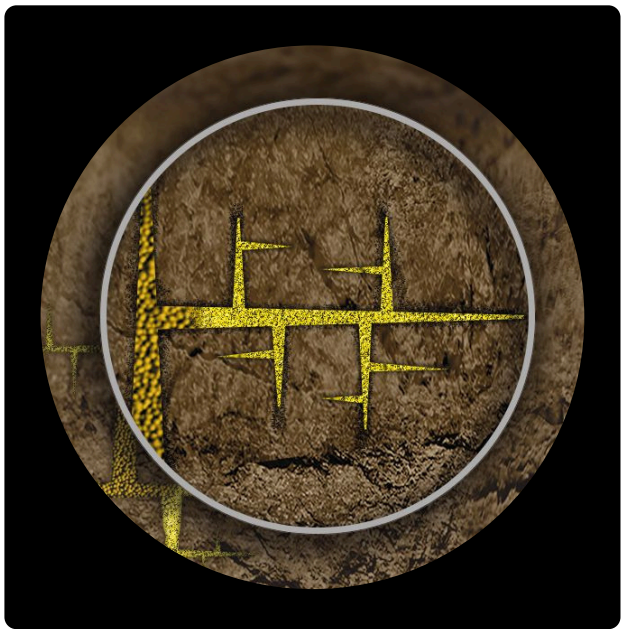
TECHNICAL DATA SHEET

NANOMITE and NANOMITE Express

PELLETIZED HIGH STRENGTH CERAMIC MICROPROPPANT

NANOMITE is a manufactured, non-silica based ceramic proppant with an average size of 325 mesh. The unique characteristics of this proppant prop open micro-fractures that go untreated with alternative proppants. NANOMITE Express is a pelletized form of NANOMITE that allows the microproppant to be delivered as a traditional proppant and to enhance operations.



NANOMITE microproppant helps increase operational efficiencies during stimulation and enhances well productivity

BENEFITS

PROP MICRO-FRACTURES TO ENHANCE AND SUSTAIN PRODUCTION

- Expand Connected Fracture Network
- Increase Recovery Factor & Mitigate Decline Rate

REDUCE NEAR WELLBORE FRICTION

- Decrease treatment pressure and increase rate
- Reduce completion time, HHP, and fuel costs

REDUCE FRACTURE TORTUOSITY AND PRESSURE DEPENDENT LEAKOFF

- Mitigate screenouts & maximize proppant placement

PELLETIZED TO IMPROVE OPERATIONS

- Handle as a traditional proppant
- No need to slurry - reduce costs

MINIMIZE HEALTH, SAFETY AND ENVIRONMENTAL RISKS

- NANOMITE is silica-free. NANOMITE Express provides low dust

FAR FIELD DIVERSION

- Minimize frac hits in offset wells

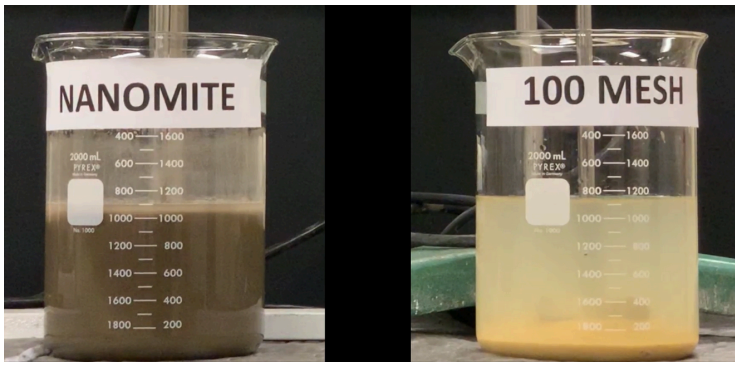
FEATURES

- **Extremely small microproppant particles**
- **Broad size range for optimum operational flow and reach**
- **Low settling velocity due to superior physical characteristics**
- **Strong and durable ceramic particles**
- **Delivered as traditional proppant**
- **Pumped with standard equipment**
- **NANOMITE Express is significantly more cost efficient than slurried microproppants**

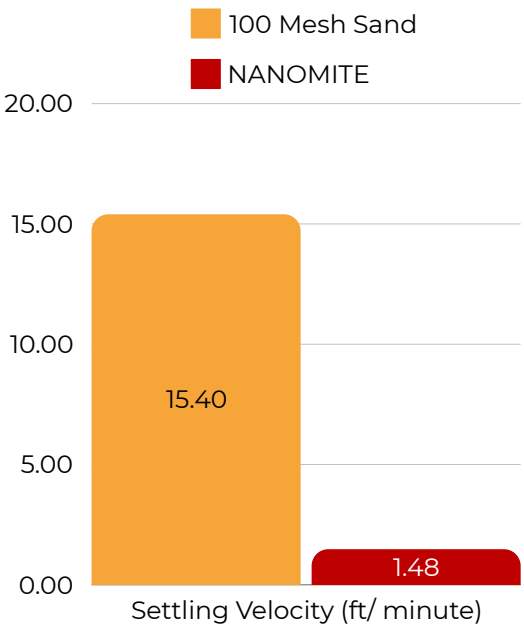
CARBO

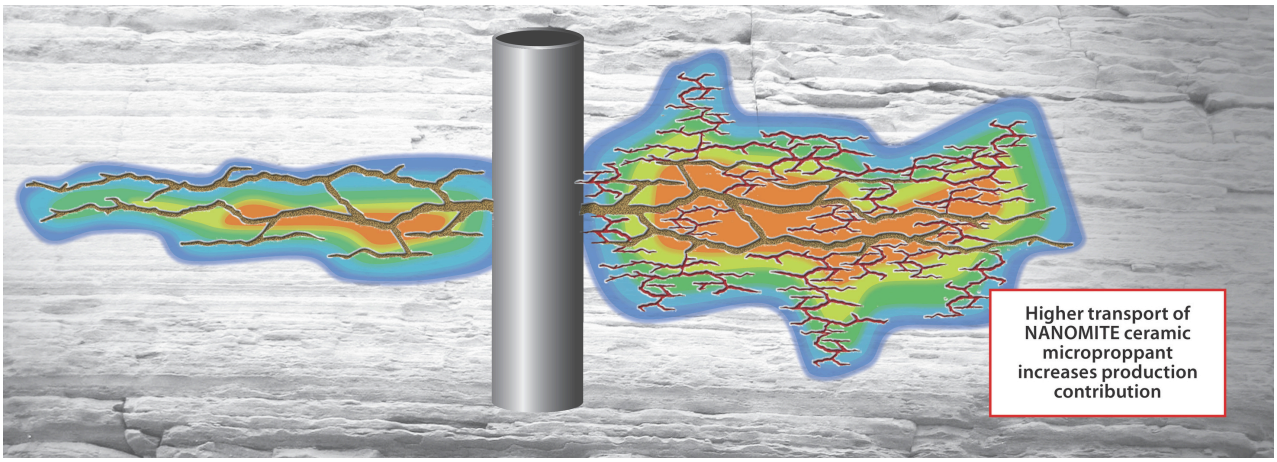
Excellent proppant transport characteristics due to a wide range of settling velocities

NANOMITE features a wide particle size distribution (150/635 mesh, 100 µm to 20 µm), with its smallest particles over five times finer than those in 100 mesh frac sand. This finer particle size, coupled with superior transport and slower settling in thin fluid systems like freshwater or slickwater, allows NANOMITE to have an average settling rate 11x as slow as that of 100 mesh sand, enhancing its reach and efficacy in fracture stimulation.



The image above demonstrates that NANOMITE settles at 11x slower rate compared to 100 mesh sand, enhancing its efficacy in transport and settling within the fluid. The graph to the right demonstrates the difference in settling velocity between the two.





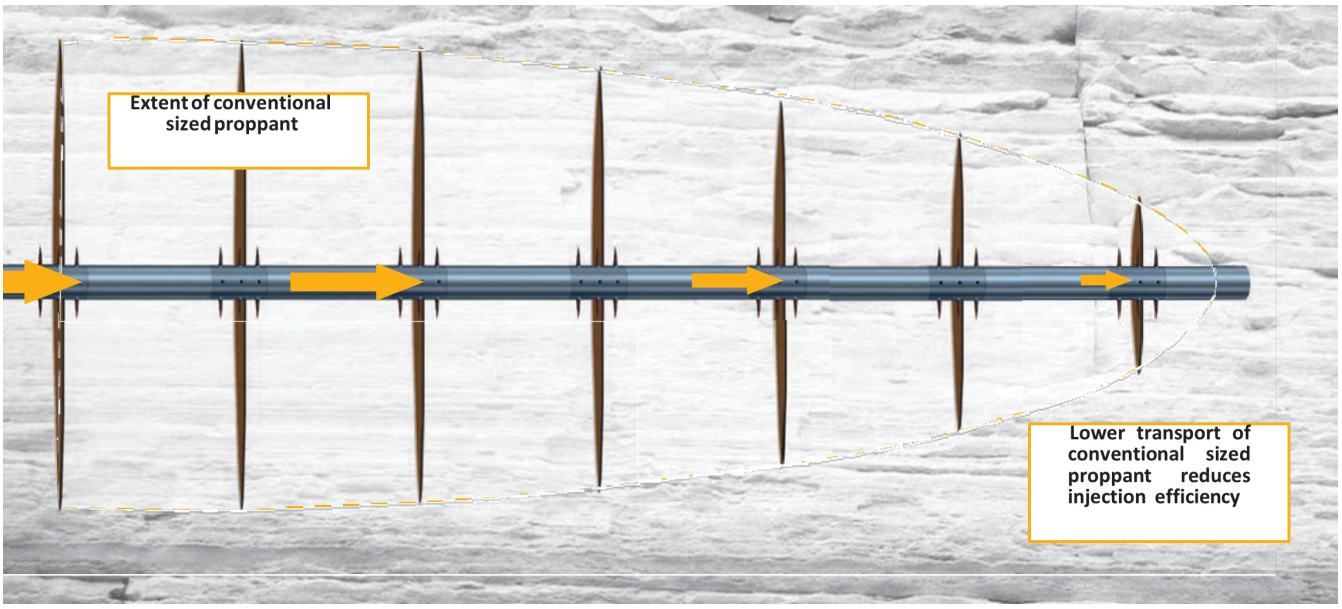
Extremely low settling velocity and particle sizing enable propping of micro-fractures deep within the complex fracture network

CARBO

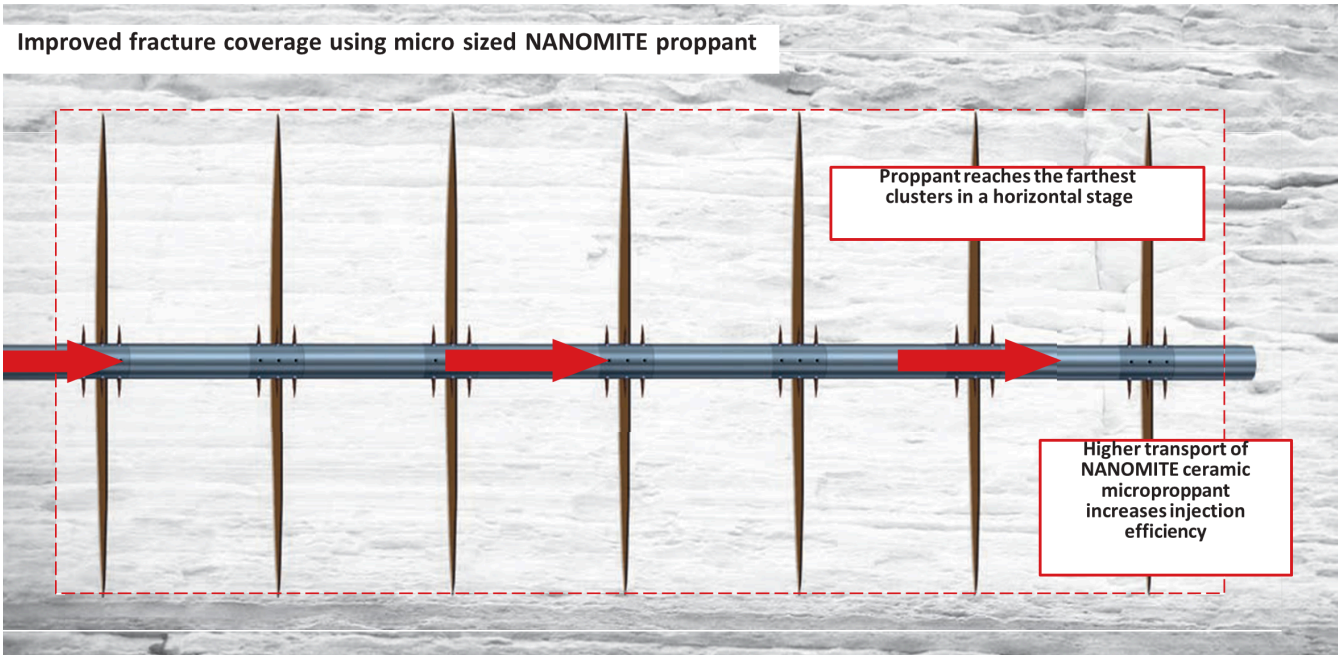
Improve production contribution from all clusters

Cluster injection efficiency is increased due to the improved transport characteristics of NANOMITE in the wellbore, ensuring that proppant reaches the farthest clusters in a horizontal stage. As the microproppant enters the fractures, it conditions the clusters reducing fracture entry restrictions, so they more readily accept conventional sized proppant. This results in more uniform distribution across all clusters.

Fracture coverage using conventional sized proppant



Improved fracture coverage using micro sized NANOMITE



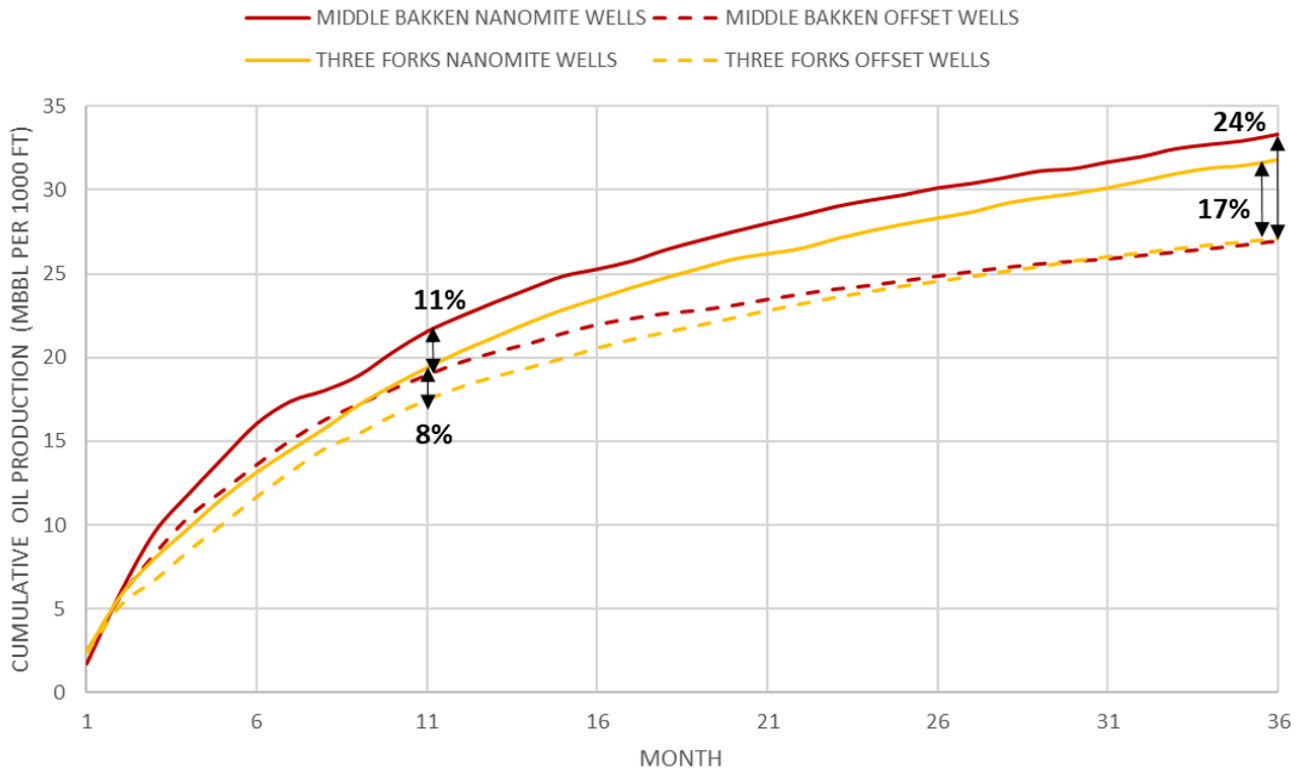
CARBO

Reduce completion time, screen-out risks, and overall completion costs

NANOMITE overcomes fracture entry restrictions in the perforations and near-wellbore area through erosion of restrictions and improves near-wellbore diversion resulting in reduced surface treating pressures. As a result, reduced pumping pressures can be realized, or lower pumping times are required due to increased injection rates, that lower completion time and overall completion costs. The removal of entry restrictions, together with a reduction in Pressure Dependent Leakoff (PDL), lowers screen-out risks.

Increase overall production contribution from the reservoir matrix

Increased propped contact within the reservoir is achieved by transporting proppant further into both primary fractures and smaller micro-fractures. This enhanced distribution of proppant allows for a greater contribution to production from the reservoir matrix. Numerous trials across various basins have consistently demonstrated this effect, showing improved production outcomes due to more extensive proppant placement within the reservoir. These findings, as documented in SPE Paper 212341, highlight the technique's potential to unlock additional hydrocarbon volumes by effectively connecting the reservoir matrix to the fracture network.



The graph above is an updated 3-year lookback from SPE-212341. The plot shows cumulative oil production normalized by 1000 feet of lateral length. Note, when the paper was published, the operator observed 8% (Three Forks) to 11% (Middle Bakken) in production uplift for the wells completed with NANOMITE. Currently, the operator is observing 17% to 24% respectively. This increasing production uplift suggests an increased stimulated reservoir volume from the propped micro-fractures.

CARBO

Outperform alternative products

NANOMITE Express delivers operational, performance, and cost benefits compared to alternative products, along with minimized health concerns associated with exposure to dust. It is easily incorporated in the stimulation treatment designs.

NANOMITE Express is delivered as traditional proppant using existing equipment and sand deployment techniques. It is traditionally pumped as the initial proppant of the proppant pack at a low slurry concentration (0.25 to 0.50 lb/gal) to maximize the depth of the microproppant penetration into the fracture. The table below shows how NANOMITE Express compares to alternative products.

	Silica Flour	Aqueous Silica	Aqueous Spheres	NANOMITE Express
HSE exposure	Hazardous	Hazardous	Safe	Safe
Delivery to blender	Powder	Slurried	Slurried	Traditional Proppant
Fracture conditioning	Poor	Moderate	Poor	Great
Long term productivity	Poor	Moderate	Great	Great
Durability	Poor	Poor	Great	Great
Total cost	$	$$$	$$$	$$

Proven results

NANOMITE has been published in several articles including three technical papers as referenced below. NANOMITE has been proven across multiple formations to help increase operational efficiencies and to enhance hydrocarbon productivity.

SPE-212341

Initial Observations From a Bakken Microproppant Field Trial

URTeC 3291

First Applications of Novel Microproppant to Achieve Optimal Production and Enhance Hydraulic Fracture Treatment Placement — A Romanian Case History

URTeC 2983

Optimizing Microproppant Placement Using Available Drilling Data – A Case History

CARBO

Durable to maintain long-term conductivity

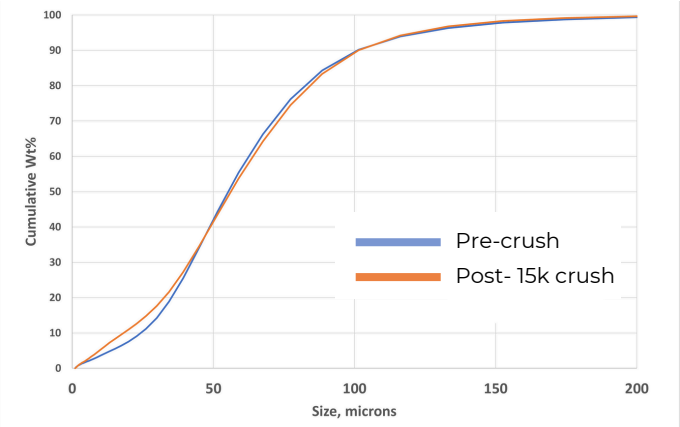
High resistance to crush

NANOMITE is a high-quality ceramic proppant that has the compressive strength and durability needed to maintain its integrity and conductivity under extreme closure pressure experiencing extremely low crush.

Crush test results performed at 15,000 psi, presented in the table to the right, show minimal differences between pre and post crush median diameters and sieve distribution of the microproppant, proving its application in highly stressed formations.

	Pre-crush	Post - 15k crush
D10 (µm)	22	18
D50 (µm)	56	56
D90 (µm)	105	101

The table above presents the average diameter size (µm) of NANOMITE pre- and post- crush at 15,000 psi.



The above figure shows cumulative weight (%) against size (microns) of NANOMITE pre- and post- crush at 15,000 psi.

Physical and chemical properties of NANOMITE

Properties	NANOMITE	NANOMITE Express
Mean particle size	45 µm [325 mesh]	1100 µm [18 mesh]
Apparent specific gravity (g/cm3)	2.7 - 3.2	2.7 - 3.2
Absolute volume (gal/lb)	0.040 - 0.044	0.040 - 0.044
Bulk Density [lb/ft3]	100 - 115	89 - 104
Bulk Density [g/cm3]	1.60 - 1.80	1.47 - 1.67