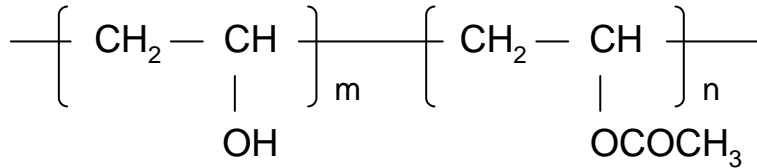


Characteristics of KURALON™ (PVA fiber)

1. Chemical Structure



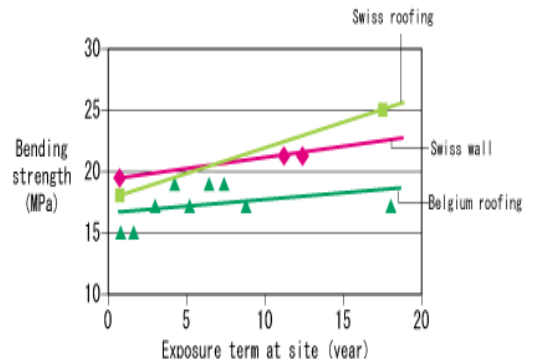
2. Characteristics

High tenacity, High modulus, Low elongation, Light weight,
 Good resistance against chemicals (alkaline),
 Good adhesion to cement matrix

Properties

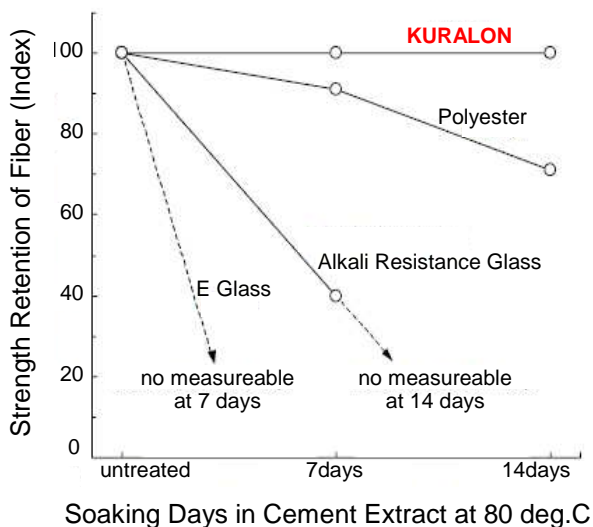
Fiber	Tensile Strength (MPa)	Elongation (%)	Tensile Modulus (GPa)	Specific Gravity (g/cm ³)	Remarks
Kuralon	880 - 1600	6	25 - 41	1.3	
Polypropylene	400	25	5	0.91	Float on the water
Steel fibre	1200	3 - 4	200	7.9	Rust and heavy
AR-Glass	2200	0 - 4	80	2.7	Weak for alkaline

Long term durability

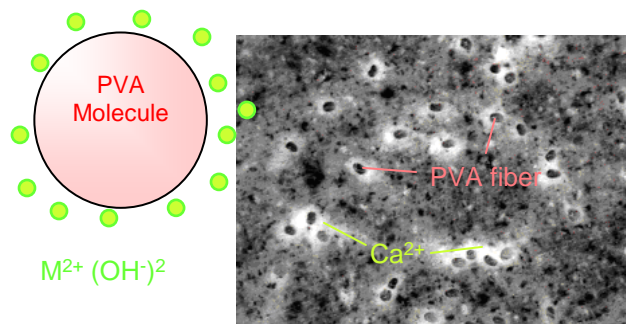


20 years experience of outdoor weathering test.

Alkaline Resistance



Adhesion to Cement Matrix



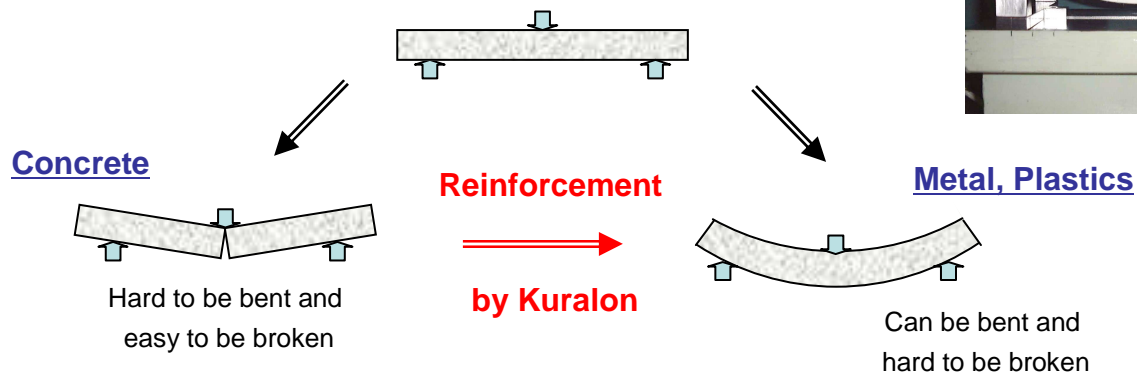
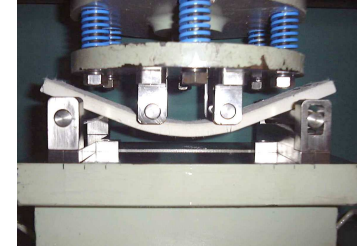
In alkaline environment, calcium hydroxides are easy to adsorb to PVA molecule due to their affinity.
 (H. Yokoi etc., J. Am. Soc., 108, pp3358-, 1986)

Performance of KURALON™ (1)

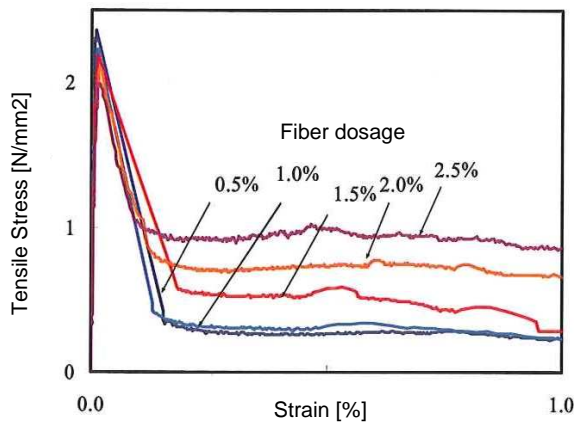
3. Improvement for Ductility

Kuralon is difficult to be pulled out from concrete matrix and can bridge between internal surface of cracks.

=> KURALON™ prevents cracks from growing wider and concrete board can be bent more without breaking.



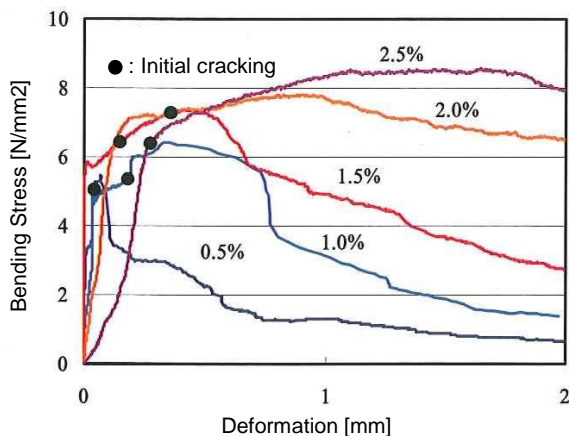
3-1. Tensile strength and Flexural strength



Graph 1. Tensile strength

PVA fibers cannot improve the stress at initial cracking of Tensile and Bending property. However, after initial cracking, they bear the stress instead of concrete matrix.

=> Kuralon can improve the deformation capacity of concrete board, and especially improve the Bending stress.



Graph 2. Flexural strength

Table 1. Mix design

Fiber dosage [vol%]	W/B [%]	Air content [%]	Water [kg/m3]	Cement [kg/m3]	FA [kg/m3]	S [kg/m3]	G [kg/m3]	Fiber [kg/m3]	Ad [B x %]
0.5	40	3	175	307	131	926	750	6.5	1.3
1						1117	555	13	1.9
1.5						1190	480	19.5	2.6
2						1190	480	26	2.6
2.5						1190	480	32.5	2.8

B = Cement + FA
 FA; Fly ash (mineral admixture (addition))
 S; Sand (fine aggregate)
 G; Gravel (course aggregate)
 Ad; chemical Admixture

Performance of KURALON™ (2)

3-2. Cracking Control (Multiple micro crack)

In Kuraray's preliminary study, KURALON™ (RSC15x8) 1.0 lbs/yd³ can reduce 50% of shrinkage cracking width shown in figure 1.

KURALON™ disperses one big crack to many small cracks, and then water-tightness and flexural strength of concrete/mortar board can be kept. ECC (Engineered Cementitious Composites) can show the feature in figure 3.

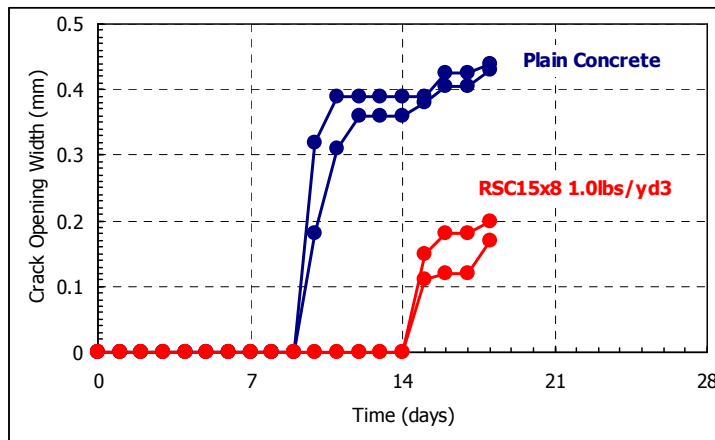


Fig. 1. Crack opening in 73 F, 35% R.H. condition



Fig. 2. Ring test specimen

W/C	S/a	W	C	S	G	SP
0.45	0.55	322	716	1610	1318	0.843

Table 1. Mix design: lbs/yd³
(Maximum Gravel Size = 3/4 inch)

	Density (lbs/yd ³)	Slump (inch)	Air Content (%)
Plain Concrete	4.00	7.9	2.1
RSC15x8 1.0lbs/yd ³	3.96	7.3	2.5

Table 2. Fresh properties of concrete

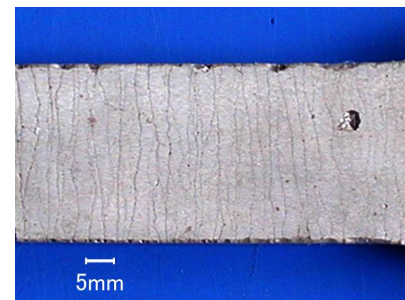


Fig. 3. Multiple micro crack

Items of KURALON™

- Various fineness and length : from 26micron/6mm to 660micron/30mm
=> You can select suitable fibers depending on your mix design
(Normally we recommend the length of fiber is 1.5 times longer than G-max)
- Resin-Bundled type : control the dispersibility of fibers to avoid re-aggregating during the mixing process (fiber ball)
- For Cracking Control : RSC15/8mm

Type	Diameter (micron)	Length (mm)	Tensile strength (GPa)	Modulus (GPa)	Note
RMS702	26	6	1.6	39	Resin-Bundled type
RSC15	40	8	1.4	36	Cracking Control
REC15	40	8, 12	1.6	41	
RECS15	40	8, 12	1.6	41	Resin-Bundled type
RECS100	100	12	1.2	28	Resin-Bundled type
RF400	200	6, 12	1.0	27	
RFS400	200	18	1.0	27	Resin-Bundled type
RF1000	310	15	1.0	29	
RF4000	660	30, 40	0.9	23	



Application of KURALON™

Application	Fiber Type	Fiber Content	Functions
Building Wall (Cladding Wall)	RECS7, REC15	1 - 1.5 vol%	Toughness, Cracking control
Permanent Formworks (Precast)	REC15, RF4000	2 - 2.5 vol%	Toughness, Cracking control
Bridge Deck Slab	RECS100	0.075 vol%	Cracking control, Abrasion prevention
OA Panel for Floor	RECS100, RF400	2.5 - 3 vol%	Impact strength, Toughness
Wind Proof Panel for Railways	RFS400	2.5 vol%	Cracking control, Toughness
Retrofit	RECS7, RECS15, RECS100	0.1 - 2vol%	Cracking control, Toughness
Shotcrete for Slope Stabilization	RFS400, RF4000	0.75 - 1 vol%	Toughness, Cracking control
Shotcrete for Tunnel Lining	RF4000	0.75 - 1 vol%	Toughness
Overlay for Concrete Road Pavement	RF4000	0.75 vol%	Toughness, Frost damage resistance
Concrete Slab on Grade	RECS100,RF4000	0.15,0.46 vol%	Cracking control, Toughness
Heavy Concrete Floor Surface	RSC15	0.077 vol%	Cracking control



Curtain Wall



Permanent Formwork



OA Floor Panel



Shotcreting for Slope Stabilization



Tunnel Lining

Attention:

If you have any question, please feel free to contact us.

We are looking forward to hearing from you.

kuraray

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