

# Polyvinyl Alcohol (PVA) fiber For Concrete & Mortar

Quality and performance of PVA fibers for durable constructions

September 28<sup>th</sup> 2023  
BIBM Congress Amsterdam

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***kuraray***

**KURALON™** *KURALON K-II™*

# KURALON™ and KURALON K-II™

KURALON™ and KURALON K-II™ is synthetic fiber which is made from PVA resin. In 1950, Kuraray started its commercial production and especially it has long history in cement composite market as substitute of asbestos.

## SPECIAL FEATURES

- High Strength
- High Modulus
- Low Elongation
- Good adhesion to Cement Matrix
- Alkaline Resistance
- Weathering Resistance
- Light Weight
- No Corrosion



RF400H/12mm



RF4000/30mm

# Fiber Properties

KURALON™ and KURALON K-II™ has unique properties in comparison with other fiber material such as Steel, AR-Glass, Polypropylene.

		KURALON™ KURALON K-II™	Steel fiber	AR-Glass fiber	Polypropylene fiber
Tensile Strength	MPa	850-1790	490-980	2500	300-750
Young's Modulus	GPa	23-45	200	74	1.4-2.2
Density	g/cm <sup>3</sup>	1.30	7.85	2.78	0.91

KURALON™, KURALON K-II™; Kuraray's technical brochure  
Other fibers; Kikuta and Mihashi, Concrete Journal, pp.414-417, Vol.50, No.5, 2012. 5

In comparison with

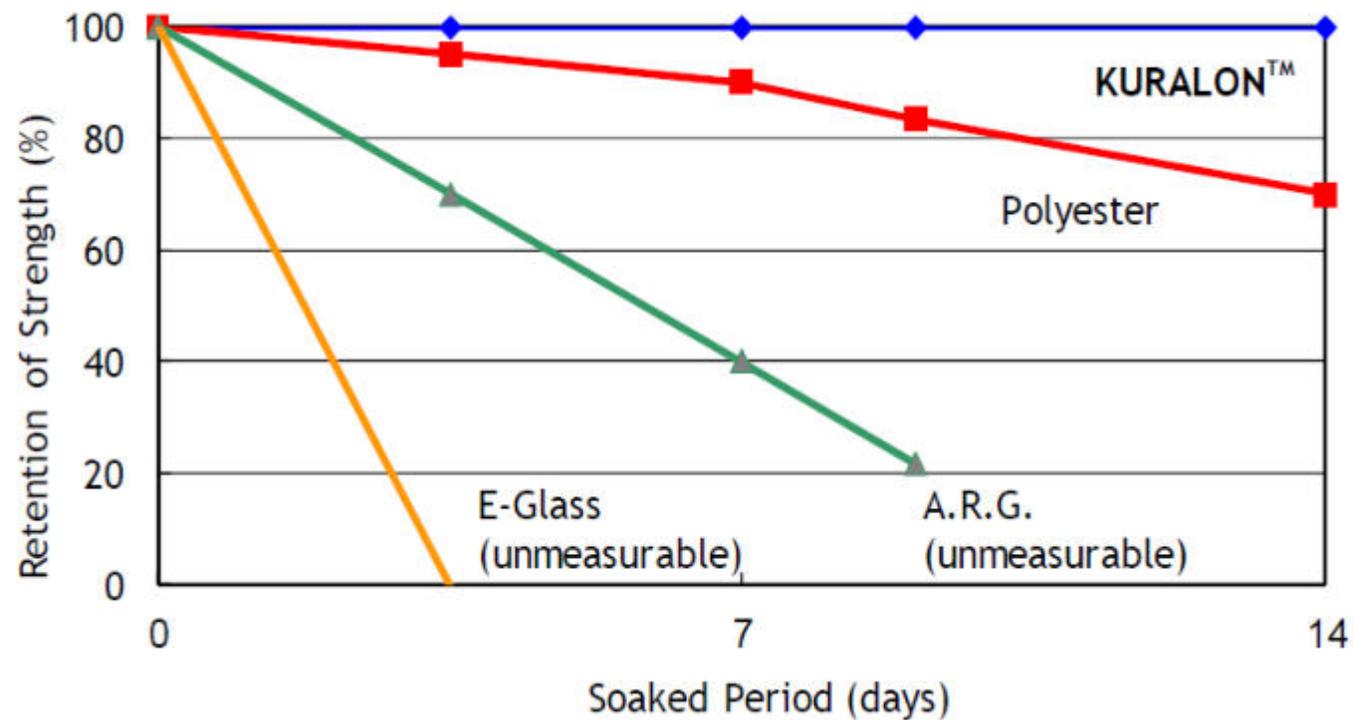
Steel fiber : lightweight, no corrosion

AR-Glass fiber : higher alkaline resistance, higher elongation

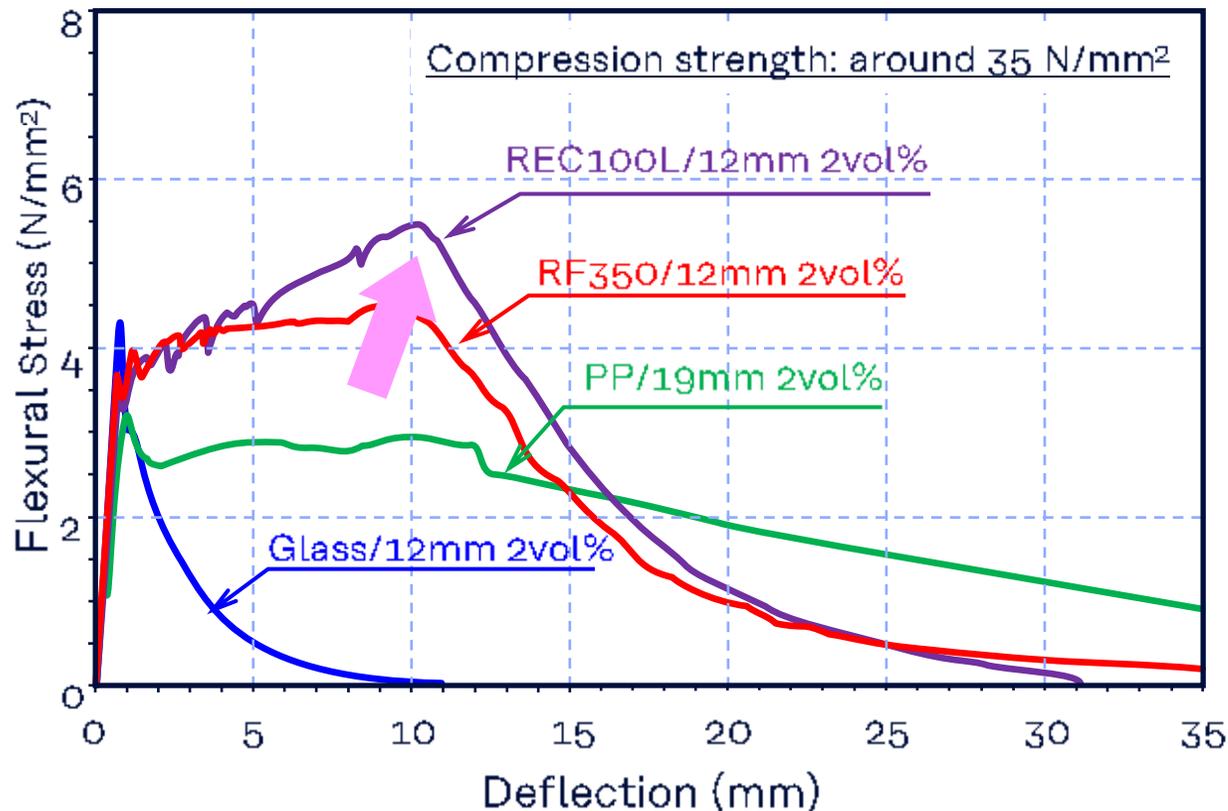
Polypropylene fiber : higher tensile strength and modulus, better adhesion to cement matrix

# Alkaline Resistance

KURALON™ and KURALON K-II™ has good chemical resistance and especially shows great alkaline resistance. Below data shows strength retention of each fiber material after soaking into extraction of cement slurry at 80 degrees C.



# Flexural Behavior of KURALON™ reinforced concrete



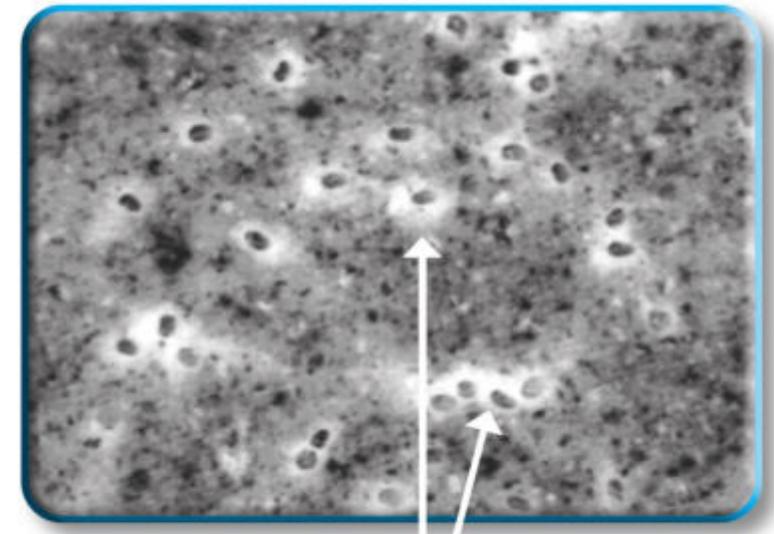
KURALON™ and KURALON K-II™ have good adhesion to cement, which prevents to fall out and provides high fiber reinforcement effect.

Test method : ASTM C1399-02 Geometry of specimen (mm) : 100/ 100/ 350  
Fiber dosage : 20kg/ m<sup>3</sup>

KURALON™ and KURALON K-II™ form chemical bonds with the cement matrix.

Ca ion in cement slurry is attracted by PVA and makes calcium compounds layers. It seems reasonable to think that calcium compound layer plays important role for adhesion.

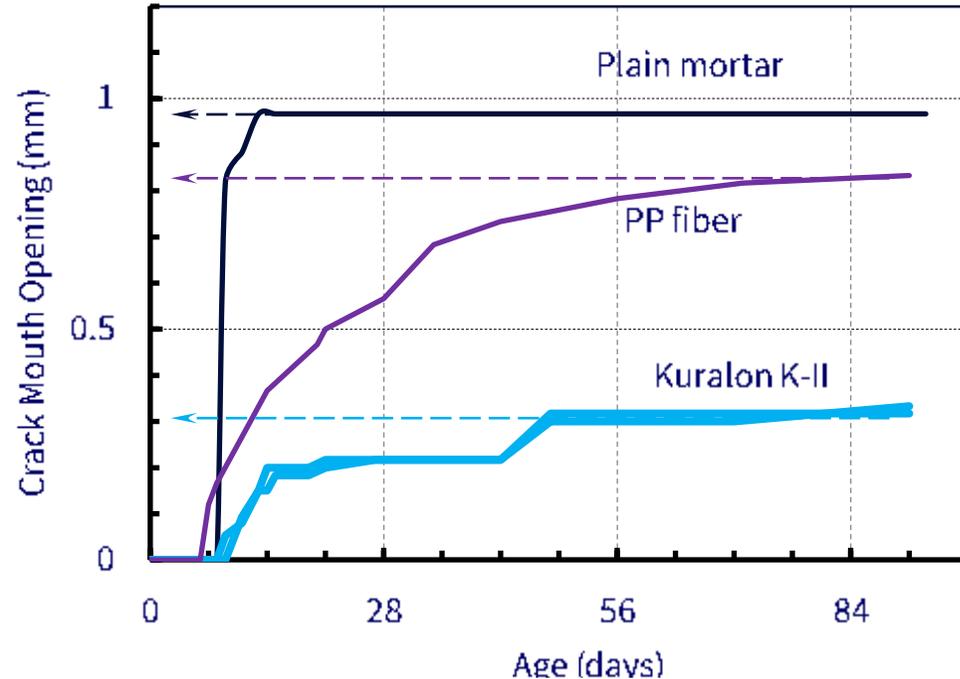
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White Layer: calcium compounds

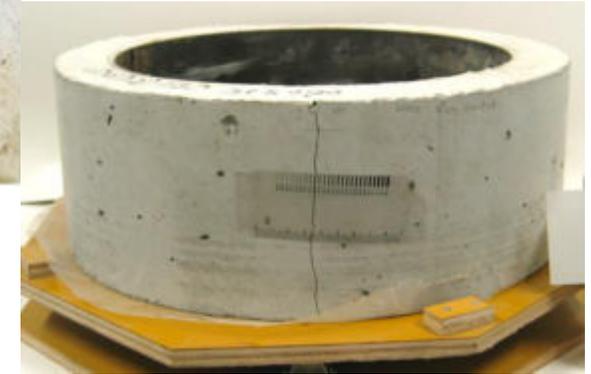
# Cracking Control

Evaluation for dry shrinkage cracking control by ASTM C1581:



Change in crack mouth opening

Mix: W/C=0.55, S/C=4.0, Vf=0.3 vol%, horizontal twin axis mixer  
Mould-off, Top surface sealing: 24 hrs after molding  
Aging: 20 C/40 %RH



Shrinkage cracking test specimen

Effect of fiber reinforcement is the bridging effect of cracks.

By using KURALON™, Crack Mouth Opening can be reduced to 1/3 of Plain mortar.

# Applications



- Shotcrete for slope reinforcement
- Architectural use
- Decorative architectural structure
- Building wall/Façade
- Bridge deck slab
- OA panel for floor
- Wind proof panel for railways
- Retrofit
- Tunnel lining
- Overlay for road pavement
- Concrete slab on grade



# KURALON™ and KURALON K-II™ -for concrete infrastructure

KURALON™ is a synthetic fiber, made from polyvinyl alcohol (PVA), suitable fiber material for “Durable and less maintenance concrete infrastructures” suggesting Carbon foot print and Life Cycle Cost efficiency, thanks to its good affinity to cement which leads to better crack control under severe conditions, such as cold weather, heavy loading traffic.

## APPLICATIONS

- PVA fiber reinforced concrete slab deck of bridges
- Concrete pavement for heavy loading traffics (scrap yards/airports)
- Permanent concrete formworks reducing rehabilitation

## BENEFITS

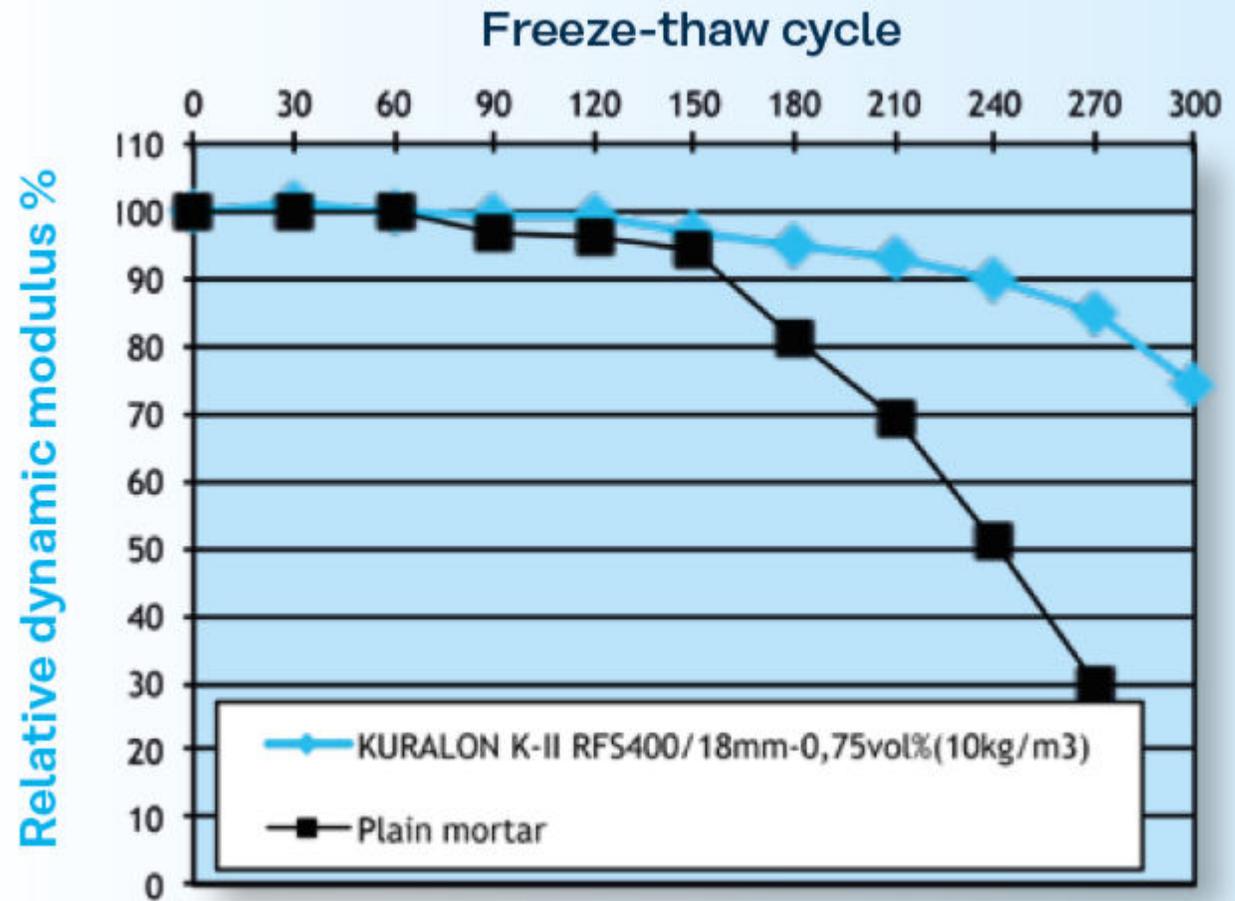
- No/less metal elements (No/less corrosion)
  - Less maintenance
- Benefits of end customers-Less consumption of cement
  - Reduce CO<sub>2</sub> emission



# Freeze-thaw cycle resistance



Slope Reinforcement by Shotcrete



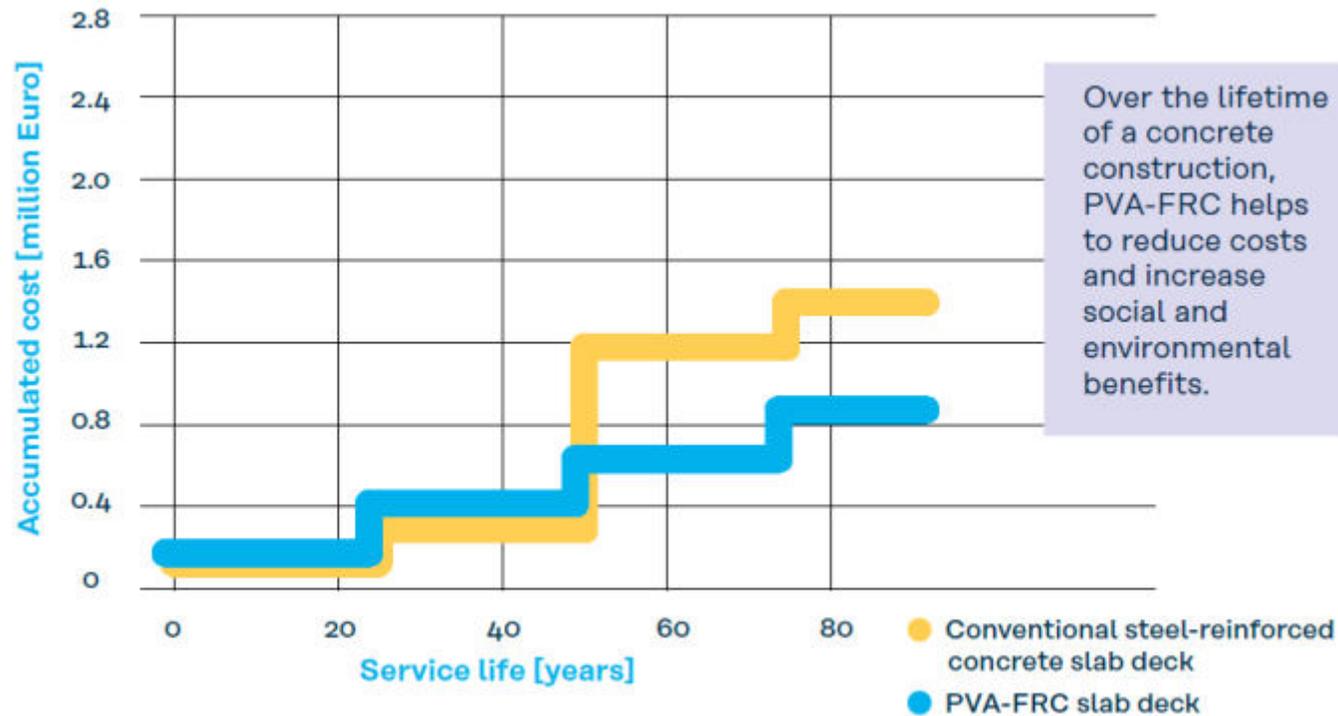
KURALON™ and KURALON K-II™ suppresses fine cracks caused by repeated freezing and thawing, resulting in very little scaling, which is expected to improve freezing damage resistance.

## Durability under repeated dynamic load

An authority in Japan reported on the application of PVA fiber reinforced concrete roadbeds with KURALON™ RF 4000/30 mm - 2,0 vol % has a capability of withstanding more than 100,000 cycles of dynamic load with 13 times of a designated load value.

KURALON™ has been used on some Japanese railway tracks. Compared to ballast, KURALON™ is more durable and requires less exchange and maintenance.

# Case study – Focus on the life time benefits



## Basis of calculation

This study is based on the guideline for LCC of constructions published in 2004 by Japanese Civil Engineering Consultants Association.

In this study, we assumed partial repair every 25 years without any renewal construction for 100 years, assuming a PVC-FRC slab deck.

## Result of study

The initial cost of the PVA-FRC slab deck is a little higher than the commodity RC deck slab, but the total cost over 50 years is lower than using the commodity method.

# Life cycle assessment of the PVA-SHCC(ECC) joint slab deck for bridges

## Advantages of PVA-SHCC(ECC) over conventional systems\*

\*Keoleian et al. estimated that the ECC link slab system consumes 40% less total primary energy and produces 39% less carbon dioxide in comparison with the traditional steel joint system.<sup>1)</sup>

Keoleian et al. estimated that the ECC bridge deck system has significant advantages in environmental performance: 40% less life cycle energy consumption, 50% less solid waste generation, in comparison with the traditional steel joint system.<sup>2)</sup>

1) Keoleian , G.A., et al., (2005), "Life Cycle Cost Model for Evaluating the Sustainability of Bridge Decks"

2) Keoleian , G.A., et al., (2005), "Life Cycle Modeling of Concrete Bridge Design: Comparison of Engineered Cementitious Composite Link Slabs and Conventional Steel Expansion Joints"



# KURALON K-II™ for UHPC– Design oriented building application

KURALON K-II™ high-tenacity type is produced by Kuraray's special spinning process. In addition to its high mechanical properties, it has high adhesiveness to cement materials and alkali resistance, which makes it an ideal fiber for UHPC, standing for Ultra High-Performance Concrete in the construction industry.

## APPLICATIONS

- Iconic PVA fiber-UHPC façade, solar shading, ceiling
- PVA fiber UHPC furniture

## BENEFITS

- Design oriented building material
- Thin and lightweight
- Durable building materials with good affinity to cement
- Design flexibility with less chipping & less crack building materials
- No rust stains



Tram Station Canopy by UHPC

# KURALON K-II™ – Technical data to create UHPC for façade

## New fiber : RF400H/12mm

In 2022, we launched RF400H, a higher strength fiber for UHPC.

We conducted bending tests with RF400, conventional fiber and RF400H for general UHPC mix design.

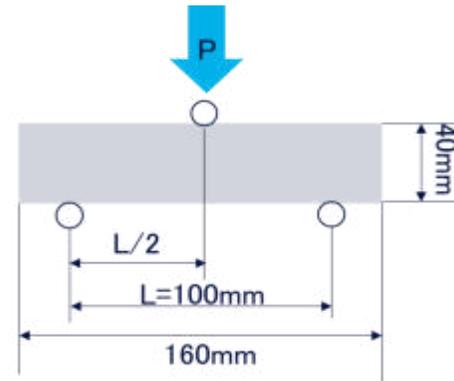
	RF400 (current fiber)	RF400H (new fiber)
Tensile Strength(MPa)	1,100	1,400

## Mix Proportion

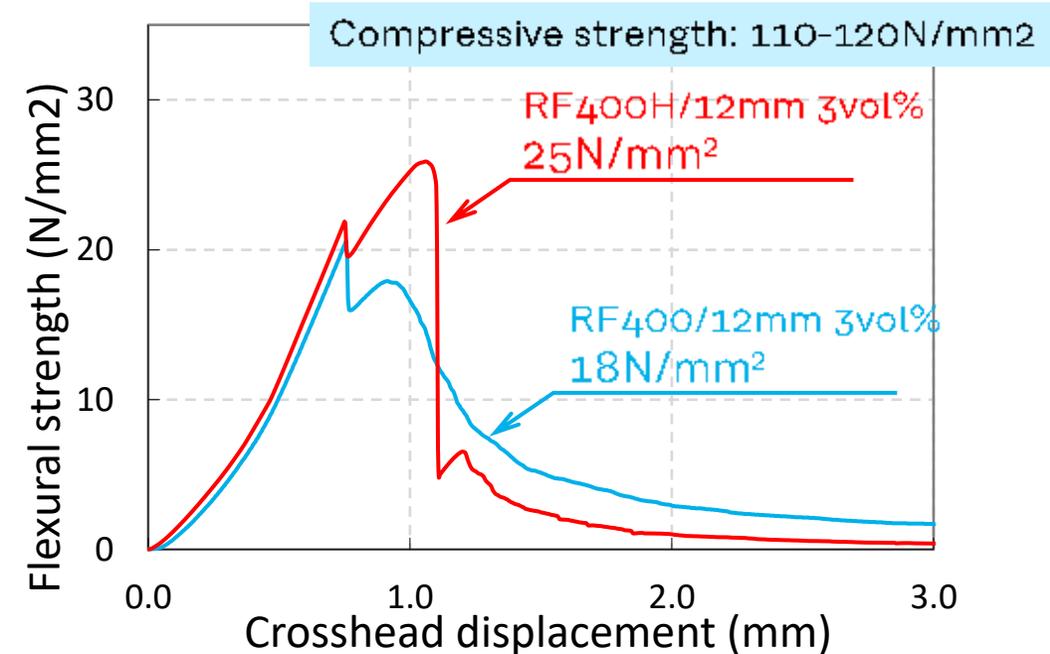
	Ratio
Water/Binder	0.18
Water/Cement	0.21
Sand/Binder *	0.92
Silica Fume/Binder	0.14

\* Binder: OPC + Silica Fume

## Flexural test method

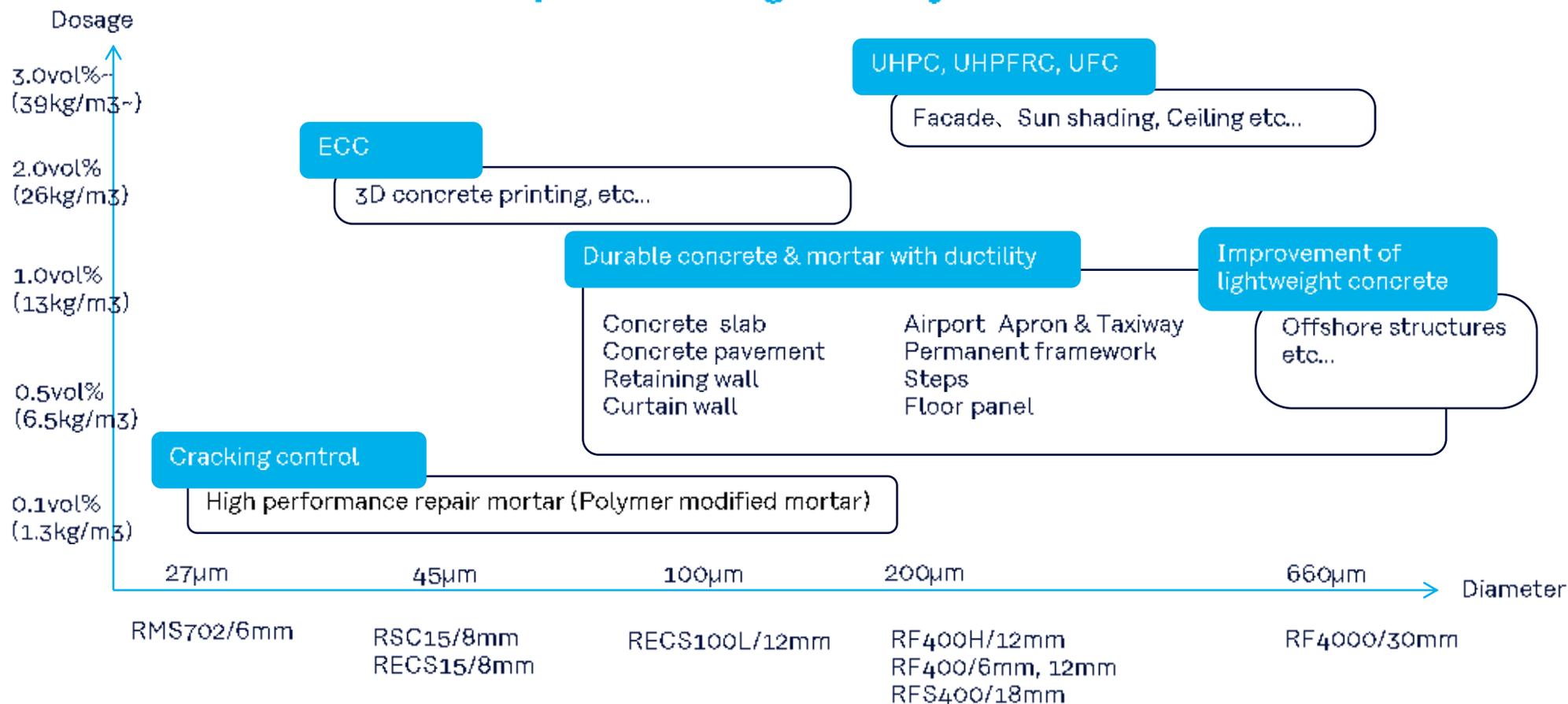


Test condition:  
Specimen size: W x D x L = 40 x 40 x 160 (mm)  
Load speed : 0.2 mm/min



# General map of fiber dosage vs. items for each application or mix

## KURALON™ and KURALON K-II™ product range meet your demands



# Your Contacts

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