



ZLPAM

Exceeding Your Expectations

# COMPLETION CHEMICALS

Your complete chemical solution for  
Hydraulic fracturing

## ZL Group Companies

Henan Zhengjia Green Energy Co.,Ltd (China): +86 371 6256 9628

ZL Chemicals Ltd (USA): +1 800 878 1694

ZL EOR Chemicals Ltd (Canada): +1 800 878 1694

Polymer Experts LLC (Oman): +968 2413 6333

Email: [info@zlpam.com](mailto:info@zlpam.com)

Website: [www.zlpam.com](http://www.zlpam.com)





# PART.01

## FRICITION REDUCER

Fracking Additives are placed in frac fluid to facilitate final hydraulic fracturing operations before well production. ZL Chemicals provides high-performance and cost-effective fracking additives associated with the inovational and technical expertise in polyacrylamide manufactory to address the customer needs on the location.

### Description

To fracture shale formation effectively, large volumes of water are injected at high pressure within few hours. Fracking fluid with 100 bbl/min rate flow passing through relative narrow 4½" Frac pipe experiences chaotic changes in the flow velocity and wellhead pressure in the process of overcoming frictional energy losses. A sufficiently million level Reynolds number generated by this flow regime is commonly recognized as turbulent flow and is characterized by the almost non-orderly flow phase in the eddy currents of the fluid.

For turbulent flow in Frac pipe, A variety of chemical additives are used in hydraulic fracturing fluids, dependent on the conditions of the specific wellbore. Introducing a minor quantity of a flexible, linear polymer with a high molecular weight into the flow for turbulent drag reduction effect is a common method on the location. Currently, the fluids used predominantly in fracture operations are water-based fracturing fluids mixed with polyacrylamide based friction reducer. Due to the particular viscoelastic properties, the addition of polyacrylamide based friction reducer strongly influence the turbulent flow characteristics, even with a small quantities.

High levels of friction reduction rate can be achieved when the right polymers are added to the fracking fluid. The energy loss caused by the turbulent flow increases operating costs and risk, thus, the friction reducing capability of polyacrylamide allows high flow rate fracking fluid mixed with proppants to be injected into the perforation zone at a short of time.

In slick water system, the primary function of friction reducer is to allow the application of full treatment with maximum hydrostatic and pumping horsepower, without having excessive frictional losses during the operation. Reductions in fluid friction of 50% to 80% are possible. The regular friction reducers are mid to high molecular weight anionic polyacrylamides, rapid inversion and hydration is necessary for optimal field performance once added to stimulation fluids. They are also designed to enhance the water displacement in oil wells by considerably reducing the friction pressure experienced during the drilling.



# PART.02

## ZLFR® APPLICATION

ZL friction reducers (ZLFR®) can be supplied in liquid form (either in an oil-based emulsion or liquid suspension carrier) or in dry-powder form. The friction reduction achievement in the applications is over 70%. Moreover, ZL friction reducers are focusing on performance/dollar spent, our products are recognized as high performance and cost-efficient by our oil field clients.



The liquid based and dry products are versatile through continuous additions into water by 'on-the-fly' method by the regular suction pump and dry on the fly unit.



Batch mixing: mix HVFR with water (fresh, TDS water, actual field water) to generate gel solution for coil tubing or drill out application.



Typical application rate range is from 0.25 up to 0.5 gpt (1.4 ppt for dry) for friction reduction and 1.5 up to 4 gpt as a viscosifier. Individual water characteristics will direct addition rate for optimum conditions.

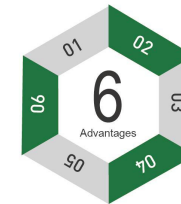


### Advantages of ZLFR®

ZLFR® is effective at low concentrations: High friction reduction rate is achieved at concentrations as low as 0.25gpt liquid form or 1.2ppt dry form.

ZLFR® offer a quick hydration and inversion which starts reducing pumping pressure within 10 seconds, approaches maximum friction reduction rate (75-80%) in less than 20 seconds.

ZLFR® can be supplied in two types of liquid form which can be customized for slick water or HVFR application to deliver the best economic-effect and performance optimization.



ZLFR® works in different types of water and overperforms other industry premium products especially in produced water.

ZLFR® could quickly yield as high as 80% friction reduction rate and hold the performance in the entire job.

ZLFR® dry powder can be mixed by Dry-on-the-Fly Unit and does not cause the clumping and fisheye problems.

ZLFR® series have a unique history that is successfully replacing premium high brine HVFR emulsion by the same or lower ratio. A significant saving is achieved with the Dry-on-the-fly technology.

# PART.03

## ZLFR® APPLICATION

The ZLFR® is a series of special friction reduction dry polymer products that have been produced by unique polymerization process for slick water and high viscosity application in fresh and 100% produced water. When the concentration of ZLFR® goes up to 1.4 lbs/1000gallons, the best friction reduction rate has been yielded immediately in 0-200,000TDS brine. The water solution starts to generate viscosity after ZLFR® dosage increased to 4.2 lbs/1000gallons. The polymer solution with 7-8.4lbs/1000gallons of ZLFR® shows very good viscoelasticity behavior.

### ZLFR® Series - For Hydraulic Fracturing

ZLFR® Series is designed to achieve the optimum performance under extremely high Reynolds number pipe flow with fresh water to ultrahigh salinity produced water and temperature up to 180F.

ZLFR with regular particle size are designed for Dry-on-the-fly and coil tubing application. The particle size distribution is special engineered for hydrating quick and eliminating fish eyes. On the field application, ZLFR® series have an unique history that is successfully replacing premium high brine HVFR emulsion by the same ratio in fracking jobs. The normal particle size products are also good viscosifiers for coil tubing application. The high viscosity and strong salt tolerance properties support ZLFR's unique performance in drill out market. Some of the field cases show ZLFR® outperformances Xanthan based gel.

ZL's advanced polymerization technologies minimize the effect of ion on the performance of the polymer including hydration delay and salt damage. Associated with the appropriate particle size distribution, ZLFR® X series are perfect fit for liquid suspension carrier. As the water TDS goes up, the performance of polymers have damages and hydration processing is delaying. The normal solution for liquid suspension is increasing solid concentration, but the new issues come out from flowability and economic-effect. ZLFR® X series offer a board products line for liquid suspension which could well work in different water condition up to 350K TDS and maintaining the regular solid concentration.

### ZLFR® Polymers - Key Characteristic

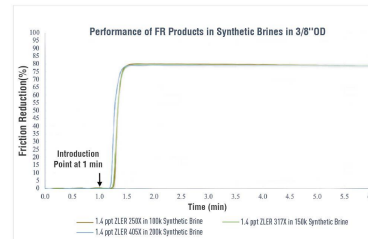


# PART.04

## ZLFR® SERIES DRY PRODUCTS

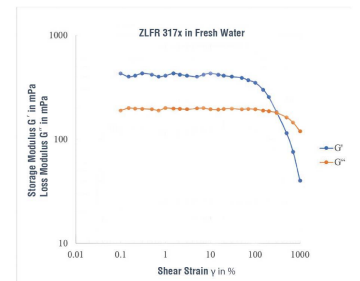
Series	Molecular Weight	Particle Size	AMPS%	TDS (ppm)
ZLFR® 130	High	Normal	Low	Up to 50,000
ZLFR® 130X	High	Fine	Low	Up to 50,000
ZLFR® 250	Moderate	Normal	Low-mid	Up to 100,000
ZLFR® 250X	Moderate	Fine	Low-mid	Up to 100,000
ZLFR® 317	Moderate	Normal	Moderate	Up to 150,000
ZLFR® 317X	Moderate	Fine	Moderate	Up to 150,000
ZLFR® 405	Low	Normal	High	Up to 200,000
ZLFR® 405X	Low	Fine	High	Up to 200,000
ZLFR® B40	Low	Normal	Ultra High	Up to 350,000
ZLFR® B40X	Low	Fine	Ultra High	Up to 350,000

ZLFR® Series offer five unique chemistries with two particle sizes distribution which can cover from fresh to 350,000TDS Brine in stimulation and coil tubing application. After a short hydration time, ZLFR products performed immediately in high salinity and high hardness brine. The friction reduction rate max out within 15s in 3/8" industry standard loop, and the performance be hold in the entire test.



The dry polymer was dispersed into 15% of total water volume with a short time of hydration to mimic dry on the fly application, and then introduce the stock solution back to the flow loop for friction reduction test.

The viscoelasticity of polymer solution is the key for sand suspension and transportation. The high molecular weight associated with engineered hydrolysis level allows ZLFR to yield a great viscoelastic behavior. The constant plateau value in wider linear viscoelastic region indicated ZLFR can carry out the higher shear without destroying the structure of the solution. The strong shear resistance behavior allow ZLFR to preform from the wellhead to the toe of fracture. The field cases indicated that ZLFR can load 30-50% less than other well-known commercial products to maintain the same level pump pressure.



# PART.05

## ZLFR® ULTRAFLO SERIES

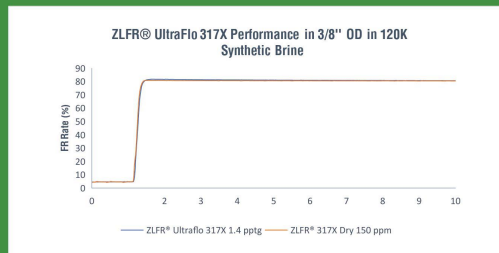
ZLFR® UltraFlo series are liquid form friction reducers, ZLFR® UltraFlo E100 is emulsion based product which has the availability of solid concentration from 25%-35%, ZLFR® UltraFlo 130X, 250X, 317X, 405X, and B40X are organic solvent based products which has the availability of solid concentration from 30-50%. ZLFR® UltraFlo series eliminated the organic clay to offer a zero formation damage, strong stability, and easy to handle products.



### ZLFR® UltraFlo Offers A Full Range of Products Covering Different Salinity Levels

Series	Molecular Weight	AMPS%	TDS (ppm)
ZLFR® UltraFlo 130X	High	Low	Up to 50,000
ZLFR® UltraFlo 250X	Moderate	Low	Up to 100,000
ZLFR® UltraFlo 317X	Moderate	Moderate	Up to 150,000
ZLFR® UltraFlo 405X	Low	High	Up to 200,000
ZLFR® UltraFlo B40X	Low	Ultra High	Up to 350,000
ZLFR® UltraFlo E100	Low	High	Up to 250,000

The surfactant and solvent packages are special engineered in ZLFR® UltraFlo series. The quick inversion and homogeneous dispersion behaviors allow the immediate maximum performance output of UltraFlo series for any water conditions. The result indicated the insignificant difference between well hydrated 317X powder and ZLFR® UltraFlo 317X in high brine flow loop test.



# PART.06

## OTHER COMPLETION CHEMICALS



### FlowAids Surfactant

Flowback water is a fracking fluid and formation water mixture which begins to flow back to the surface once the completion is finished. High flowback rate provides a cleaner hydrocarbon flow channel in the fracture to offer better well productivity. ZL CleanStim is a bio-based FlowAids surfactants series which drops interfacial tension between fracking fluid and formation hydrocarbon dramatically in a short of time. No emulsifier behavior makes water and oil separation fast. ZL ChemStim shows a quick oil breakthrough and high oil flow rate performance in flow back test.



### ZL CleanStim 100

Economical product is engineered for ultra-performance.



### ZL ChenStim 200

Premium product is designed for performing in challenging situation (high brine, low PH or high undissolved solid concentration).



### FR Booster

ZL Emo Boost is a booster product to increase the salinity tolerance of FR emulsions.

