

ELViS[®] - Effective Laminar-flow Viscous Spacer

1. System Description and Benefits

ELViS spacer system is engineeringly designed to displace mud effectively prior to cementing using effective laminar-flow technique whenever turbulent flow is not applicable. The system can be easily formulated to meet with criteria of laminar flow technique which requires the hierarchy of slurry density and apparent viscosity between drilling fluids, spacer and cement slurries.

Characteristics	Benefits
Fast-hydration polymer with special defoamer or antifoam agent	Simple operations and easy field mixing
High yield point to provide good spacer stability	Stable hierarchy viscosity and density design to displace muds effectively using effective laminar flow technique
Adjustable apparent viscosity	
Controllable density with various weighing agents	
Can be mixed with fresh water and brines	Applicable for cementing various oilwells

2. ELViS Additives

Product	Code	Form
Antifoam Agent	KCM003	Colorless liquid
Defoamer and Anti-foaming Agent	KCM043	White emulsion
High Temperature ELViS Additive	KCM004	Yellow powder
Medium Temperature ELViS Additive	KCM006	Red-brown powder

3. Typical Properties and Field Applications

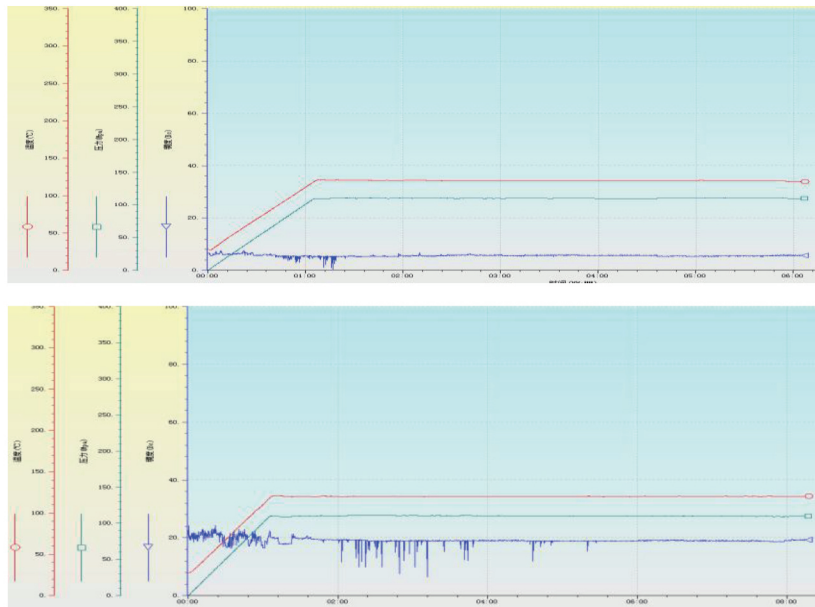
ELViS spacer technology was commercialized in 2009 successfully and has been applied in various oil and gas fields in the world. It has been proved to be effective in cementing oil or gas wells with the following conditions and properties:

Temperature: BHST 95-320°F (35-160°C)
 Density: 10.0 ppg to 20.5 ppg (1.20 – 2.45 g/cm³)
 Mix-water: Fresh water, seawater, and brines
 Rheology: Adjustable up to 160°C
 API mud fluid loss: ≤50 mL

Further information about field jobs is described in documented “Case History of ELViS Technology”.

Typical compatibility and thickening time of ELViS spacers are shown in the following Table and Figures.

Mud, 1.95g/cm ³	Rheology at room temperature	270/169/128/82/15/9
	Rheology at 93°C	85/55/42/30/7/4
Spacer, 2.05g/cm ³	Rheology at room temperature	150/98/78/52/16/15
	Rheology at 93°C	102/72/59/42/12/11
Lead slurry, 2.10g/cm ³	Rheology at room temperature	x/194/138/75/5/4
	Rheology at 93°C	226/125/89/48/4/3



4. Precautions and HSE Considerations

High temperature (KCM004) and medium temperature ELViS additive play the most important role in cementing job design using effective laminar technique. In addition, defoamer (KCM043) and antifoam agent (KCM003) are also used in ELViS systems. ELViS density can be easily adjusted with various weighing agents such as hematite and barite, which are compatible with ELViS additives.

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

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

Antifoam Agent KCM003

1. Introduction

Foams formed while mixing cement slurry cause many problems such as lower and wrong density reading, poor particle wetting and hydration efficiency, and pumping difficulties due to pump cavitation and loss of suction. KCM003 antifoam agent is often required in cement slurry to prevent foaming tendency and avoid problems described above.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Melting/Flash Point (°C)	Health Hazard	Physical Hazard	pH
KCM003	Colorless liquid	0.98-1.03	Soluble	>93	Eyes Irritation	None	8-9

3. Chemical Properties and Application

KCM003 is an effective antifoam agent in most cement slurries that do not have high salt concentrations. It is not a foam breaker therefore KCM003 should be always added into mixing water before any foam forms. Higher agitation is required in cold weather for better dispersion.

4. Treatment

KCM003 is an effective antifoam agent in most cement slurries that do not have high salt concentrations. It is not a foam breaker therefore KCM003 should be always added into mixing water before any foam forms. Higher agitation is required in cold weather for better dispersion.

5. Packaging

KCM003 is supplied in 5 gallons high density polyethylene (HDPE) drums or 55 gallons steel drums. Keep it away from extreme conditions such as places near flames or direct sunlight.

High Temperature ELViS Additive KCM004

1. Introduction

KCM004 is a mid to high temperature spacer engineered to assist mud removal by acting as a buffer between cement slurry and drilling fluids with specific density and rheological properties. Together with chemical washes, it can be pumped as either turbulent or laminar flow. Some spacers also provide good fluid loss control. Some additives present in spacer can help cement bond with casing and formation rocks.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Melting Point (°C)	Health Hazard	Physical Hazard	pH
KCM004	Yellow powder	1.95-2.15	Soluble	ND	Eyes	Dust	N/A

3. Chemical Properties and Application

KCM004 is a viscous spacer designed to displace mud at laminar flow technique. It can be used for both freshwater and saltwater mud systems. Salt can be added into spacer for any salty formations and typically a few percent of KCL is good enough to maintain shale stability in most applications.

Laminar flow technique is easily achieved by designing the density and rheological properties of KCM004 viscous spacer. The criteria are to keep density and viscosity of KCM004 system between those of drilling mud system and cement slurry by adjusting the concentration of KCM004.

Compatibility of KCM004 viscous spacer with drilling fluids and cement slurry are required and must be tested in laboratory before field applications. Specialty additives are sometimes added in KCM004 system to improve cement bonding and mud removal efficiency.

4. Treatment

Typical concentrations range from 3.0 lbs./bbl. to 15.0 lbs./bbl. For high salt formations, higher loading of KCM004 is required to provide fluid loss control.

KCM004 can be used up to 300°F. Lower viscosity and settling are generally observed if temperature is higher than 300°F. Calcium Carbonates is recommended as weighting agent for density range of 1.2-1.4 S.G. Barite can be used to extend density to 2.4 S.G. For density higher than 1.9 S.G., hematite is generally recommended as weighting agent.

5. Packaging

KCM003 is supplied in 5 gallons high density polyethylene (HDPE) drums or 55 gallons steel drums. Keep it away from extreme conditions such as places near flames or direct sunlight.

Medium Temperature ELViS additive KCM006

1. Introduction

Spacers are engineeringly designed to assist mud removal by acting as a buffer between cement slurry and drilling fluids with specific density and rheological properties. Together with chemical washes, it can be pumped as either turbulent or laminar flow. Some spacers also provide good fluid loss control.

Specialty spacers sometimes contain additives, which help to improve cement bonding with casing and formation rocks.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Melting/Flash Point (°C)	Health Hazard	Physical Hazard	pH
KCM006	Red-brown powder	1.86-2.06	Soluble	>93	Eyes	Dust	N/A

3. Chemical Properties and Application

KCM006 is a viscous spacer designed to displace mud at laminar flow technique. It can be used for both freshwater and saltwater mud systems. Salt can be added into spacer for any salty formations and typically a few percent of KCl is good enough to maintain shale stability in most applications.

Laminar flow technique is easily achieved by designing the density and rheological properties of KCM006 viscous spacer MT. The criteria are to keep density and viscosity of KCM006 system between those of drilling mud system and cement slurry by adjusting the concentration of KCM006.

Compatibility laboratory of the spacer MT with drilling fluids and cement slurry are required and must be tested in laboratory before field applications.

Specialty additives are sometimes added to the KCM006 system to improve cement bonding and mud removal efficiency.

4. Treatment

Typical concentrations range from 4.0 lbs./bbl. to 20.0 lbs./bbl. For high salt formations, higher loading is required to provide fluid loss control.

Mixing water: Fresh or saltwater

Concentration: Generally, 12-55 kg/m³. For salt formations, higher concentration is required to improve fluid loss control. For example, to control fluid loss for spacers containing high concentration (20%) of sodium chloride (or KCl), KCM006 concentration should be greater than 25 kg/m³.

Density: 1.20-2.40 S.G. Calcium Carbonate is recommended as weighting agent for density range of 1.2-1.4 S.G. Barite can be used to extend density to 2.4 S.G. For density higher than 1.9 S.G., hematite is generally recommended as weighting agent.

Temperature: KCM006 can be used up to 110°C. Lower viscosity and settling are generally observed if the temperature is higher than 110°C.

5. Packaging

KCM006 is supplied in plastic-lining bags with net weight of 25kg/sack. It should be stored in shaded areas with good ventilation. Keep it away from high temperature, humidity and direct sunlight.

Defoamer and Anti-foaming Agent KCM043

1. Introduction

Foams formed while mixing cement slurry cause many problems such as lower and wrong density reading, poor particle wetting and hydration efficiency, and pumping difficulties due to pump cavitation and loss of suction. Defoamer or antifoaming agent is often required in cement slurry to avoid problems described above, especially for Latex Slurries.

2. Physical Properties and Hazards

Additives	Form	S.G. (20°C)	Water Solubility	Flash Point (°C)	Health Hazard	Physical Hazard	pH
KCM043	White emulsion	0.92-1.12	dispersible	>93	Eyes	None	6-8

3. Chemical Properties and Application

Due to its chemical nature and high content of active ingredient, KCM043 is an effective foam breaking agent in most cement slurries. It can also function as good foam preventer such as KCM003.

KCM043 has been found to be compatible with most additives in cement slurry design without density and temperature limitations. KCM043 is also very effective in latex gas migration control systems and salt-tolerant cement slurries especially in salt-saturated systems.

4. Treatment

0.01-0.05 gal/sack of cement is required in most cement slurry applications.

5. Packaging

This product is supplied in 5 gallons high density polyethylene (HDPE) pail.

Keep it away from extreme conditions such as places near flames or direct sunlight.