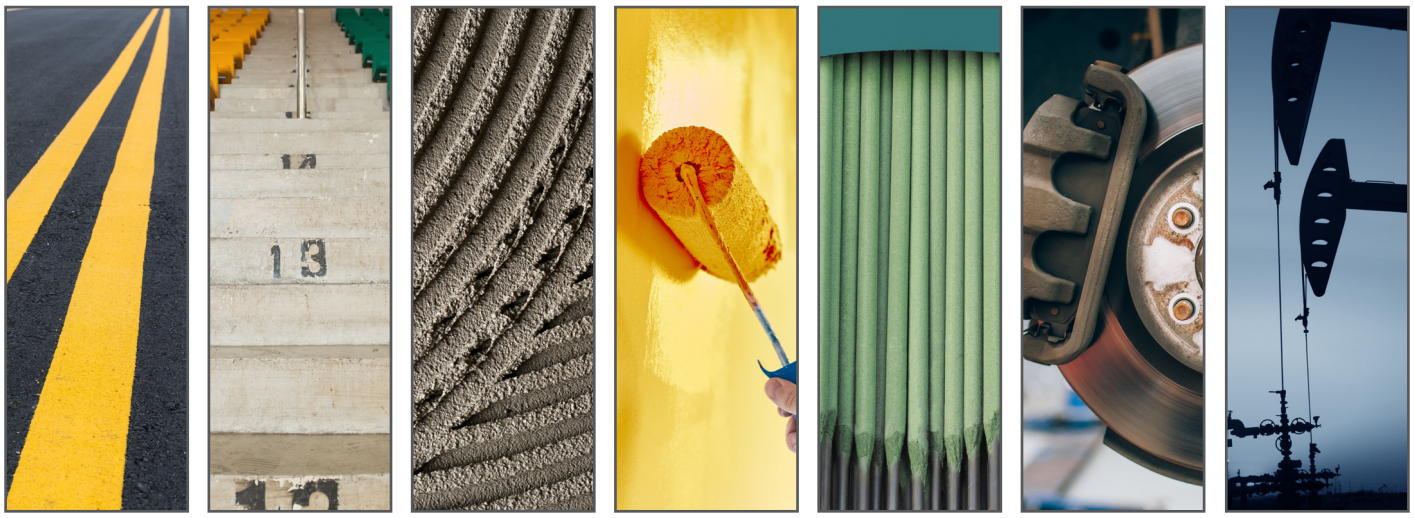

JRS USA INDUSTRIAL PRODUCT PORTFOLIO

info@jrsusa.com

What is cellulose?

Cellulose is an insoluble, powdery to fibrous thixotropic fiber, produced from a range of renewable plant materials such as hard and softwood trees, oats, rice, potatoes, etc. Raw material is not the only factor to consider when trying to find the right fiber for your product. Fiber thickness, length, purity and fibrilness also play a role, as each attribute provides a different functionality.

Benefits of JRS USA cellulose

- Aids in reinforcement
- Improves flowability
- Thickener
- Improves drying gradient
- Increases green strength
- Prevents drainage
- Filler
- Stabilizer
- Extrusion aid
- Absorbent/ matting agent

What is modified cellulose?

Modified cellulose is a colloidal gelling system based on water insoluble microcrystalline cellulose co-processed with water soluble polymers, carboxy-methylcellulose.

Benefits of JRS USA modified cellulose

- Reduce syneresis
- Improve open-time
- Thickener
- Stabilize
- Rheological additive
- Gel forming

What are specialty fibers?

Specialty fibers are non-cellulose based fibers, produced from cotton, sisal, nylon, polyester, polyethylene, acrylic and non-gelling MCCs materials.

Benefits of JRS USA specialty fibers

- Impact resistance
- Excellent weatherability
- Self extinguishing*
- Increased tensile strength
- Not prone to degradation
- Non absorptive

* Nylon flock only

Most commonly recommended JRS USA cellulose products

JRS USA Fiber	Avg. length	Density (g/L)	% Ash
CF 100	1400	30	3-20
ARBOCEL® 230	1000	60	20
CF 240	600	80	20-28
ARBOCEL® BWW40	250	130	<1
ARBOCEL® GCW10	250	120	27
Alpha-Cel® BH40	60	182	<1
Alpha-Cel® BH100	40	248	<1

Most commonly recommended JRS USA modified cellulose products

JRS USA Fiber	Avg. length (µm)	2% Cp Min.	2% Cp Max.	Fiber
ARBOCEL® P4000X	10	2000	4000	MCC
ARBOCEL® P4000S	10	12.5%	25.0%	MCC
ARBOCEL® P4000	10	16.7%	50.0%	MCC

Most commonly recommended JRS USA specialty products

JRS USA Fiber	Length (µm)	Density (g/L)	Type
ARBOCEL® UFC100	10	185	MCC
W200 Cotton	350	152	Cotton
62 Sisal	9000	128	Sisal
31WAF	500	44	Acrylic
62WNF-T	1100	70	Nylon
FILLTECK 250	6000	NA	Polyester
15WPF-E	300	128	Polyester

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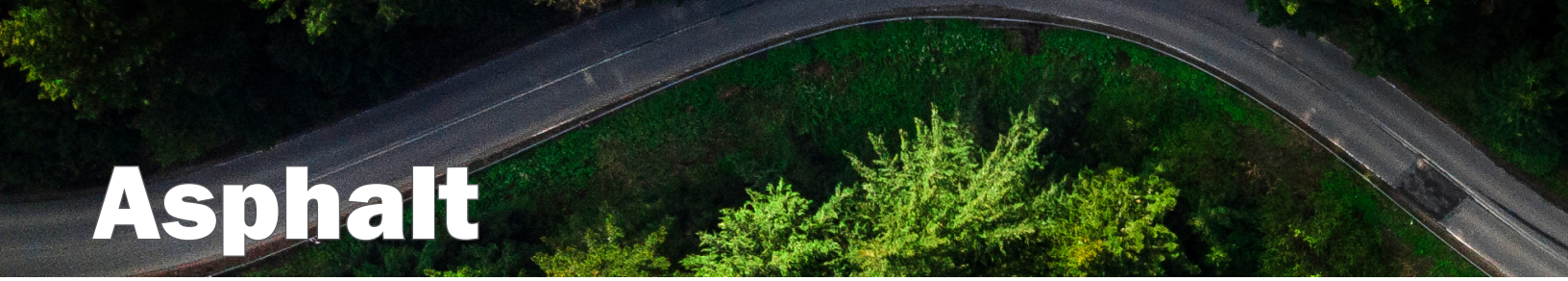


Asphalt

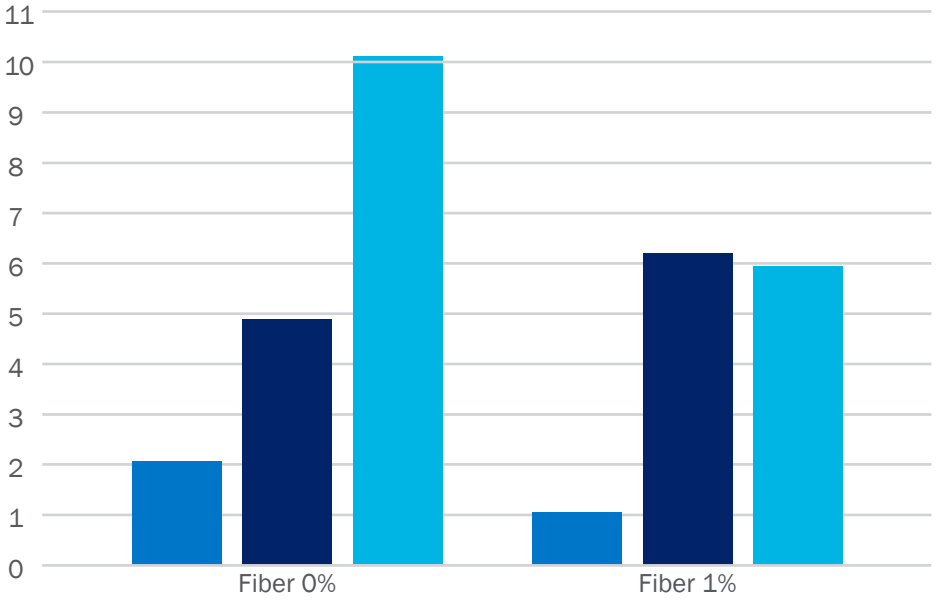
Asphalt

The addition of JRS fibers to asphalt systems provides a physical matrix within the mix. This matrix helps to enable a uniform coating on the aggregate as well as improve adhesion.

Benefits of JRS USA fiber in asphalt

- Improves consistency
- Improves cure time
- Improves wet track abrasion
- Reduces drain down
- Increased set time
- Reduces syneresis
- Improves cohesion
- Reduces oil migration

Wet track abrasion, g/sq-ft



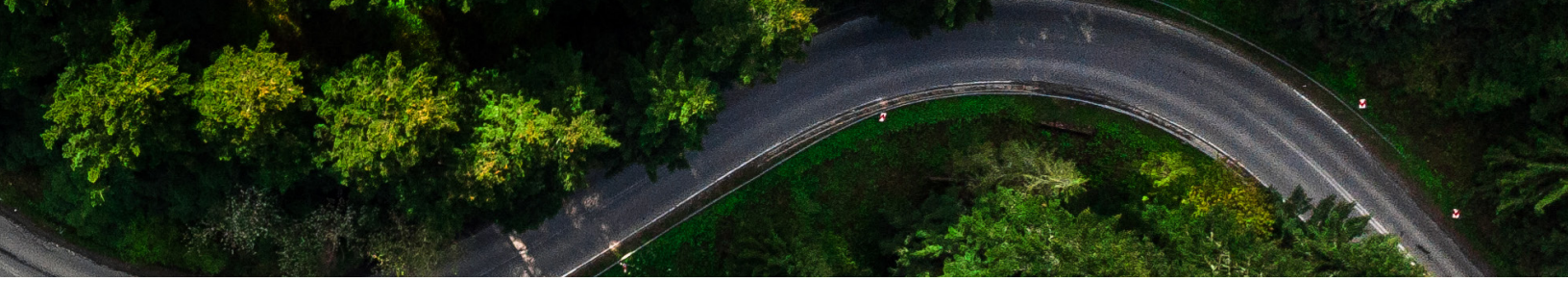
Adding a small amount of fiber improves abrasion resistance of emulsion.

Cohesion percent change - Stronger film through 3 dimensional matrix

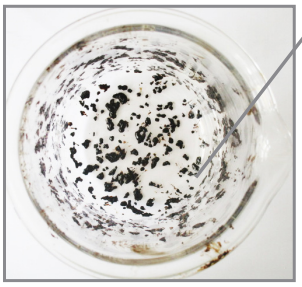
	Fiber 0%	Fiber 1%	Fiber 1.5%
Asphalt Mix Design 1	9	27	27
Asphalt Mix Design 2	14	17	19

Cure time percent change - Less downtime

	Fiber 0%	Fiber 1%	Fiber 1.5%
Asphalt Mix Design 1	2.5	3	3.5
Asphalt Mix Design 2	3.5	3.75	3.75



Reduces drain down



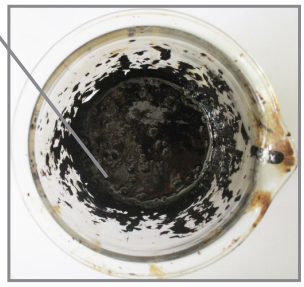
Contains:

- 6.8% asphalt
- 0.3% JRS USA **ROAD-CEL®** fiber
- 92.9% aggregate and filler

ROAD-CEL® allows the asphalt to bond to the aggregate.

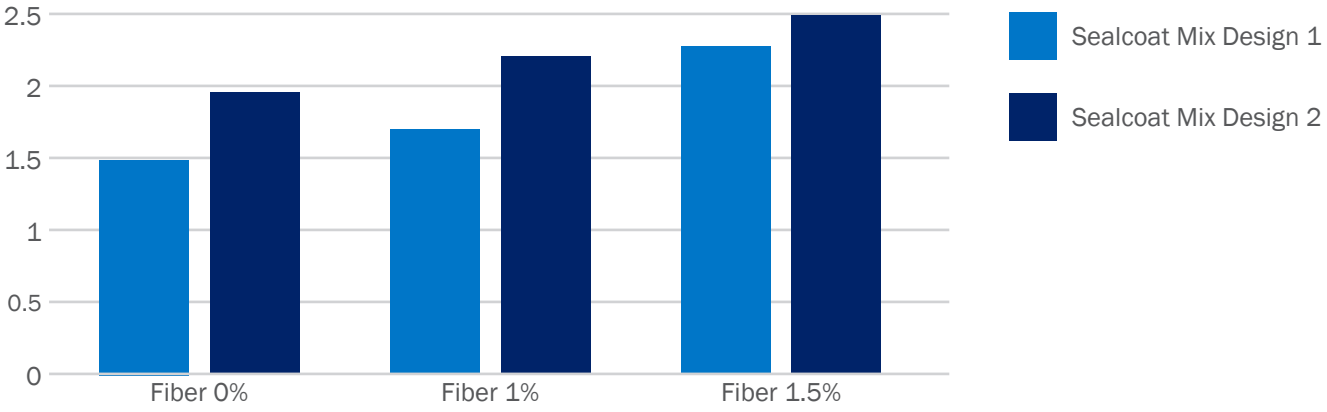
Contains:

- 6.8% asphalt
- 0.3% competitor fiber
- 92.9% aggregate and filler.



Competitor fiber allows for significant asphalt drain down and loss of binder.

Increased set time, hours - sealcoat



Most commonly recommended JRS USA products for asphalt

JRS USA Fiber	Avg. Length (µm)	Density (g/L)	Oil Binding	Applications
ROAD-CEL®	1000	60	5 x's	Asphalt roads, roof coatings, mastics, sealer, moisture barriers, tapes, sound dampeners
CF 425	600	80	4 x's	
ARBOCEL® FTP	500	92	3.10 x's	
CF S40605	530	90	4 x's	

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Cement

Cement

Various JRS fibers bind excess water within the cellulose structure, modifying the cementitious formulation to help improve the overall physical properties in a given formulation. By adding modified fibers to bagged cementitious materials you can reduce dust and comply with OSHA regulations.

Benefits of JRS USA fiber in cement

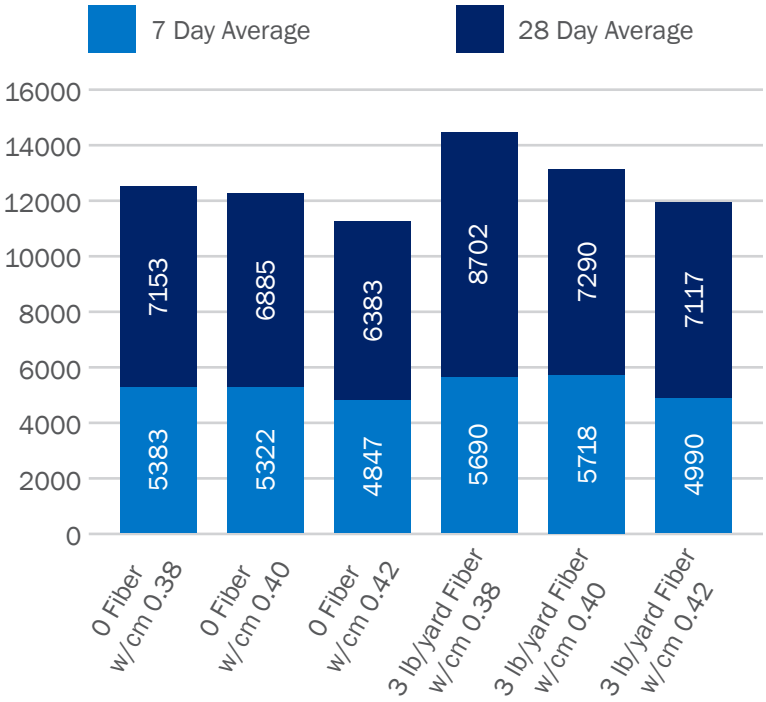
- Decreases bleedwater
- Improves fluidity and stability
- Improves compressive and flexural strengths
- Low dusting
- Prevents cracking

Reduces matrix segregation

The mix on the left contains no fiber and shows significant bleedwater around the base.

The mix on the left contains JRS USA's **ARBOCEL® BWW40 LD** fiber. Not only is there less bleedwater, the mixture has minimal slump compared to that of it's counterpart without fiber.

Improves compressive and flexural strengths



Most commonly recommended JRS USA products for cement

JRS USA Fiber	Avg. length (µm)	Density (g/L)	Water Binding	Applications
ARBOCEL® BWW40-50 LD	250	240	3.4 x's	Mortars, grouts, redi-mix, self leveling underlayment, tile adhesives, stucco
ARBOCEL® BWW40	250	130	6.3 x's	
CF100	1400	30	13.35 x's	

Adhesives and sealants

Adhesives and sealants

The fibrous characteristics and tendency for hydrogen bonding make JRS USA fibers the perfect reinforcing material. Their ability to bridge is substantial in products that are used to coat and/or seal uneven surfaces.

Benefits of JRS USA fiber in adhesives and sealants

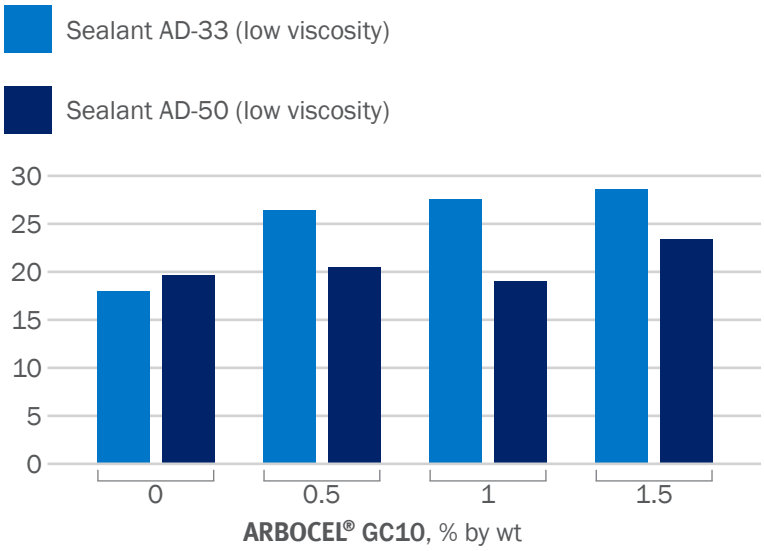
- Reduces oil migration
- Improves tensile strength
- Elongation not adversely affected
- Reduced shrinkage
- Extrudability unaffected

Reduces oil migration

The small addition of JRS USA fiber greatly reduces oil, polymer and plasticizer bleed.

Without fiber the sealant can lose properties and stain substrates.

Tensile strength (ASTM D412), psi



Most commonly recommended JRS USA products for adhesives and sealants

JRS USA Fiber	Avg. Length (µm)	Density (g/L)	Type	Applications
SYLOTHIX®	100-400	1000-1600	HDPE	Caulking, wood glues, epoxy adhesives, tapes, mastics
ARBOCEL® 230	1000	60	Reclaimed	
ARBOCEL® FTP	500	92	Reclaimed + surfactant	
ARBOCEL® GCW10	250	120	Reclaimed white	
CF725	540	88	Reclaimed gray	

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Paint and coatings

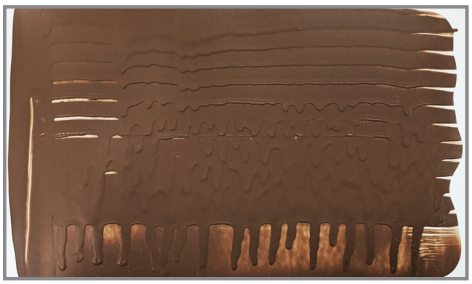
Paints and coatings

The rheological properties and recovery of JRS USA cellulose create a smooth and effortless rolling of paint with less splatter.

Benefits of JRS USA fiber in paints and coatings

- Reduces cracking
- Improves sag resistance
- Improves open-time
- Provides sheer thinning
- Reduces syneresis

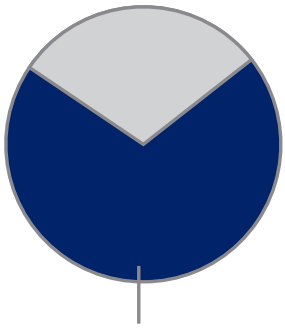
Improves sag resistance



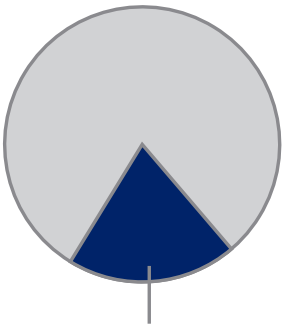
Control without JRS USA fiber

Test with **ARBOCEL® P-4000**

Improves open time

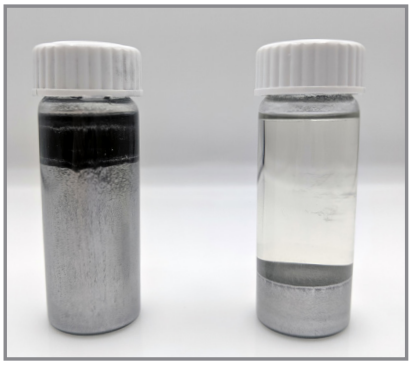


ARBOCEL® P4000 included = 42 minute open time



No JRS USA fiber included = 12 minute open time

Reduces settling and caking



The left vial shows paint that contains **ARBOCEL® P4000** while the vial on the right does not contain fiber.

Most commonly recommended JRS USA products for paint and coatings

JRS USA Fiber	Avg. length (µm)	Density (g/L)	Type	Applications
ARBOCEL® GCW10	250	120	Reclaimed white	Interior and exterior paints, waterproof coatings, EIFS, stains, damp proofing
ARBOCEL® P-4000	10	420-650	MCC-CMC	
SYLOTHIX®	100-400	1000-1600	HDPE	
ARBOCEL® UFC100	10	160	MCC	

Welding rods

Welding rods

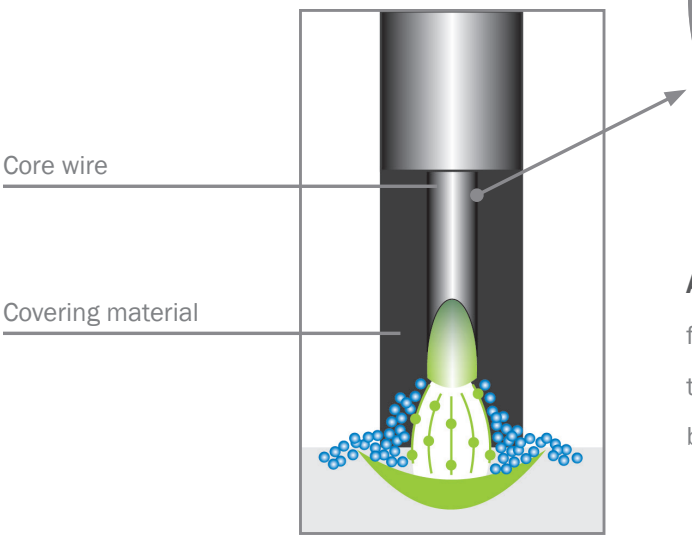
JRS Fibers are widely used in the manufacture of many types of stick welding rods. The specific fiber length and wicking nature of JRS celluloses helps to provide optimal extrusion and bond strength around the electrode.

Benefits of JRS USA fiber in welding rods

- Reinforces coating consistency
- Aids in extrusion
- Enhances welding arc strength
- Prevents slag movement

Prevents slag movement

During the burning stage, **ARBOCEL®** causes a high gas pressure in the direction of the weld seam. The combustion causes a rapid flow and deep fire. Slag is fixed and has no chance to move, giving exceptional weld results even in difficult positions.



Reinforces coating consistency

ARBOCEL® Cellulose fibers in 3D fiber network

ARBOCEL® cellulose fibers create a three dimensional fibrous framework, which supports an even drying process and prevents the formation of cracks during electrode production giving you a better quality product and a faster production process.

Most commonly recommended JRS USA products for welding rods

JRS USA Fiber	Avg. length (µm)	Density (g/L)
ARBOCEL® F200	200	196
ARBOCEL® B800	120	176
ARBOCEL® B100	40	170
Alpha-Cel® BH40	60	182

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Friction

Friction

The high melting point, elastic fiber structure and carbon forming properties of JRS USA's **ARBOCEL®** fibers create the perfect addition to any break pad for a smooth and quiet ride.

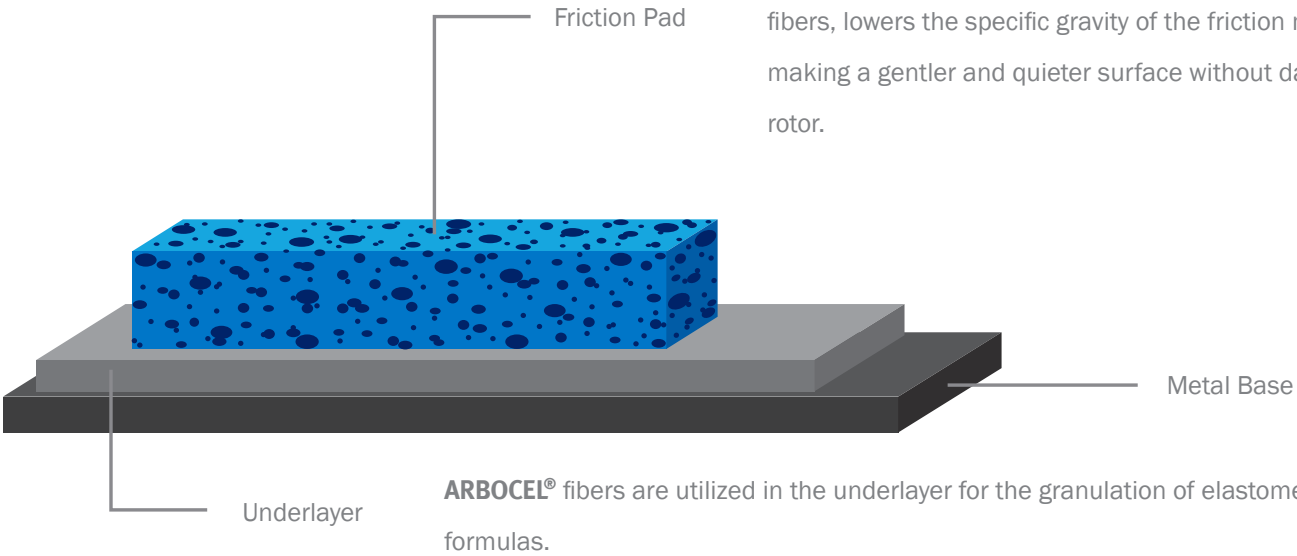
Benefits of JRS USA fiber in friction material

- Offers a cost reduction
- Improves processing
- Non carcinogenic
- Reduces noise
- Dust reduction
- Pore creator

ARBOCEL® in Brake Pads

JRS USA fibers are used in the pre-mixing and main mixing processes for friction pad production. Working to granulate elastomers in basic compounds, **ARBOCEL®** also works as a multi-functional fiber for homogenizing and reinforcing mixing components in main compounds.

The porous surface of the friction pad, created by **ARBOCEL®** fibers, lowers the specific gravity of the friction material, making a gentler and quieter surface without damaging the rotor.



ARBOCEL® fibers are utilized in the underlayer for the granulation of elastomers in friction formulas.

Most commonly recommended JRS USA products for friction

JRS USA Fiber	Avg. length (µm)	Density (g/L)
ARBOCEL® 230	1000	60
ARBOCEL® FT	540	90
ARBOCEL® BWW40	250	130
D220 Denim	600	110
31WAF Acrylic	500	44

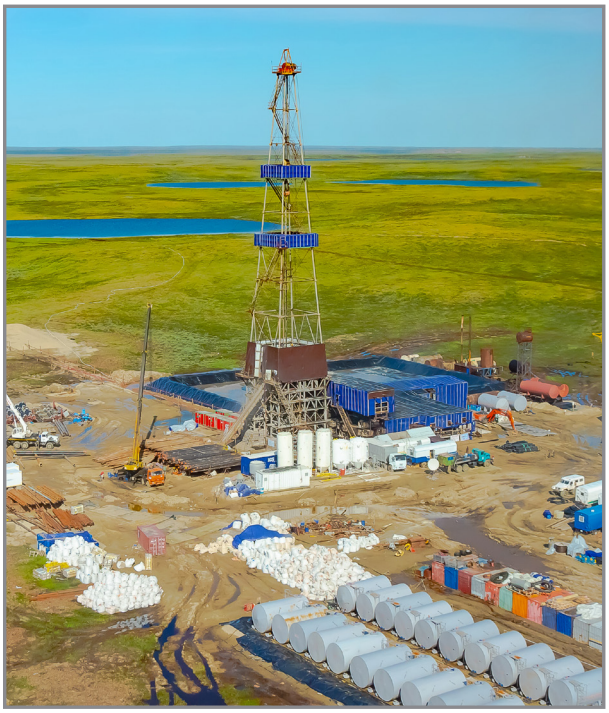
Oil fields

Oil fields

JRS provides a broad range of natural fibers with structural and rheological properties well suited for use in your oil field operation from well development through end-of-life plugging.

Benefits of JRS USA fiber in oil fields

- Consistent dosing
- Helps control viscosity
- Adsorbent
- Wide pH tolerance
- Provides sheer thinning
- Provides cost reduction
- Environmentally safe



LCMs

Unlike competitors, JRS USA LCMs are only made of clean fibers with consistent length, giving you the ability to create a dependable formulation that doesn't need adjusting with each bag.

Drilling muds and fluids

From super fine MCC to fiber lengths over 2,000 µm, JRS fibers help create flowability in your drilling muds and fluids so equipment can continue to run efficiently and smoothly.

Adsorbents

Economical and environmentally safe, JRS USA fibers will adsorb several times their weight in oil and contaminants in both wet and dry environments.

Most commonly recommended JRS USA products for oil fields

JRS USA Fiber	Avg. length (µm)	Density (g/L)	Applications
Drill Paper	1400	30	LCM
ARBOCEL® 483B	1000	65-85	LCM
ARBOCEL® BWW40-50 LD	250	240	Cements
ARBOCEL® P-4000	10	420-650	Drilling fluids
Sisal	1500-9000	130-250	LCM

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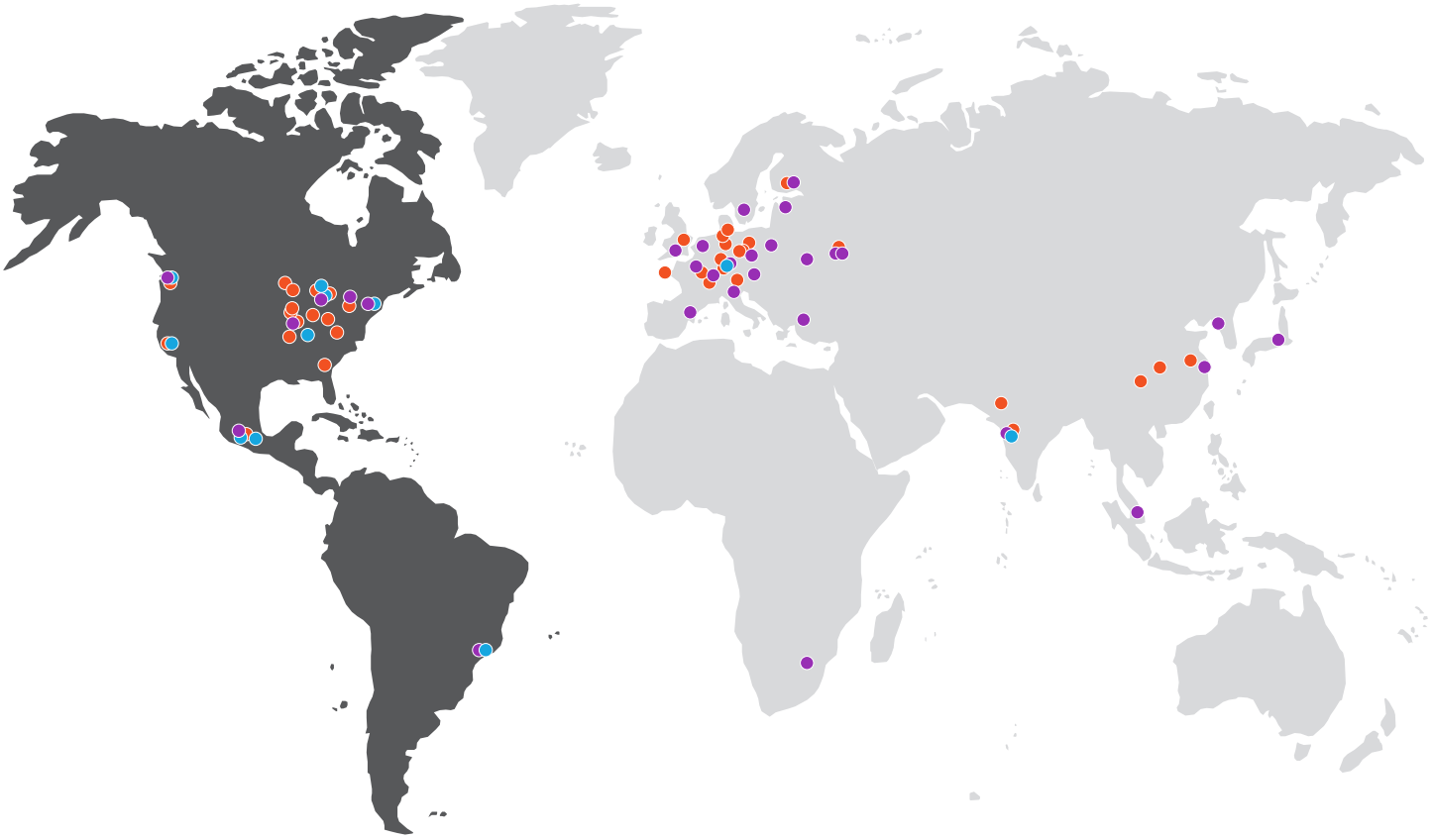
Your global partner

The JRS Group has over 140 years of expertise to call upon for all of your fiber needs. A global network of companies, our dedicated teams work together to provide you with the highest quality products available in the market. No matter if you are looking for customization or reformulation, we are always ready to help you create the most effective finished product to reach your goals.

Contact your JRS USA team with questions today.



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J. RETTENMAIER USA LP

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A Member of the JRS Group

Your JRS Partner for the USA + Canada
16369 US 131 Highway
Schoolcraft, MI 49087
Phone: (269) 679 2340
Fax: (269) 679 2364
Web: jrsusa.com

info@jrsusa.com

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