



Texan Stone LLC

DBA Texan Minerals and Chemicals

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PRODUCT DATA SHEET

TEXAN CATIONIC DPAM

Cationic Friction Reducer in Powder & Slurry Form

PRODUCT DESCRIPTION

TEXAN Cationic Dry Brine is a premium Cationic water-soluble polyacrylamide friction reducer (FR) in dry powder form which is suitable to be used in a Dry Hydration Unit on the fly as well as in a 2% concentrate form where significant multivalents are present. The product can also be custom blended using suitable Mineral Oil, Surfactant, Clay Stabilizer to be used in Slurry form. It offers excellent performance in high salinity brines and can be effective at small dosages. TEXAN CATIONIC DPAM has a very high molecular weight and is manufactured as dry powder with 60-100 mesh size for optimal hydration. Addition of small amounts, typically 0.25 – 1.00 gpt (gallons per thousand gallons) to water based high brine frac fluids can deliver friction reduction (pressure loss) of over 70% in a short period of time. Due to its rapid hydration properties, it can be pumped continuously into stimulation fluids as supplied or by batch mixing before treatment. TEXAN CATIONIC DPAM is APE (alkyl phenol ethoxylates) and NPE (nonyl phenol ethoxylates) free, thus making it environmentally friendly. It is a field tested and proven product in oil field operations.

APPLICATIONS

TEXAN CATIONIC DPAM has been specifically optimized for use as a high brine high Multivalent (Ca, Fe, Sr) friction reducer, which can be used directly as fine dry powder form, concentrate form or dispersed in oil with excellent hydration properties. Due to its Cationic nature, it is compatible with conventional non-ionic and Cationic stimulation additives, and its compatibility range is wide ranging.

The particle size distribution of the product ranges from 60-100 Mesh making the product suitable to use in Slurry form with fast hydration properties and also be efficiently used in a 2% concentrate form without the Polymer Slicing unit saving operational costs.

The dissolution in water should be in a temperature range between 10°C and 40°C. When treating turbid water, the flocculant solution must be added to water at a point of average turbulence, to achieve a thorough and homogeneous mixing without impairing the flock formation. Recommended operating concentration is 1.25 lbs. to 2.5 lbs. of powder per thousand gallons.

TEST METHOD BY INDEPENDENT LABORATORY

CATIONIC DPAM POWDER TESTING METHOD:

Test Method(s): Friction reduction properties of TEXAN CATIONIC DPAM were tested on a custom Flow Loop at a flow rate of 6 gpm, generating 89,000 Reynolds number. The test section of the loop consisted of pipe having 3/8" O.D. A dosage of 0.25 gpt (via 2% solution, which is equivalent to 0.625 lbs powder per thousand gallons), was injected on the fly through the suction header of the mono-pump. Total test time was 6 minutes. TEXAN CATIONIC DPAM was tested in API brine (**108K TDS**) with composition: NaCl (95.5 g/L), CaCl₂ (28.10 g/L) with a FR dosage of 0.25 gpt, and Marcellus brine (**150K TDS**) with composition NaCl (96.47 g/L), KCl (1.54 g/L), CaCl₂ (59.38 g/L), BaCl₂ (7.47 g/L), NaHCO₃ (0.07 g/L), MgCl₂ (11.43 g/L) and SrCl₂ (17.52 g/L) with a FR dosage of 0.25 gpt.

CATIONIC DPAM SLURRY 2.5 LB. LOADING TESTING METHOD:

The Cationic DPAM Slurry 2.5 lb. loading contained around 28% Active content suspended in suitable Mineral Oil, Surfactant and Clay Stabilizer. Friction reduction properties of Texan Cationic DPAM Slurry 2.5 lb. loading was tested on a custom Flow Loop at a flow rate of 10 gpm, generating 100,000 Reynolds number. The test section of the loop consisted of pipe having 1/2" O.D. Typical dosage of 0.5 gpt or 1.25 lbs of powder was used and the polymer was injected through the hopper. Total test time was 6 minutes. The product was tested with Synthetic water with a **pH of 5.4, S.G of 1.17 with a Total dissolved solid level of 290,000. Further, 68 ppm of Fe²⁺ was added to the Synthetic water on the fly 2 minutes before the injection of the Slurry Product.** The



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Elemental composition of water in mg/l (ppm): Chlorides (Cl⁻): 177,289, (Na): 74,442, **Calcium (Ca²⁺): 28405, Magnesium (Mg²⁺): 3637**, Potassium (K): 2048, Strontium (Sr²⁺): 1623, Sulfate (SO₄²⁻): 713, Manganese (Mn²⁺): 10.3, **Iron (Fe²⁺): 68.3**, Boron (B): 56.5, Lithium (Li): 119, Bicarbonate: 864, Bromide: 2034, Barium (Ba²⁺): 6.8. **The Cationic High Brine DPAM can achieve the desired results equivalent to Anionic DPAM (1 gpt slurry with 2.5 lb. loading) by using only 0.5 gpt Cationic Slurry 2.5 lb. loading with similar harsh water conditions in flow loop testing.**

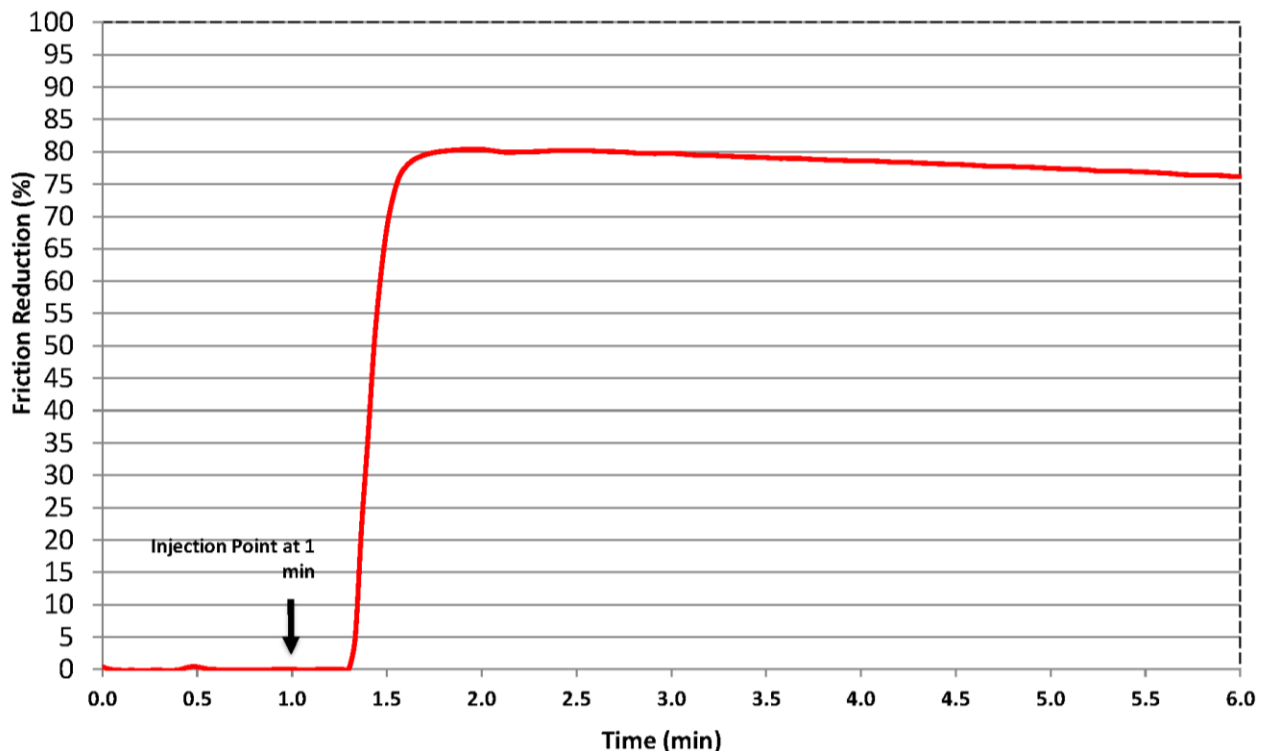
Form	White Fine Dry Powder
Flash Point	Not applicable
Freeze Point	Not determined
Mesh Size	100 Mesh
Molecular Weight (Million)	10-13
Cationic Charge	28-32
Solid Content (%)	≥ 90
Viscosity (cps)@Temp	315 cPs (0.1% solution)
Odor	Little odor or odorless
Density (g/cm ³)	≥ 0.60 g/cm ³
Ph	7.3 (1% solution)
Solubility	Water Soluble
Insoluble Content (%)	≤ 0.5
Shelf Life	24 Months <i>(It should be stored in a dry place and the storage temperature is 0 °C to 35 °C, away from direct sunlight and moisture.)</i>

PACKED IN JUMBO BAGS WEIGHING 1650 LBS.

Texan CATIONIC DPAM tested in the two brines performance and Results

0.25 gpt via 2% solution, which is equivalent to 0.625 lbs powder per thousand gallons.

Figure 1. FR performance of TEXAN CATIONIC DPAM in 3/8"OD in 108 K TDS API brine at room temperature



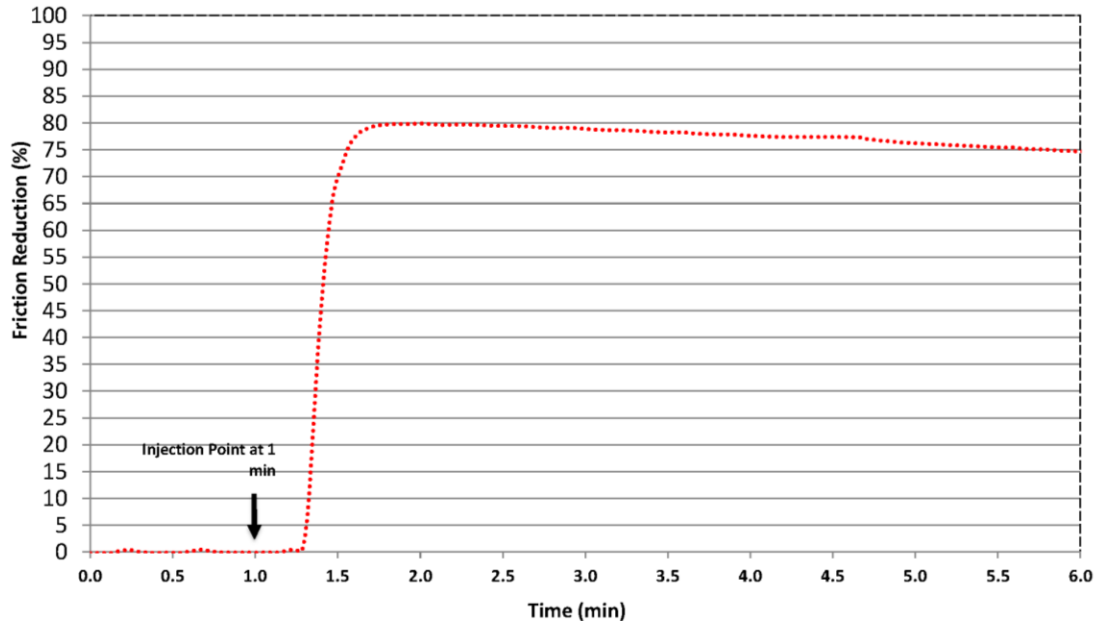


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Figure 2. FR performance of TEXAN CATIONIC DPAM in 3/8"OD and 150K TDS Marcellus brine at room temperature



1. From the above results, it is clearly demonstrated that TEXAN CATIONIC DPAM powder is a superior and versatile product, which achieves FR value of 80.35% in 108 K API brine and 79.89 % in 150K Marcellus Brine.
2. Therefore, the TEXAN CATIONIC DPAM offers a tremendous advantage compared to competitors. It can be applied easily under varying brine and harsh water conditions.

TEXAN CATIONIC DPAM SLURRY 2.5 lb. LOADING PERFORMANCE & RESULTS:

0.5 gpt dosage which is equivalent to 1.25 lbs powder per thousand gallons.

% Friction Reduction - Brine Based

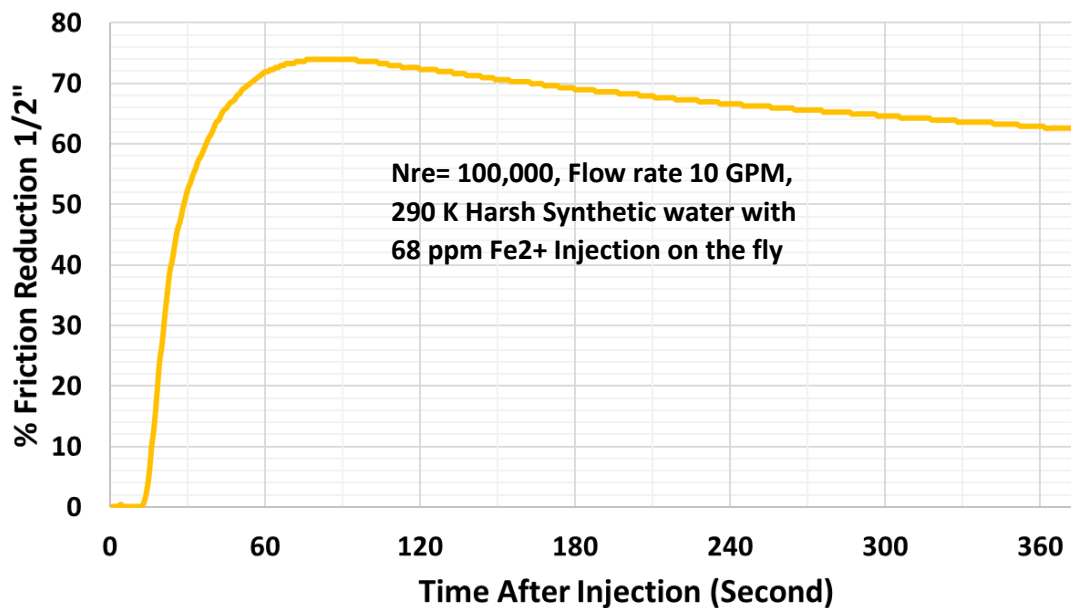


Figure 3. FR performance of TEXAN CATIONIC DPAM in 1/2"OD and 290K TDS Synthetic water with 68 ppm Fe2+ The above graph shows that Texan Cationic DPAM Slurry 2.5 lb. loading achieves around 73% Friction reduction in less than a minute of injection and exhibits good shear resistance under extremely harsh water conditions with good amounts of Divalent Cations, high specific gravity and low pH level.