Clay Stabilizer KHF002L

1. Introduction

Clay stabilizers are routinely added to aqueous-based fracturing fluids to help prevent damage to the formation caused by clay migration and swelling. These clay stabilizers are either a temporary or permanent type, and they are often used in combination.

The clay stabilizer KHF002L is a KCl substitute for KHF002 which can be used to prepare the salt water for mixing fracturing fluid. The additive can also stabilize the reactive clays in the formation temporarily during fracturing and flowback operations.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF002L	Colorless liquid	1.08-1.13	Soluble	Moderate- Eyes	None	7.0-8.0

3. Chemical Properties and Application

Temporary Clay Stabilizer KHF002L is an organic efficient liquid clay stabilizer. It is NOT liquid KCl, but it can be substituted for KCl in most applications.

KHF002L has been used at temperatures up to 350°F without any adverse effect on fluid rheology.

KHF002L can be batch mixed, or continuously mixed into the fracturing fluid using a liquid-additive system. This eliminates the time-consuming step of batch mixing dry KCl in the base fluid. KHF002L can be used in most aqueous-based fracturing fluids and is compatible with most additives used in the fracturing fluid systems.

4. Treatment

The recommended KHF002L concentration is 2 Gal/1,000 Gal (2 L/m^3). For specific formations such as high reactive clay content, the KHF002L concentration can be further optimized using laboratory core tests.

5. Packaging

KHF002L is supplied in 55 gallons high density polyethylene (HDPE) drums or 265 gallons HDPE totes. Keep it away from extreme conditions such as places near flames or direct sunlight.

Biocide KHF003

1. Introduction

The mixing water for the preparation of fracture fluid should be free of bacteria and enzymes. Either can cause degradation of the polymer and premature viscosity break. They can also prevent viscosity development. Bacteria produce enzymes to which most guar or guar derivative polymers are particularly sensitive.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF003	Colorless to yellowish liquid	0.95-1.00	Soluble	Eyes, skin, inhalation	Flammable	7.0-8.0

3. Chemical Properties and Application

The biocide KHF003 is added to the mix-water as early as possible before the bacterial problem develops. It can be continuously mixed during the treatment to prevent bacterial growth in the reservoir, but it will be of little or no benefit to the stability of the fracturing fluid if added by continuous mix. This product will kill bacteria but cannot remove enzymes.

When using polymer-free systems (such as SurFrac), biocides or bactericides are NOT required because KHF003 may interfere with rheological properties of SurFrac fluids.

KHF003 is compatible with most additives used in crosslinked guar based fracturing fluids, but certain additives such as scale inhibitors, demulsifiers especially enzyme breakers might not be compatible with KHF003. Laboratory testing is required before using these additives together in fluid systems.

4. Treatment

The recommended concentration for KHF003 is 0.25-0.75 Gal/1,000 Gal of mixing water.

5. Packaging

This product is supplied in 55 gallons high density polyethylene (HDPE) or steel drums. Keep it away from extreme conditions such as places near flames or direct sunlight.

Stabilizer Aid KHF004

1. Introduction

Iron ions present in mix-water or fracturing fluids can affect the fluid properties adversely. A stabilizer must be added whenever the dissolved iron concentration is greater than 10 ppm. KHF004 is one of the effective stabilizers used in guar-based fracturing fluids to prevent the adverse effect of iron on fluid properties.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF004	Colorless to light yellow liquid	1.12-1.18	Soluble	Eyes, skin	None	9.0-11.0 (1%)

3. Chemical Properties and Application

High concentration of dissolved iron in mix-water or fracturing fluids can severely affect fluid viscosity especially at elevated shear and temperature. Stabilizer Aid KHF004 is an organic-based iron stabilizer which can be used to minimize the adverse effect of dissolved iron and to enhance fluid properties at elevated temperature and shearing. If dissolved iron concentration is low (less than 2 ppm) and temperature is less than 220°F, KHF004 is generally NOT required for stabilization. However, KHF004 MUST be used if fluid temperature is greater than 250°F no matter the concentration of dissolved iron.

KHF004 is compatible with most additives used in guar-based fracturing fluids, but it may interfere with some oxidizing breakers if the fluid is not properly designed.

4. Treatment

The recommended concentration for KHF004 is 1-3 Gal/1,000 Gal of mixing water.

5. Packaging

KHF004 is supplied in 55 gallons high density polyethylene (HDPE) drums. Keep it away from extreme conditions such as places near flames or direct sunlight.

Flowback Additive KHF007S

1. Introduction

Surface active reagents were generally used in aqueous-based stimulation fluids to lower the interfacial tension that restricts fluid flow in the rock matrix. KHF007S surfactant lowers the capillary pressure by both improving the wettability of the pore throat and reducing the interfacial tension.

Both laboratory testing and field results have shown that KHF007S can provide superior cleanup due to the wetting properties and surface tension reduction that leads to lower capillary pressures. The use of KHF007S results in less swabbing time, faster cleanup and more complete recovery of stimulation fluids.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF007S	Light yellow liquid	1.00-1.05	Soluble	Eyes, skin, inhalation	Fire	7.0-9.5

3. Chemical Properties and Application

KHF007S promotes fracturing fluid cleanup of the proppant pack and the invaded rock matrix because the contact angles resulting from the use of KHF007S are higher than those for other conventional cleanup surfactants. In addition, the surface and interfacial tension values from the use of KHF007S are also lower than most conventional surfactants used. This leads to significantly lower capillary pressures which reduces the force required to initiate flow of the stimulation fluid and therefore, KHF007S should provide better and quicker fluid recovery following a stimulation treatment.

KHF007S are compatible with all additives used in Guar-based fracturing fluids such as OPTiFrac. Lab testing indicates that KHF007S can be used for temperature applications up to 350°F.

KHF007S can reduce the surface tension to as low as 22 Dynes/cm at 30°C.

4. Treatment

The CMC value for KHF007S is low. However, 1-2 Gal/1,000 Gal is the generally recommended concentration for most fracturing fluids.

5. Packaging

KHF007S is supplied in 55 gallons high density polyethylene (HDPE) drums or 265 gallons HDPE totes. Keep it away from extreme conditions such as places near flames or direct sunlight.

Low Temperature Breaker KHF011

1. Introduction

Proppant-pack permeability can be severely damaged by gelling agents such as guar or its derivatives. The amount of damage increases as polymer concentration increases. Breakers are generally used to reduce the viscosity of the fracturing fluids by degrading the polymer that is concentrated in the proppant pack. KHF011 is an oxidizer breaker used in most guar or guar derivative based fracturing fluids.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF011	White crystals	1.89-2.09	Soluble	Eyes, skin	Oxidizer	3.0-7.0 (5%)

3. Chemical Properties and Application

The reactivity of KHF011 is strongly dependent on temperature. Thermal decomposition of KHF011 produces highly reactive radicals that can attack the guar-based polymer backbone.
By itself, KHF011 is effective in the temperature range of 125 to 225°F. KHF011 can be used at fluid temperatures less than 125°F when breaker aid is used together. Encapsulated breaker KHF012 should be used at high temperature greater than 225°F.
KHF011 is not compatible with reducing chemicals and stronger oxidizers. Care should be taken to avoid the use of reducing additives and stronger breakers together with KHF011.

4. Treatment

Breaker KHF011 is an oxidative breaker. It can be used in both linear gel and crosslinked fluids. Breaker KHF011 can be batch mixed, continuously mixed or used as a dry material.
Typical concentration of 0.01-2.0 lbs/Mgal is recommended to cover most fracturing operations.

5. Packaging

KHF011 is supplied in 55 lbs plastic-lining bags generally in buckets with net weight of 25 kg/packaging. Keep it away from extreme conditions such as places wet and humid or direct sunlight.

Medium Temperature Encapsulated Breaker KHF012

1. Introduction

Proppant-pack permeability can be severely damaged by gelling agents such as guar or its derivatives. The amount of damage increases as polymer concentration increases. Breakers are used to reduce the viscosity of the fracturing fluid by degrading the polymer that is concentrated in the proppant pack. KHF012 is the encapsulated version of KHF011, which is used for breaking polymers in fracturing fluids.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF012	White to tan granules	1.76-1.96	N/A	Eyes, skin	Oxidizer	N/A

3. Chemical Properties and Application

KHF012 is a particulate material with specific size produced by coating (encapsulating) KHF011 with a water-resistant barrier. Encapsulation of the breaker greatly reduces fracturing fluid exposure to the breaker and enables the use of high concentrations of breaker that, without coating, would rapidly reduce the fluid viscosity. KHF012 cannot leak off and be lost to the formation, KHF012 remains in the fracture where it is needed to degrade concentrated polymers. After fracturing treatment, release of the breaker occurs as the reservoir temperature increases and the fracture closes.

The effective working temperature for KHF012 is in the range of 125-275°F.

KHF012 can be used in most guar and derivative based fracturing fluid systems such as OPTiFrac and UniFrac. It is compatible with most additives used in these systems except for reducers or stronger oxidizers.

4. Treatment

Breaker KHF012 is an oxidative breaker. It can be used in both linear gel and crosslink fluids. KHF012 can be used with proppant sizes 16/30 mesh and smaller. As much as 5 times of KHF011 loading (up to 10 lbs/Mgal) can be added into fracturing fluids by using encapsulation technique such as in KHF012.

5. Packaging

KHF012 is supplied in 55 lbs plastic-lining bags generally in buckets with net weight of 25 kg/packaging. Keep it away from extreme conditions such as places wet and humid or direct sunlight.

High Temperature Breaker KHF013

1. Introduction

Proppant-pack permeability can be severely damaged by gelling agents such as guar or its derivatives. The amount of damage increases as polymer concentration increases. Breakers are generally used to reduce the viscosity of the fracturing fluids by degrading the polymer that is concentrated in the proppant pack. KHF013 is an oxidizer designed for breaking guar or guar derivative based fracturing fluids at high temperature applications.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF013	White granules	3.27-3.47	Soluble	Eyes, Skin	Oxidizer	7.0-8.0 (1%)

3. Chemical Properties and Application

The reactivity of KHF013 is strongly dependent on temperature. Thermal decomposition of KHF013 produces highly reactive radicals that attack the guar-based polymer backbone.
KHF013 is effective in the temperature range of 200 to 300°F. KHF011 can be used at fluid temperatures less than 200°F. KHF014 (encapsulated KHF013) should be used at high temperatures greater than 300°F.
KHF013 is a strong oxidizer which is reactive with most chemicals such as acids, salts, and all reducing agents. Toxic or corrosive gases may release from the above reactions. Care should be taken seriously to avoid the use of reducing agents, acids, salts and other oxidizers together with KHF013.

4. Treatment

KHF013 concentration depends on factors such as polymer concentration, temperature, break time requirement, and polymer type. Typical concentration of 0.01-2.0 lbs/Mgal is recommended to cover most fracturing operations. Laboratory testing may be required for optimized breaker schedule design.

5. Packaging

KHF013 is supplied in 55 lbs plastic-lining bags generally in buckets with net weight of 25 kg/packaging. Keep it away from extreme conditions such as places wet and humid or direct sunlight.

High Temperature Encapsulated Breaker KHF014

1. Introduction

Proppant-pack permeability can be severely damaged by gelling agents such as guar or its derivatives. The amount of damage increases as polymer concentration increases. Breakers are used to reduce the viscosity of the fracturing fluid by degrading the polymer that is concentrated in the proppant pack. KHF014 is the encapsulated version of KHF013, which is used for breaking polymers in fracturing fluids at high temperatures.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF014	Light yellow granules	1.92-2.12	N/A	Eyes, Skin	Oxidizer	N/A

3. Chemical Properties and Application

KHF014 is a particulate material with specific size produced by coating (encapsulating) KHF013 with a water-resistant barrier. Encapsulation of the breaker greatly reduces fracturing fluid exposure to the breaker and enables the use of high concentrations of breaker that, without coating, would rapidly reduce the fluid viscosity. KHF014 cannot leak off and be lost to the formation, KHF014 remains in the fracture where it is needed to degrade concentrated polymers. After the fracturing treatment, release of the breaker occurs as reservoir temperature increase and the fracture closes.

The effective working temperature for KHF014 is in the range of 200-350°F.

KHF014 can be used in most guar and derivative based fracturing fluid systems such as OPTiFrac and EZFrac. It is compatible with most additives used in these systems except for reducers, acids, salts, and other oxidizers, which require extra care to confirm using them together.

4. Treatment

As much as 5 times of KHF013 loading (up to 10 lbs/Mgal) can be added into fracturing fluids by using encapsulation technique such as in KHF014.

5. Packaging

KHF014 is supplied in 55 lbs plastic-lining bags generally in buckets with net weight of 25 kg/packaging. Keep it away from extreme conditions such as places wet and humid or direct sunlight.

Guar Gelling Agent KHF021

1. Introduction

Gelling Agent KHF021 is a high-yielding dry guar product for continuous or batch mixing of fracturing fluids. Its hydration rate is faster compared to conventional guar and is easier to disperse and hydrate in water.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF021	White powder	1.35-1.55	Soluble	Eyes, nose, throat	Fire, dust, water slick	6.5-7.0 (0.6%)

3. Chemical Properties and Application

Slurry based (diesel or other oils) guar products are typically hazardous to environment. KHF021 is a specially treated dry powder of guar that delivers faster hydration rate and higher yielding values after hydration. This higher yield guar generally provides much better crosslinking properties (viscosity) than conventional guar products, allowing much lower gel loading and leads to better fracture conductivity.

Together with crosslinker, activator, and the delaying agent, the gelling agent KHF021 provides wide range of delay time and rheological property at temperature and shear. The delay time can vary from 0~6 minutes and the fluid are stable up to 150°C.

The high temperature stabilizer KHF005 can be used to prevent degradation of fracturing fluids at temperatures greater than 200°F (93°C).

4. Treatment

The 20-40 lbs/1,000 gal gel loading is generally required to get enough viscosity to initiate the fracture and transport the proppant into the fracture. The gel loading is dependent on the formation bottom hole temperature. Typically, higher the temperature, higher is the gel loading required to achieve the required viscosity.

5. Packaging

KHF021 is supplied in plastic-lining bags with net weight of 25 kg/sack or 900 kg/jumbo bag. It should be stored in shaded areas with good ventilation. Keep it away from high temperature, humidity and direct sunlight.

Guar Slurry KHF021L

1. Introduction

Gelling Agent KHF021L is a high-yielding guar slurry for continuous or batch mixing of fracturing fluids. Its hydration rate is faster compared to guar powder, and is easier to meter, disperse and hydrate in water.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF021L	Amber liquid	1.06-1.11	Soluble	Eyes, nose, throat	Fire, water slick	N/A

3. Chemical Properties and Application

For fracturing applications, specially-treated free-flowing dry guar powder is liked by the operating companies due to the absence of diesel and similar oils. However, its metering and use at the well site are difficult. When mixed with water, these dry guar powder can form fish eyes, and thus many times cannot achieve the desired maximum viscosity on hydration. For this reason, guar powder is slurry in diesel or mineral oils, and provides much better crosslinking properties (viscosity) allowing much lower gel loading and leads to better fracture conductivity.

In addition to proppant carrying in hydraulic fracturing, this slurry can also be used as a pad for both hydraulic and acid fracturing. Together with crosslinker, activator, and the delaying agent, the gelling agent KHF021L provides wide range of delay time and rheological property at temperature and shear. The delay time can vary from 0~3 minutes and the fluid are stable up to 350°F.

The high temperature stabilizer and stabilizer aids can be used to prevent degradation of fracturing fluids at temperatures greater than 200°F (93°C).

4. Treatment

Guar Slurry equivalent to 20-40 lbs/1,000 gal guar gel loading is generally required to get enough viscosity to initiate the fracture and transport the proppant in to the fracture. The gel loading is dependent on the formation bottom hole temperature, pumping time, and cool down. Typically, higher the temperature, higher is the gel loading required to achieve the required viscosity.

5. Packaging

KHF021L is supplied in 265 gallons high density polyethylene (HDPE) totes. It should be stored in shaded areas with good ventilation. Keep it away from high temperature, fire, humidity and direct sunlight.

Foaming Agent KHF022

1. Introduction

Surfactants are molecules that reduce surface and interfacial tensions between water and oil phases. Foaming agents are composed of one or more surfactants specifically tailored to stabilize the interface between the internal and external phases of a foam. KHF022 is a superior foaming agent and is highly recommended for foam fracturing and coiled tubing cleanout applications. Foam tends to use much less volume of water and is good for fracturing in gas wells and in water sensitive formations.

2. Physical Properties and Hazards

Additive	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF022	Light yellow liquid	0.90-1.00	Soluble	Eyes, skin, inhalation	Fire	9.0-11.0

3. Chemical Properties and Application

The foaming agent can generate a stable foam in the presence of gas and water with or without salt/acid or similar. The foaming agent can be injected with the fluid or introduced later using coiled tubing. KHF022 is unique in chemical nature so that it not only acts as a foaming agent, but also reduces surface tension and interfacial tension of the stimulation fluids and changes the wettability behavior of the fluids in rock matrix. KHF022 can be used to foam water, but the stability of the foam can be increased significantly when a linear gel with 20 lbs/1,000 gal guar is used. Foam fluids also help in the faster unloading of the well after a fracturing treatment.

4. Treatment

1 to 5 Gal/1,000 Gal of KHF022 is sufficient to create a very stable form for fracturing and coiled tubing cleanout. This fluid can be energized or foamed with Nitrogen or Carbon Dioxide. Oil and other organic solvents can lower the stability of foams.

5. Packaging

KHF022 is supplied in 5 gallons high density polyethylene (HDPE) pails or 55 gallons steel drums. Keep it away from extreme conditions such as places near flames or direct sunlight.

Crosslinker KHFN0304

1. Introduction

Crosslinker are generally introduced to polymer-based fracturing to improve the rheological properties of fracturing fluids.

KHFN0304 is a borate crosslinker used in N_2 foamed guar based fracturing fluids such as E-Frac. Borate-crosslinked N_2 foamed guar-based fracturing fluids reach optimum properties when the pH is in the range of 10.5-12.0. Crosslinker KHFN0304 itself contains a pH buffer and delaying agent to optimize crosslinking and improve fluid viscosity and stability.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHFN0304	Light yellow liquid	1.18-1.23	Soluble	Eyes, skin, Inhalation	Corrosive	12.0-14.0 (1%)

3. Chemical Properties and Application

KHFN0304 is a borate crosslinker used in N_2 foamed guar-based fracturing fluids. It provides the required pH value to crosslink guar or derivatives hydrated in salt or mix-water. Therefore, it is used in most guar or guar derivative-based fracturing fluids to improve fluid rheological properties and temperature stability. The pH value is controlled within the range of 10.5-12.0 under most application conditions.

KHFN0304 molecules contain special groups that delay the crosslink reaction between borate and guar or guar derivative molecules. Depending on the chemical environment such as mix-water, reactant concentrations such as KHF021, and temperature, crosslink delay time can be controlled in the range of 1-6 minutes.

The optimum KHFN0304 concentration should be designed based on the required crosslink delay time and fluid properties, depending on other additives and their concentrations.

KHFN0304 is compatible with all additives used in E-Frac fracturing fluid systems, which are engineered for use up to 200°F.

4. Treatment

The concentration of KHFN0304 dependent on the polymer concentration, temperature, mix-water salinity and desired crosslink delay time. Typically, 3-10 Gal/1,000 Gal KHFN0304 are required to cover most applications.

5. Packaging

KHFN0304 is supplied in 55 gallons high density polyethylene (HDPE) drums or 265 gallons HDPE totes. Keep it away from extreme conditions such as places near flames or direct sunlight.

Crosslinker KHFN0510

1. Introduction

Crosslinker are generally introduced to polymer-based fracturing to improve the rheological properties of fracturing fluids.

KHFN0510 is a borate crosslinker used in N_2 foamed guar based fracturing fluids such as E-Frac. Borate-crosslinked N_2 foamed guar-based fracturing fluids reach optimum properties when the pH is in the range of 10.5-12.0. Crosslinker KHFN0510 itself contains a pH buffer and delaying agent to optimize crosslinking and improve fluid viscosity and stability.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHFN0510	Light yellow liquid	1.25-1.30	Soluble	Eyes, skin, Inhalation	Corrosive	12.0-14.0 (1%)

3. Chemical Properties and Application

KHFN0510 is a borate crosslinker used in N_2 foamed guar-based fracturing fluids. It provides the required pH value to crosslink guar or derivatives hydrated in salt or mix-water. Therefore, it is used in most guar or guar derivative-based fracturing fluids to improve fluid rheological properties and temperature stability. The pH value is controlled within the range of 10.5-12.0 under most application conditions.

KHFN0510 molecules contain special groups that delay the crosslink reaction between borate and guar or guar derivative molecules. Depending on the chemical environment such as mix-water, reactant concentrations such as KHF021, and temperature, crosslink delay time can be controlled in the range of 1-6 minutes.

The optimum KHFN0510 concentration should be designed based on the required crosslink delay time and fluid properties, depending on other additives and their concentrations.

KHFN0510 is compatible with all additives used in E-Frac fracturing fluid systems, which are engineered for use up to 275°F.

4. Treatment

The concentration of KHFN0510 dependent on the polymer concentration, temperature, mix-water salinity and desired crosslink delay time. Typically, 3-10 Gal/1,000 Gal KHFN0510 are required to cover most applications.

5. Packaging

KHFN0510 is supplied in 55 gallons high density polyethylene (HDPE) drums or 265 gallons HDPE totes. Keep it away from extreme conditions such as places near flames or direct sunlight.