High Zirconia Alkali-resistant Glass Fibre

NEG ARG FIBRE

For Glass Fibre Reinforced Concrete (GRC) and Asbestos Replacement Products

Continuous Roving

Chopped Strands

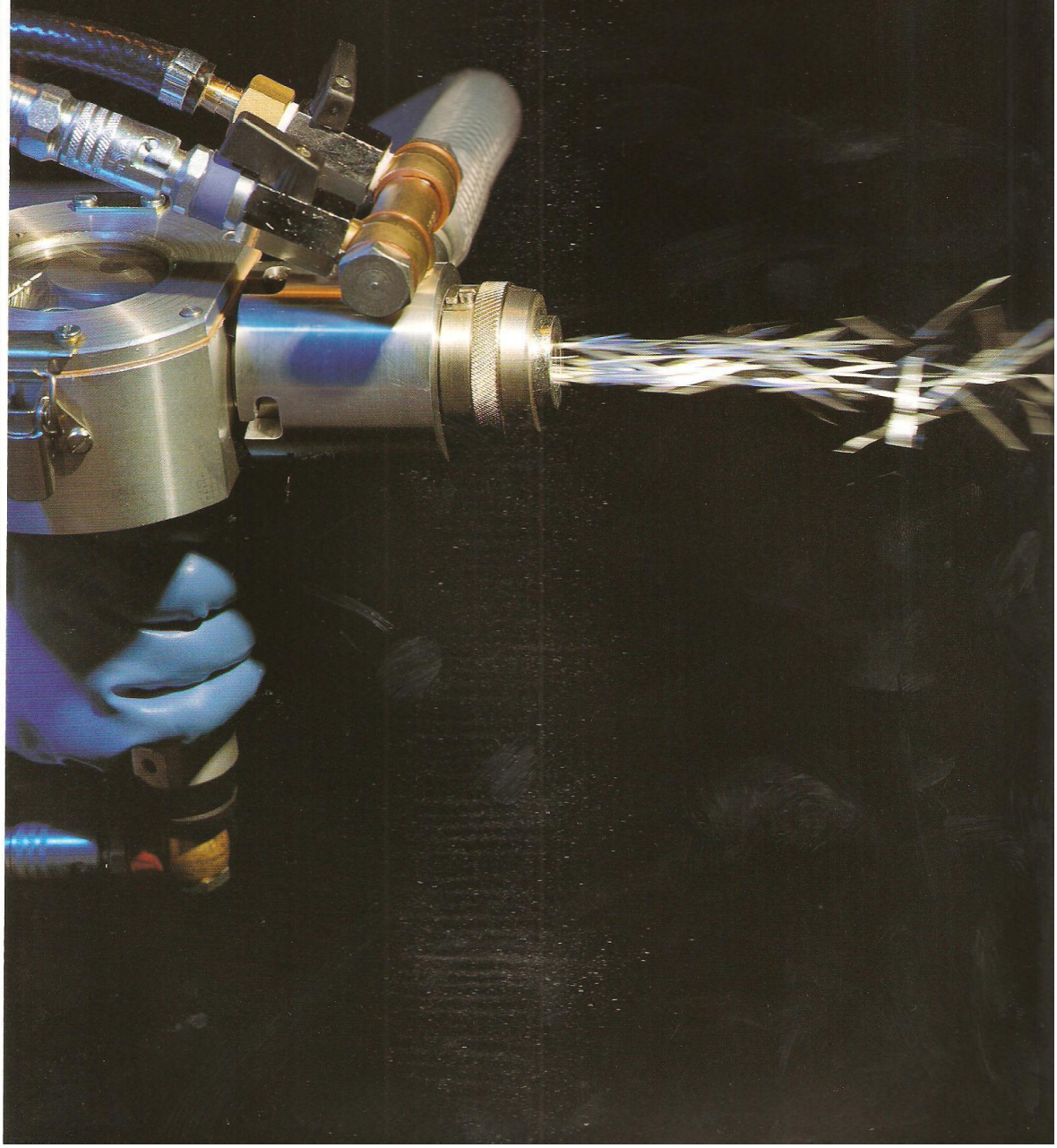
Net

Super-Cracknon

Nippon Electric Glass

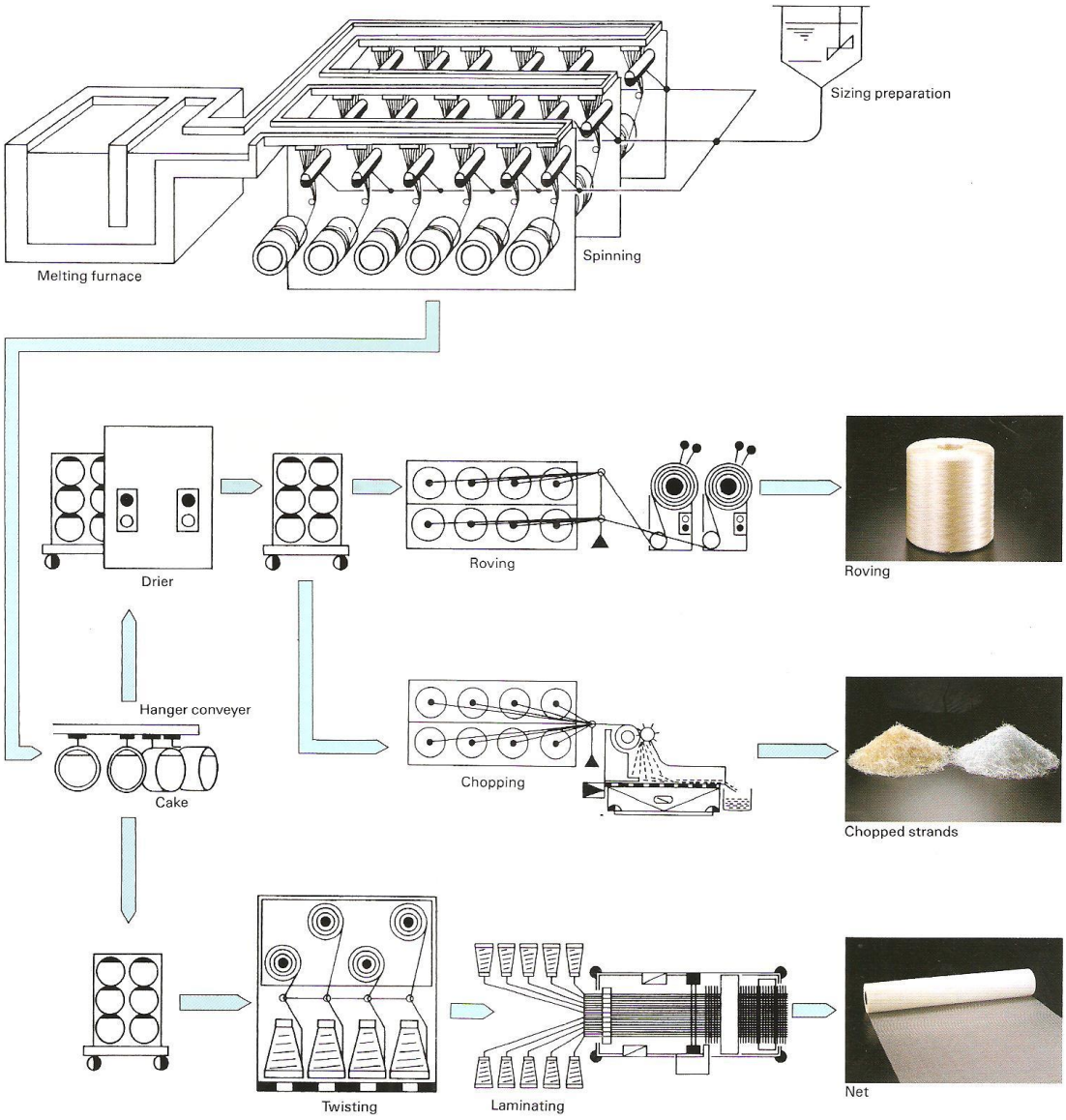
High-quality NEG ARG Fibre

NEG ARG Fibre, manufactured by Nippon Electric Glass Co., Ltd. (NEG) is used throughout the world as a reinforcement for cement composites, including asbestos replacement products.



NEG ARG Fibre Manufacturing Process

Mass production of high zirconia alkali-resistant glass fibre by NEG began in 1975 using a unique Direct Melt Method with an all-electric melting furnace.
At NEG we have always concentrated on providing products which meet the diverse needs of our customers. For this, we will continue to concentrate on product improvement, technology development and superior quality products.



Continuous Roving

Continuous Roving is made by gathering 100 to 200 ARG Fibre filaments into a strand, then winding 20 to 50 strands to form a cylindrical package. Continuous roving is best suited to the spray deposition process and is used in a wide range of products in construction, civil engineering, etc.

Characteristics

1. Roving products have excellent mortar wet-out characteristics.
2. Roving products have excellent chopping characteristics, and stable production can be carried out regardless of humidity and temperature condition.

Standard Specifications

Code	Roving (tex)	Strand (tex)	Strand
AR2500H-103	2500	78	32
AR2500H-200	2500	78	32
AR5000H-530X	5000	78	64
AR2500H-350Y	2500	39	64

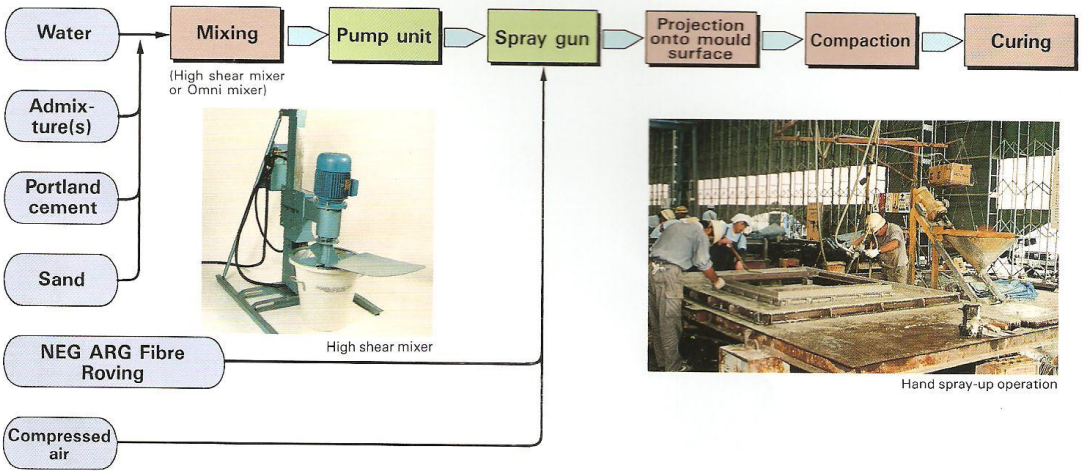
- **Package**
  - H-103 : 19.0 kg in shrink-film
  - H-200 : 19.0 kg in shrink-film
  - H-530X : 17.5 kg in shrink-film
  - H-350Y : 17.5 kg in shrink-film
- **Order Number Key**

A R 2500 H-200

- H — Sizing
- 200 — Roving tex (tex: g/1000m)
- 2500 — Roving
- R — Alkali-resistant glass

- **Process** — Spray-up, centrifugal casting
- **Application** — GRC

Hand spray-up process



Chopped Strands

Chopped strands are produced by cutting bundled strands into required length.
There are two types:

- A high integrity non-filamentised strand to meet the requirements of the conventional "premix" products
- A high filamentised dispersible strand for use in the Hatscheck and Magnani process for asbestos free products

Standard Specifications

Type	Code	Cut Length (mm)
High Integrity Type	ACS○○PH-901X	9,13,19,25
	ACS○○H-530X	13
	ACS○○H-350Y	13
	ACS○○H-350Z	13
Dispersible Type	ACS○○S-750	6,13

○○=cut length in mm

- **Package**——20 kg in polyethylene bag

- **Order Number Key**

A CS 13 H-530 X

Number of filaments per strand*
(High integrity type only)
Sizing H: High integrity type
S: Dispersible type
Length in mm
Chopped strand
Alkali-resistant glass

*X: 200fil/st
Y: 100fil/st
Z: 50fil/st
without letter: 200fil/st

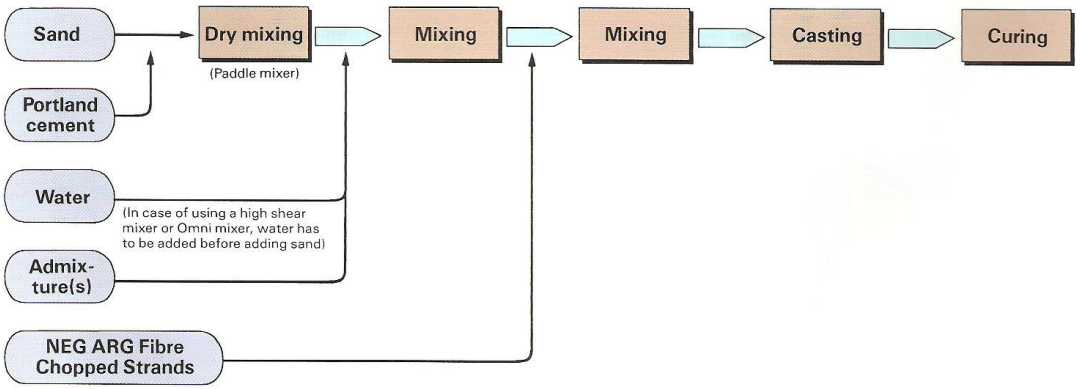
Characteristics

1. High integrity-type chopped fibres disperse as strands in a matrix of cement slurry.
2. Dispersible-type chopped strands disperse into filaments in a matrix of calcium silicate or cement slurry.

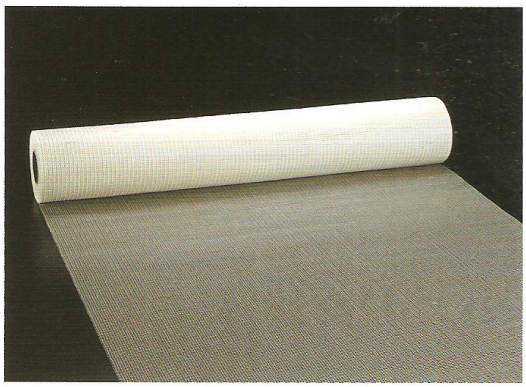
- **Process**
High integrity type: Premix, casting
Dispersible type: Hatschek, Magnani, casting

- **Applications**
High integrity type: GRC, Calcium silicate
Dispersible type: Asbestos replacement

Premix process



Net



Net (scrim) is produced by laminating twisted strands into a net shape and gluing together with resin.

Characteristics

Net is used in GRC manufacturing with a spray-up process, to reinforce the areas which need additional strength, or to prevent sagging.

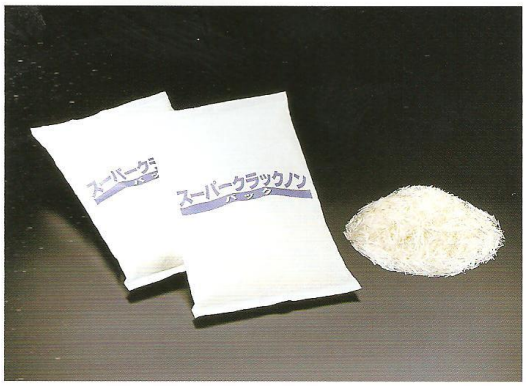
Standard Specifications

Code	Weight (g/m²)	Width (m)	Length (m)
SC NET	80	1	50
TD10×10	80	1	100
TD5×5	150	1	50

Cracknon net (width : 150mm, length : 100m) is also available.

● **Application**——Render, GRC products

Super-Cracknon Pack



Just add one bag of Super-Cracknon Pack to 1m³ concrete.

Characteristics

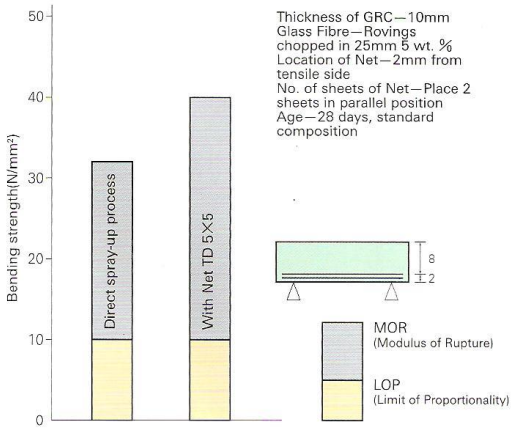
Super-Cracknon Pack can control plastic shrinkage cracking of concrete.

● **Package**
1bag: 0.5 kg in weight
1case: 20 bags

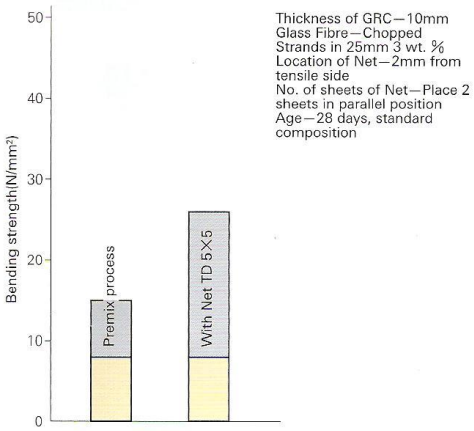
● **Application**——Concrete

Bending Strength of GRC using Net

1. Combination with Direct Spray-up Process



2. Combination with Premix Process



Characteristics of NEG ARG Fibre

NEG ARG Fibre is a high-quality alkali-resistant glass fibre which is designed to reinforce cementitious and other alkaline matrices. NEG ARG Fibre has non-combustibility characteristics, corrosion resistance, and also has high tensile strength as piano wire.

1. Properties of NEG ARG Fibre

NEG ARG Fibre properties are highly stable because of its unique glass composition and manufacturing process using an all electric direct melt furnace.

Table 1 Properties of NEG ARG Fibre

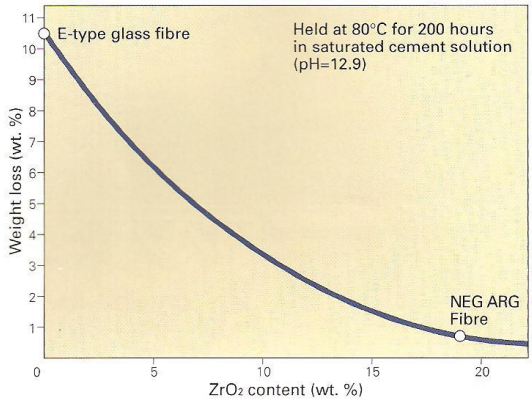
Property				
Thermal expansion coefficient		$\times 10^{-6}/°C$	9	
Density		g/cm³	2.7	
Tensile strength		GN/m²	1.4	
Young's modulus		GN/m²	74	
Strain to failure		%	2	
Alkali-resistivity	Weight loss 1)	%	NEG ARG Fibre	0.8
			E-type glass fibre	10.5
	Tensile strength retention 2)	%	NEG ARG Fibre	75
			E-type glass fibre	14
Acid-resistivity	Weight loss 3)	%	NEG ARG Fibre	0.6
			E-type glass fibre	42.7

1) Weight loss rate (%) of strand, held at 80°C for 200 hours in saturated cement solution
2) Tensile strength retention rate (%) of cement paste applied strand, held at 50°C for 300 hours in 100% RH
3) Weight loss rate (%) of glass powder, held at 80°C for 90 hours in 10% HCl

2. Alkali Resistivity of ARG Fibre

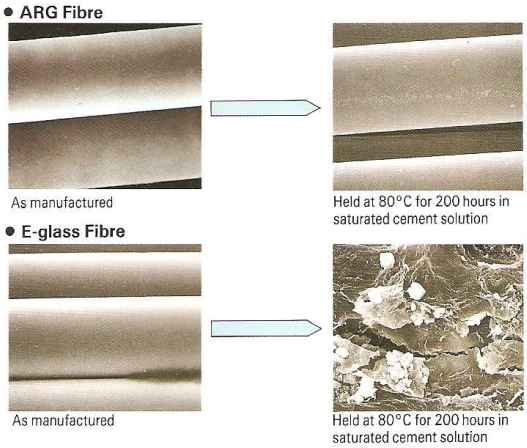
The alkali resistance of glass fibre is determined mainly by the zirconia (ZrO_2) content in the glass. The higher the ZrO_2 content, the greater the alkali resistance (Figure 1).

Figure 1 Alkali Resistance of Glass and ZrO_2 Contents



Since NEG ARG Fibre contains the largest percentage of ZrO_2 (Min. 19%) of commercially available alkali-resistant glass fibres, it has outstanding alkali resistance. In Figure 2 is shown the comparison of alkali erosive attack in ARG Fibre and E-type glass fibre before and after being immersed in saturated cement solution at 80°C.

Figure 2 Comparison of Alkali Erosive Attack in ARG Fibre and E-type Glass Fibre (SEM-photohgraphs)



● **Number of NEG ARG Fibre Related Patents** (as of May, 1990)
Japan Patents: 44 (pending 16) Japan Utility Articles: 4
Overseas Patents: 17 (pending 4)

U.S.A.

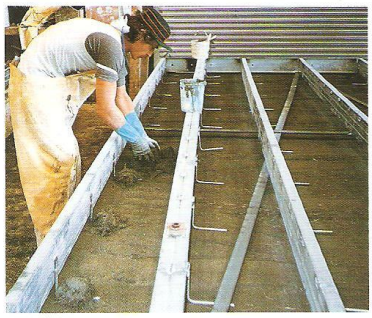
GRC exterior panels using NEG ARG Fibre have been used in a wide range in construction, civil engineering, etc. Recently, 30 to 40 storey high-rise buildings in the United States employed GRC cladding and included the use of a steel stud frame system. Design, manufacture and installation of these GRC cladding panels are safely carried out in accordance with PCI's* guideline, and Building Codes.
The concept behind this installation method is that the GRC skin is isolated from the steel studs, via flex anchors, which are bonded to the GRC skin. The flex anchors enable the weight of the GRC skin to be supported elastically, yet yield to compensate for the volumetric change of skin.

*PCI: Prestressed Concrete Institute
175 West Jackson Boulevard, Chicago, Illinois 60604, U.S.A.

Characteristics of Steel Stud Frame Panel

1. Flex anchors allow expansion/contraction of GRC panel, reducing constraint on the panel.
2. Without ribs, light weight has been achieved.
3. Both light-weight steel frame and the space of anchors give the superior wind pressure resistance required for 30 to 40-storey building.
4. There is enough flexibility to withstand an earthquake.**

**The structure and the GRC cladding panel system performed very well during the Loma Prieta earthquake in San Francisco on 17th October 1989.



Exterior panels (The San Francisco Marriott Hotel, San Francisco, CA)