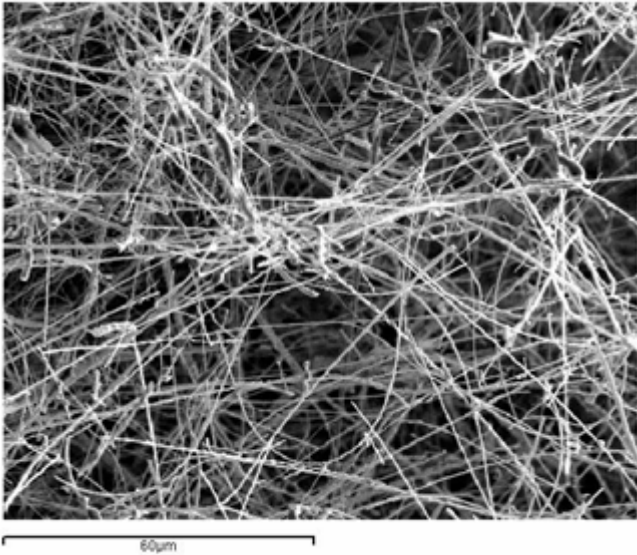




NKR[®] Fibers

Single Crystal Alumina Fibers



Main Features

Produced using Neoker's unique deposition technology, NKR[®] fibers can be described with a high degree of accuracy as:

- Nearly pure alpha alumina (α -Al₂O₃, corundum or sapphire). Absence of secondary deleterious phases.
- Corundum is considered the hardest material among oxides.
- Single crystal: Eventually free from grain boundaries.
- Stability in a huge range of conditions (corrosive, acid, alkalis).
- High Mechanical performance.

NKR[®] single crystal alumina fibers are generally used to improve the thermal performance and the chemical and mechanical properties of advanced composites.

Single crystal alumina (sapphire) fibers are able to provide toughening to ceramic composites (CMC's) and survive the needed temperatures.

NKR[®] single crystal alumina fibers NKR are the best candidates for mechanical reinforcement of

metal and alloys, to avoid deformation at high temperatures in such MMC's.

Our customers have also reported improvements in thermal and mechanical features of Polymer Matrix Composites (PMC's) by adding NKR[®] fibers to their compositions.

Uses of NKR[®] fibers

NKR[®] fibers are typically indicated for:

- Aggressive environments (acids or bases).
- Combustion environments (engines, turbines ...).
- A wide range of working temperatures: (melting point ~2000° C, stable up to ~1700°C even in reducing atmospheres).
- Improved creep resistance in MMC's and CMC's.
- Increased hardness and abrasion resistance.
- Improved impact resistance.

For more information on the different applications of the NKR[®] fibers, please visit our web page.

Forms of use

NKR[®] fibers can be used to make filters of preforms, or as a reinforcing phase in composite materials like MMC, CMC or PMC:

- Used as an additive mixed with the original raw materials.
- Developed as preforms for subsequent infiltration.
- Applied to the composite through surface treatments.
- As an insulator able to withstand high temperatures, aggressive environments and friction.

For more information about how to use NKR[®] fibers, please send us an e-mail.

Chemical Composition

Due to VLS deposition technology, NKR® fibers can have trace element content of catalysts as Si, Ni, or others.

Under our Integrated Quality and Environment Management System, Neoker performs DRX and ICP analysis periodically on production batches, being typical results that their purity is around 90%, although higher purities could be available on demand.

Characterization

As an example of a typical batch, we show below a characterization analysis made at Technion – Israel Institute of Technology. Different batches may slightly vary.

Element	Technique	Outcome
Length and diameter distribution	SEM, HRSEM, Optical microscope	Length between ~1 and 500 μm Average length: $62 \pm 60 \mu\text{m}$ (>1000 counted); Average diameter: $2.7 \pm 2 \mu\text{m}$ (>200 counted); Average aspect ratio: 64 ± 50
Chemical composition	EDS	$\alpha\text{-Al}_2\text{O}_3$ (Sapphire single crystal)
Surface morphology Planar defect content (grain boundaries)	SEM, HRSEM, TEM, EBSD	Growth direction and steps analyzed on one fiber in TEM: <ul style="list-style-type: none">•c-axis growth direction;•steps at surfaces composed of the $(10\bar{1}1)$ and $(\bar{1}012)$ planes. 23 fibers analyzed by EBSD, 22 show just one orientation (single crystal), and only fiber showed two orientations.

State of the Art Features:

Below we show the typical accepted values for alpha alumina:

Density: 4 gr/cm^3

Melting Point: 2050°C