction of plasticizer amount by 50%** – Compared with common UFPC, Viscolite-EL20 can reduce plasticizer by 50%.

**Maintenance of high elongation** – The elongation level is maintained even if the amount of plasticizer is reduced.

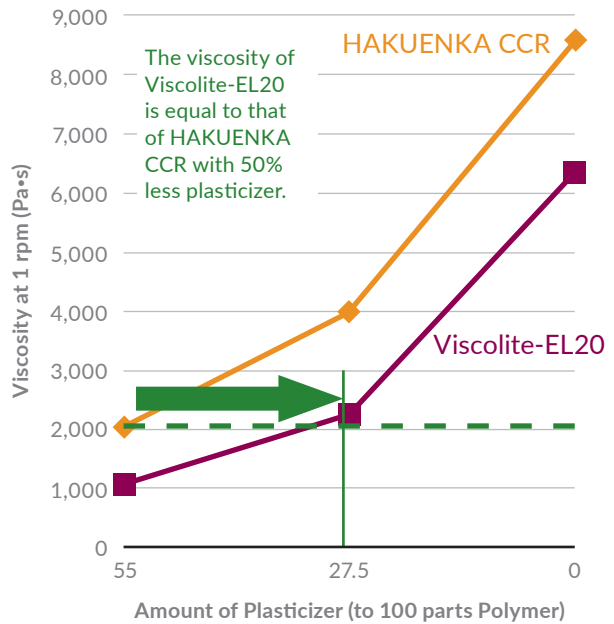
Basic formulation is 100 parts polymer and 55 parts plasticizer. Regarding reduced plasticizer, a test result of the viscosity, modulus and elongation is indicated.

### 1c-Hybrid Sealant Formulation

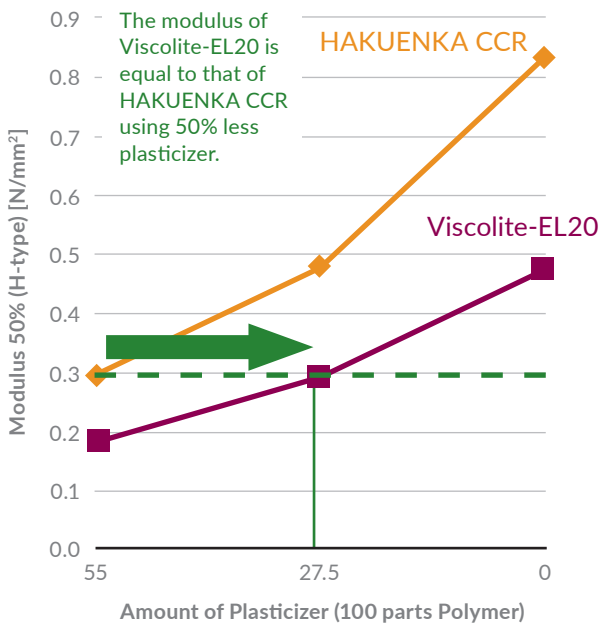
Function	Content [Parts]	
Hybrid Pre-Polymer A	60	←
Hybrid Pre-Polymer B	40	←
<b>Plasticizer</b>	<b>55</b>	<b>27.5</b>
UFPC	120	←
GCC	40	←
Others	11	←

Aging conditions: 23 °C 14 days → 30 °C 65% RH  
 14 days Measuring conditions: 50 mm/min

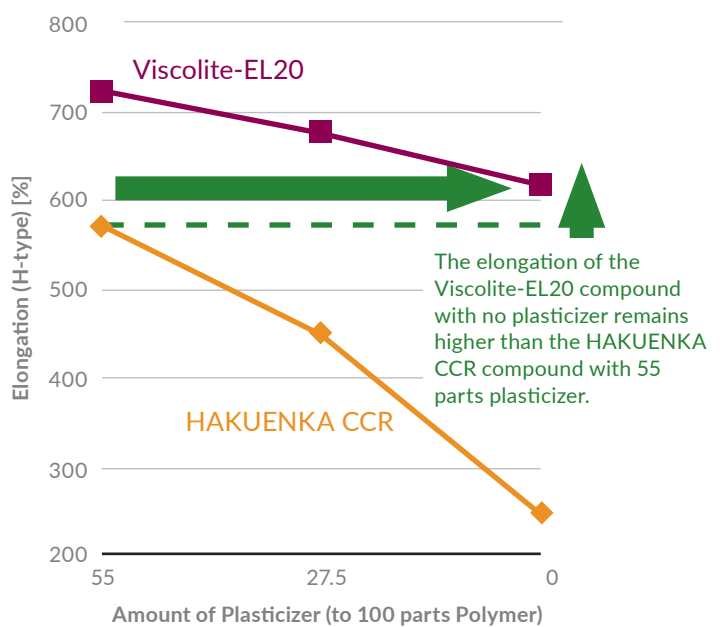
### Initial Viscosity



### Modulus (H-type)



### Elongation (H-type)



## The Properties of 1c-Hybrid Sealant (Low-Plasticizer Formulation)

		Viscolite-EL20			HAKUENKA CCR		
Hybrid Pre-Polymer A	parts	60	60	60	60	60	60
Hybrid Pre-Polymer B	parts	40	40	40	40	40	40
<b>Plasticizer</b>	<b>parts</b>	<b>55</b>	<b>27.5</b>	<b>0</b>	<b>55</b>	<b>27.5</b>	<b>0</b>
Viscolite-EL20	parts	120	120	120	-	-	-
HAKUENKA CCR	parts	-	-	-	120	120	120
GCC	parts	40	40	40	40	40	40
Thixotropic Agent	parts	2	2	2	2	2	2
UVA	parts	1	1	1	1	1	1
HALS	parts	1	1	1	1	1	1
Water Scavenger	parts	2	2	2	2	2	2
Adhesion Promoter	parts	3	3	3	3	3	3
Catalyst (Sn)	parts	2	2	2	2	2	2
<b>Total</b>		<b>326</b>	<b>298.5</b>	<b>271</b>	<b>326</b>	<b>298.5</b>	<b>271</b>
Initial Viscosity							
1 rpm	Pa·s	1,068	2,256	6,336	2,040	3,996	8,580
10 rpm	Pa·s	205	426	1,170	354	678	1,536
TI index	-	5.2	5.3	5.4	5.8	5.9	5.6
Viscosity Change							
23 °C 14 Days 1 rpm	%	-3	11	-3	5	-1	13
23 °C 14 Days 10 rpm	%	6	19	9	17	11	26
Tensile Test (H-Type Piece Al-Al)							
Modulus 50%	N/mm <sup>2</sup>	0.19	0.29	0.48	0.30	0.48	0.84
Tensile Strength	N/mm <sup>2</sup>	0.83	1.10	1.26	1.13	1.34	1.44
Elongation	%	723	677	617	571	451	248
Break Style	-	CF95/TCF5	CF95/TCF5	CF100	CF60/TCF40	CF95/TCF5	CF50/TCF50
Tensile Test (Dumbbell-Type Piece)							
Modulus 50%	N/mm <sup>2</sup>	0.23	0.30	0.47	0.31	0.46	0.84
Modulus 100%	N/mm <sup>2</sup>	0.33	0.43	0.61	0.53	0.75	1.27
Tensile Strength	N/mm <sup>2</sup>	2.12	2.16	2.23	1.87	2.07	2.20
Elongation	%	890	830	725	628	605	433

### Formulation conditions:

- Mixed hybrid pre-polymers with HALS using a 3-roll mill (3 passes).
- Vacuum mixed at 120 °C for 2 hours, then cooled to room temperature.
- Finally, mixed with water scavenger, adhesion promoter and catalyst.



H.M. Royal, Inc.

689 Pennington Avenue / Trenton / NJ 08601

Phone: (800) 257-9452 / hmroyal.com