

MGA® - Multi-functional Gelled Acid

1. System Description and Benefits

Diverting treatment fluids to target zones and increasing oil production rate are crucial in acid stimulation of complex sandstone formations. MGA used in sandstone stimulation treatment not only divert acids to provide zonal coverage, but also behaves as relative permeability modifier to increase oil production and reduce water-cut. Operational simplicity and non-damaging nature of MGA reduces operational risks and improves flowback of treatment fluids.

Characteristics	Benefits
Less additives in acids	Simple and easy field mixing and operations
Combine acids with viscoelastic diverter	
Different rheological profile in water and oil zone	Increase oil/gas production by reducing water-cut and effective diversion without damaging
Self-diverting of acids for better zonal coverage	
Non-polymeric nature	
Stable in wide temperature ranges	Applicable in variety of wells and formations
Used in wide ranges of water-cut and permeability contrast	

2. MGA Additives

Additive	OPT Code	Color and Form
Mutual Solvent	KMA002	Colorless Liquid
Viscoelastic Surfactant	KMA007	Light Brownish Liquid
Ultra-high Temperature Viscoelastic Surfactant	KMA007A	Amber-yellow Liquid
High Temperature Viscoelastic Surfactant	KMA007B	Amber-yellow Liquid

3. Typical Properties and Field Applications

MGA technology was commercialized in 2019 successfully and has been applied in various oil and gas fields in the world. It has been proved to be effective in treatment of sandstone reservoirs with the following conditions:

Temperature: BHST 80-350°F (27-177°C)

Formation: 5 mD to 2 D at various water-cut

Treatment fluids: HCl/HF, organic acids/HF, EZStim fluids

Mix-water: Fresh water, seawater, brines

Further information about field applications is described in documented "Case History of MGA Technology".

4. Precautions and HSE Considerations

Viscoelastic diverter (KMA007, KMA007A and KMA007B) in MGA systems play the most important role in effective stimulation of various sandstone reservoirs with high water-cut. In addition, the mutual solvent (KMA002) is also used in breaking the surfactant micelles in MGA systems.

The laboratory procedures, quality assurance program and guidelines for field mixing and handling of MGA systems are described in MGA fluid manual.

Refer to the technical sheet and SDS of the respective product for the health, safety and environmental information of each product.

Mutual Solvent KMA002

1. Introduction

Oil film around formation fines sets a barrier for acids or other stimulation fluids to react with formation rock. Mutual solvent mixed in acids or stimulation fluids will dissolve the oil films and water-wet the formation fines. KMA002 is therefore normally used in most acidizing fluid systems to penetrate sandstone matrix and water-wet formation grains in order to improve acidizing efficiency.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA002	Colorless liquid	0.90-0.95	Soluble	Eyes, skin	Fire	5.5-6.5

3. Chemical Properties and Application

KMA002 is a multi-functional surfactant which is very effective in facilitating fluid flow, breaking emulsions, and preventing water blocks. It can be used for most applicable stimulation fluid systems at various well conditions.

KMA002 is miscible in acids, oils, water and brines. The functional groups attached to KMA002 molecules provides KMA002 with strong surface-active properties. KMA002 reduces surface tension of water and interfacial tension of water oil interfaces and reverse the wettability of solid surfaces from oil-wet to water-wet. It is especially effective in removing oil films from formation fines leaving surface water-wet for more acids to react.

KMA002 is compatible with most additives in stimulation fluid systems. Lab testing is required when new corrosion inhibitor is considered since KMA002 may have adverse effect on corrosion inhibition.

4. Treatment

5-10% Volume is typically enough for most cleanup and acidizing jobs. 10% Volume is considered the optimum concentration in most fluid designs.

5. Packaging

KMA002 is supplied in 55 gallons steel drums. Keep it away from extreme conditions such as places near flames or direct sunlight.

Viscoelastic Surfactant KMA007

1. Introduction

Fluid and petro-physical heterogeneities are encountered in most sandstone and carbonate formations. Chemical diverter technology is one of the methodologies to be used in stimulation treatment to divert treatment fluids from high water cut layers to low water cut layers, and/or from high permeability zones to low permeability zones. KMA007 is a non-damaging chemical diverter used in stimulation fluid systems to improve treatment fluid distributions across formation matrix to increase stimulation efficiency.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA007	Light brownish liquid	0.95-1.05	Soluble	Eyes, skin	Fire	6.0-7.0 (1% Alcohol solution)

3. Chemical Properties and Application

KMA007 is a surfactant based chemical diverter which is very effective in distributing treatment fluid homogeneously across treatment zones in stimulation treatment at various well conditions.

KMA007 forms viscous micelle structure when its concentration reaches certain level in water or brines. The viscosity breaks dramatically when it contacts with hydrocarbon or crude oils. The in-situ viscous behavior of KMA007 in aqueous solution will divert treatment fluids from high water-cut to low water-cut, from high permeability to low permeability zones of the rock matrix. The matrix is therefore stimulated homogeneously.

KMA007 is compatible with most additives in stimulation fluid systems. Some additives such as corrosion inhibitor or solvent may have adverse effect on KMA007 rheological properties. Compatibility testing is generally required when KMA007 is used in stimulation treatment.

4. Treatment

5-10% Volume is typically enough for most stimulation jobs. 7.5% Volume is considered the optimum concentration in most fluid design.

5. Packaging

KMA007 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.

Ultra-high Temperature Viscoelastic Surfactant KMA007A

1. Introduction

Fluid and petro-physical heterogeneities are encountered in most sandstone and carbonate formations. Chemical diverter technology is one of the methodologies to be used in stimulation treatment to divert treatment fluids from high permeability zones to low permeability zones. KMA007A is a non-damaging chemical diverter used in stimulation fluid systems to improve treatment fluid distributions across formation matrix to increase stimulation efficiency. It is suitable to be used in wells that are below 350°F.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA007A	Amber-yellow liquid	1.00-1.05	Miscible	Eyes, skin	Fire	7.0-8.0 (1% Alcohol solution)

3. Chemical Properties and Application

KMA007A is a surfactant based chemical diverter which is very effective in distributing treatment fluid homogeneously across treatment zones in stimulation treatment at various well conditions.

KMA007A forms viscous micelle structure when its concentration reaches certain level in water or brines. The viscosity breaks dramatically when it contacts with hydrocarbon or crude oils. The in-situ viscous behavior of KMA007A in aqueous solution will divert treatment fluids from high water-cut to low water-cut, from high permeability to low permeability zones of the rock matrix. The matrix is therefore stimulated homogeneously.

KMA007A is compatible with most additives in stimulation fluid systems. Some additives such as corrosion inhibitor or solvent may have adverse effect on KMA007A rheological properties. Compatibility testing is generally required when KMA007A is used in stimulation treatment.

4. Treatment

5-10% volume is typically enough for most stimulation jobs. 6% volume is considered the optimum concentration in most fluid design.

5. Packaging

KMA007A 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, direct sunlight and moisture.

High Temperature Viscoelastic Surfactant KMA007B

1. Introduction

Fluid and petro-physical heterogeneities are encountered in most sandstone and carbonate formations. Chemical diverter technology is one of the methodologies to be used in stimulation treatment to divert treatment fluids from high permeability zones to low permeability zones. KMA007B is a non-damaging chemical diverter used in stimulation fluid systems to improve treatment fluid distributions across formation matrix to increase stimulation efficiency. It is suitable to be used in wells that are below 350°F.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA007B	Amber-yellow liquid	1.00-1.05	Miscible	Eyes, skin	Fire	7.0-8.0 (1% Alcohol solution)

3. Chemical Properties and Application

KMA007B is a surfactant based chemical diverter which is very effective in distributing treatment fluid homogeneously across treatment zones in stimulation treatment at various well conditions.

KMA007B forms viscous micelle structure when its concentration reaches certain level in water or brines. The viscosity breaks dramatically when it contacts with hydrocarbon or crude oils. The in-situ viscous behavior of KMA007B in aqueous solution will divert treatment fluids from high water-cut to low water-cut, from high permeability to low permeability zones of the rock matrix. The matrix is therefore stimulated homogeneously.

KMA007B is compatible with most additives in stimulation fluid systems. Some additives such as corrosion inhibitor or solvent may have adverse effect on KMA007B rheological properties. Compatibility testing is generally required when KMA007B is used in stimulation treatment.

4. Treatment

5-10% volume is typically enough for most stimulation jobs. 7.5% volume is considered the optimum concentration in most fluid design.

5. Packaging

KMA007B 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.