TECHNICAL DATA SHEET

CARBOBOND LITE

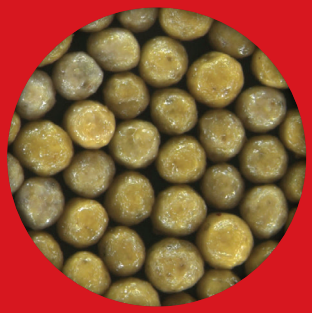
Resin-coated low-density, high-performance ceramic proppant

Features

- Formulated for maximum compatibility with complicated frac fluids
- Bonded proppant pack reduces effective stress on proppant
- High cyclic loading tolerance
- Resin coating completely encapsulates substrate
- Bonds in the fracture with temperature and closure

Benefits

- Versatile—expands the usable application range (depth, temperature and stress)
- No proppant flowback—eliminates subsequent equipment damage, expense of cleanouts and disposal
- Maintains conductivity—resin coating prevents fines from being released
- Maintains particle integrity—prevents chemical attack on substrate
- No additional chemical costs—since no fluid chemistry change is required, the job can be pumped as designed



Extending the lightweight advantage

The higher-strength CARBOBOND® LITE resin-coated low-density, high-performance ceramic proppant is effective at greater well depths, temperatures and stresses than any comparable premium lightweight ceramic proppant. CARBOBOND LITE also requires 17% less proppant by weight than any resin-coated intermediate-density ceramic proppant. CARBOBOND LITE is designed with high cyclic loading tolerance, while the bonded proppant pack reduces the effective stresses encountered at deeper depths.

Long-term conductivity

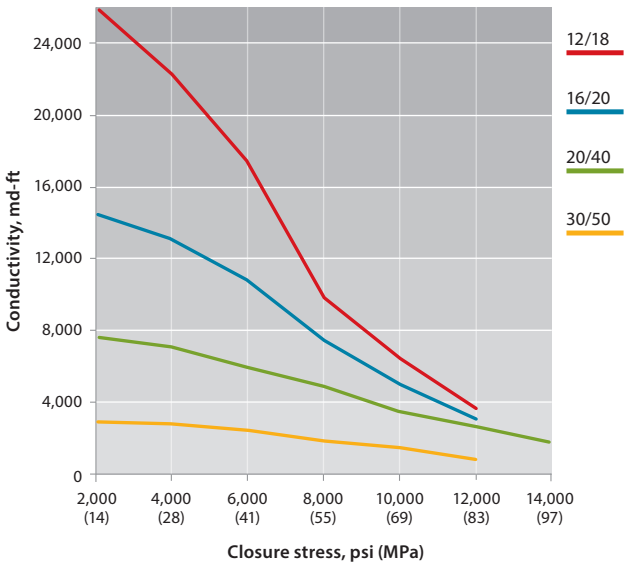
Reference conductivity, md-ft @ 250˚F (121°C)

Closure stress psi (MPa)	12/18	16/20	20/40	30/50
2,000 (14)	24,670 (7,519)	14,355 (4,375)	7,715 (2,351)	2,985 (910)
4,000 (28)	22,315 (6,801)	12,855 (3,918)	6,960 (2,121)	2,755 (840)
6,000 (41)	17,640 (5,376)	10,910 (3,325)	6,025 (1,836)	2,415 (736)
8,000 (55)	9,525 (2,903)	7,340 (2,237)	4,580 (1,396)	1,910 (582)
10,000 (69)	6,310 (1,923)	4,870 (1,484)	3,580 (1,091)	1,445 (440)
12,000 (83)	3,655 (1,114)	3,270 (997)	2,605 (794)	965 (294)
14,000 (97)			1,825 (556)	

Reference permeability, Darcies @ 250˚F (121°C)

Closure stress psi (MPa)	12/18	16/20	20/40	30/50
2,000 (14)	1,305	770	420	155
4,000 (28)	1,195	690	385	145
6,000 (41)	950	595	340	130
8,000 (55)	535	415	260	100
10,000 (69)	370	290	205	80
12,000 (83)	225	205	155	55
14,000 (97)			110	

2 lb/ft², 250°F, with 2% KCl | Between Ohio sandstone



Reference conductivity and permeability are measured with a single phase fluid under laminar flow conditions in accordance with API RP 19D. In an actual fracture, the effective conductivity will be much lower due to non-Darcy and multiphase flow effects. For more information, please refer to SPE Paper #106301.

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Production. Enhanced.

CARBOBOND LITE

Resin-coated low-density, high-performance ceramic proppant

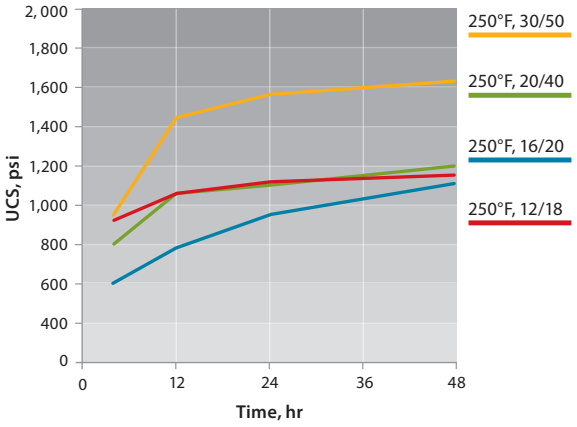
Bond strength performance

Unconfined compressive strength

Fluid temp °F (°C)	Closure stress psi (MPa)	Time hr	Bond strength psi (MPa) 12/18	16/20	20/40	30/50
250 (121)	0 (0)	24	<50 (0.345)	<50 (0.345)	<50 (0.345)	<50 (0.345)
	1,000 (6.895)	4	920 (6.343)	605 (4.171)	800 (5.516)	950 (6.550)
		12	1,050 (7.239)	785 (5.412)	1,050 (7.239)	1,450 (9.997)
		24	1,120 (7.722)	943 (6.502)	1,115 (7.688)	1,550 (10.687)
		48	1,165 (8.032)	1,098 (7.570)	1,200 (8.274)	1,610 (11.101)

For bottomhole static temperature (BHST) less than 150°F/65°C use CARBOBOND Low Temperature Chemical Activator (LTCA) to enhance bond strength. LTCA may also be beneficial in cold weather conditions.

Unconfined compressive strength



Physical and chemical properties

Typical chemical properties

Resin type	Proprietary Phenolic
Equilibrium pH	8.9 - 9.3
Residual acidity per gal 50% NaOH/1000 gal 2% KCl	< 0.1
Shelf-life (years)	> 3 estimated

Solubility: ISO 13503-2	**Weight %**
Water	< 0.2
Alkaline water* uncured	< 1.0
Alkaline water* cured	< 0.2
Water with 2% KCl	< 0.2
Light brine	< 0.3
12% HCl/3% HF Acid	< 1.0
Oil	< 1.0

*66°C, unbuffered 2% KCl, adjusted to pH = 11, 1.4 kg/L added

Compatibility: Compatible with most commonly used fracturing fluids, both water and oil. Testing with fluids prior to pumping is advised. Some fluids may require adjustment of pH control, breaker or foamer loading. Avoid prolonged exposure to highly alkaline fluids, i.e., pH > 12 and > 2¼ gal 50% NaOH/1000 gal (2.2 L/m3).

All data represents typical values.

Typical physical properties

Available sizes	12/18, 16/20, 20/40, 30/50
Substrate	CARBOLITE
Physical state	Solid, particulate
Apparent specific gravity	2.60 ± 0.05
Specific volume (cm^3/g)	0.046
Bulk density [lb/ft^3] (g/cm^3)	96 ± 4 1.54 ± 0.06
Roundness	0.9
Sphericity	0.9
Particle size distribution uncoated ceramic substrate	Meets or exceeds API RP 19C
Turbidity, (NTU) [FTU]	< 250
Coating efficiency (weight %)	> 99.8
Bond strength	See included chart
Long-term conductivity	See included chart

Talk to CARBO to find out how we can help you enhance your production.

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