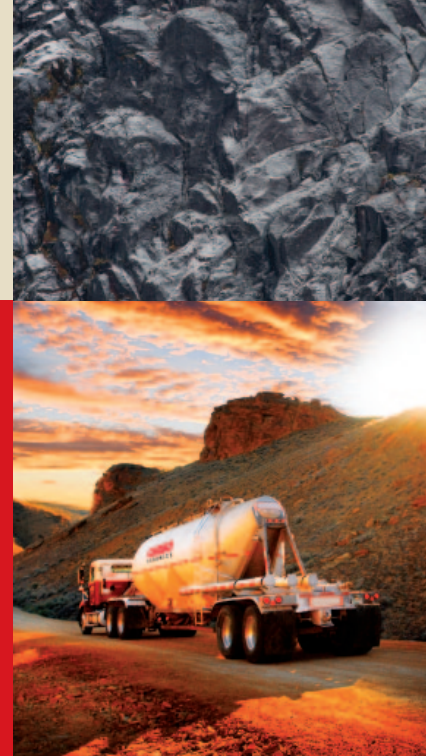


# CARBO LITE®

Lightweight, high-performance proppant

## FEATURES

- The ideal high-performance proppant in oil wells
- High flow capacity for enhanced production rates
- Provides highest fracture conductivity in wells to moderate depths
- Bulk density and specific gravity similar to sand
- Available in five closely sieved standard sizes – 12/18, 16/20, 20/40, 30/50 and 40/70



## Physical and Chemical Properties

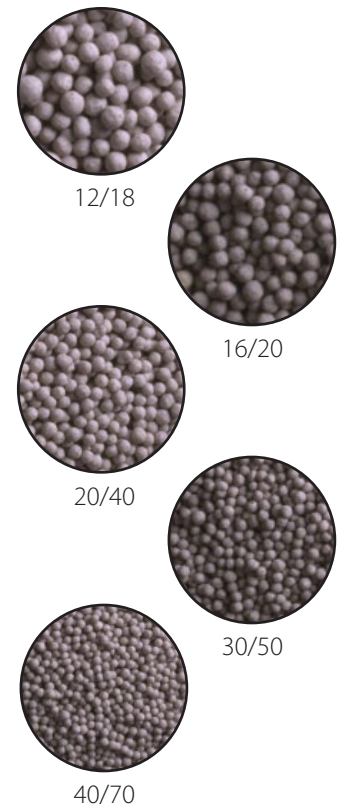
### Typical Sieve Analysis [weight % retained]

U.S. Mesh [mesh]	Microns	12/18	16/20	20/40	30/50	40/70
+12 mesh	+1700	4	—	—	—	—
-12+16 mesh	-1700+1180	91	5	—	—	—
-16+20 mesh	-1180+850	5	93	7	—	—
-20+30 mesh	-850+600	—	2	90	4	—
-30+40 mesh	-600+425	—	—	3	90	1
-40 mesh	-425	—	—	—	6	—
-40+60 mesh	-425+250	—	—	—	—	97
-50 mesh	-300	—	—	—	—	—
-60+70 mesh	-250+212	—	—	—	—	2
<b>Median Particle Diameter [microns]</b>		1374	1001	730	522	334
<b>API Crush Test</b>						
% by weight fines generated	@7,500 psi	17.9	14.0	5.2	2.5	2.0
	@10,000 psi	—	19.3	8.3	5.8	4.4

**Sizing Requirements:** A minimum of 90% of the tested sample should fall between the designated sieve sizes. These specifications meet the recommended practices as detailed in ISO 13503-2.

### Typical Additional Properties

Roundness	0.9	Chemistry [weight %]	
Sphericity	0.9	Al <sub>2</sub> O <sub>3</sub>	51
Bulk Density [lb/ft <sup>3</sup> ]	97	SiO <sub>2</sub>	45
[g/cm <sup>3</sup> ]	1.57	TiO <sub>2</sub>	2
Apparent Specific Gravity	2.71	Fe <sub>2</sub> O <sub>3</sub>	1
Absolute Volume [gal/lb]	0.044	Other	1
Solubility in 12/3 HCl/HF Acid [% weight loss]	1.7		



## Long-Term Conductivity

### Reference Conductivity\*, md-ft @ 250°F

Closure Stress [psi]	2 lb/ft <sup>2</sup> 12/18	2 lb/ft <sup>2</sup> 16/20	2 lb/ft <sup>2</sup> 20/40	2 lb/ft <sup>2</sup> 30/50	2 lb/ft <sup>2</sup> 40/70
2,000	38,795	24,629	10,700	4,640	2,200
4,000	24,558	17,781	8,900	3,740	1,660
6,000	9,941	9,035	6,000	2,870	1,270
8,000	4,839	4,623	3,700	1,900	870
10,000	2,234	2,398	2,000	1,270	555
12,000	—	—	—	650	340

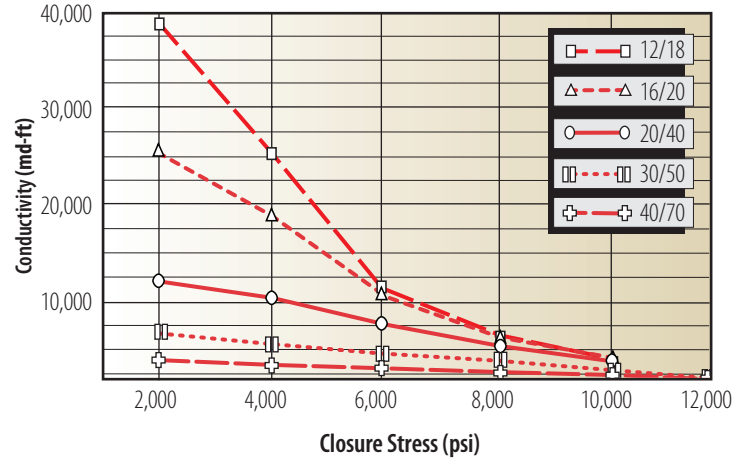
### Reference Permeability, Darcies @ 250°F

Closure Stress [psi]	2 lb/ft <sup>2</sup> 12/18	2 lb/ft <sup>2</sup> 16/20	2 lb/ft <sup>2</sup> 20/40	2 lb/ft <sup>2</sup> 30/50	2 lb/ft <sup>2</sup> 40/70
2,000	2,003	1,288	570	250	135
4,000	1,325	955	480	200	100
6,000	570	510	340	160	80
8,000	293	276	210	110	60
10,000	141	150	120	75	35
12,000	—	—	—	40	25

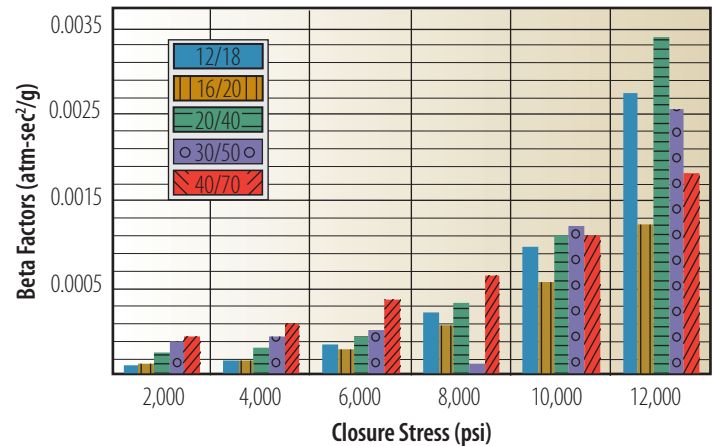
## Beta Factors

Closure Stress [psi]	Beta Factor [atm sec <sup>2</sup> /g]				
	12/18	16/20	20/40	30/50	40/70
2,000	0.00007	0.00009	0.00020	0.00030	0.00034
4,000	0.00011	0.00011	0.00024	0.00035	0.00046
6,000	0.00027	0.00022	0.00035	0.00040	0.00070
8,000	0.00058	0.00045	0.00066	0.00080	0.00092
10,000	0.00120	0.00086	0.00131	0.00140	0.00131
12,000	0.00266	0.00141	0.00319	0.00250	0.00190

### 2 lb/ft<sup>2</sup>, 250°F, with 2% KCl | Between Ohio sandstone



### 2 lb/ft<sup>2</sup>, 250°F, with 2% KCl | Between Ohio sandstone, Young's modulus of 5x10<sup>6</sup> psi | No gel damage included



Beta Factor data reported by Stim-Lab Consortium, PredK Feb 2002

\* Reference conductivity and permeability are measured with a single phase fluid under laminar flow conditions in accordance with ISO 13503-5. 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.

### CARBO Ceramics

Energy Center II  
575 N. Dairy Ashford, Suite 300  
Houston, Texas 77079 USA  
T: +1-281-921-6400  
F: +1-281-921-6401  
CarboCeramics.com

**CARBO**<sup>®</sup>  
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