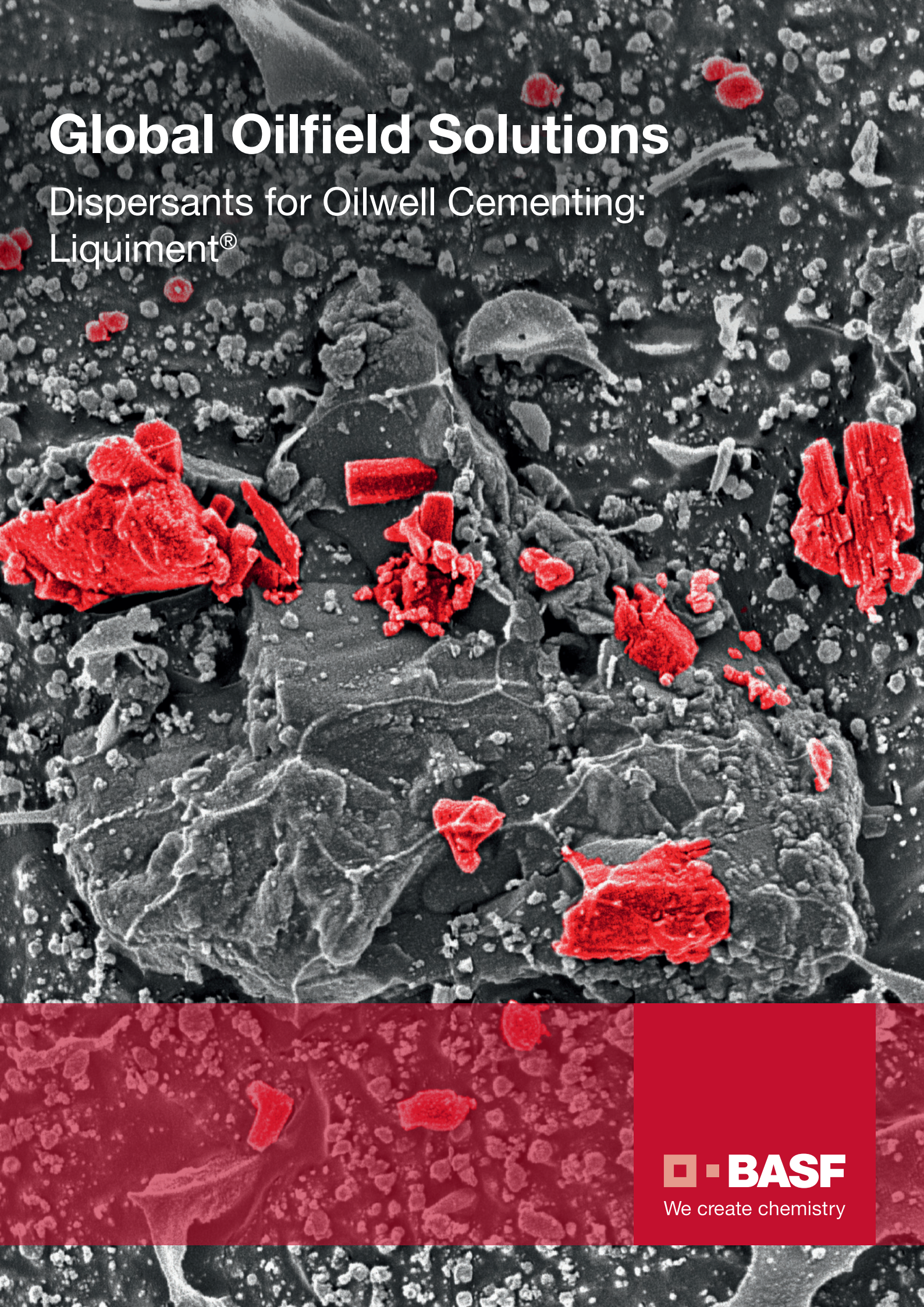


Global Oilfield Solutions

Dispersants for Oilwell Cementing: Liquiment®

BASF
We create chemistry

Disperse cement rheology issues with Liquiment®

One of the primary goals in cement slurry design is the balance between fluid density and the set properties. Cement slurries have to be placed in the annulus without excessive friction pressures that may exceed the fracture gradient of the surrounding formations.

Introduction

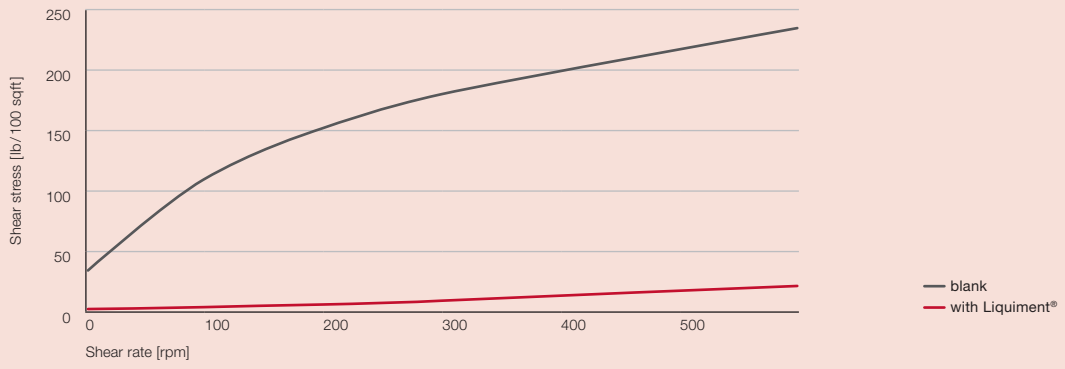
For complete hydration of cement clinker a water / cement ratio of 0.4 is sufficient, but such a slurry would be highly viscous or even unable to be pumped. High molecular polymers like fluid loss control additives additionally increase slurry viscosity. It is possible to decrease the viscosity of the mixture by increasing the water / cement ratio, but this destabilizes the slurry. Cement slurry stability is particularly critical in highly deviated, extended reach and horizontal wells, and in any situation with potential for gas / water migration after cementing. Cement dispersants reduce cement slurry density without destabilizing the cement slurry. As a result, dispersants in cement help reduce power requirements in pumping, mitigate the risk of fracturing weak formations, and limit lost circulation of material.

Within the Liquiment® portfolio BASF is able to offer different, high-performing dispersant technologies to the oilfield service industry.

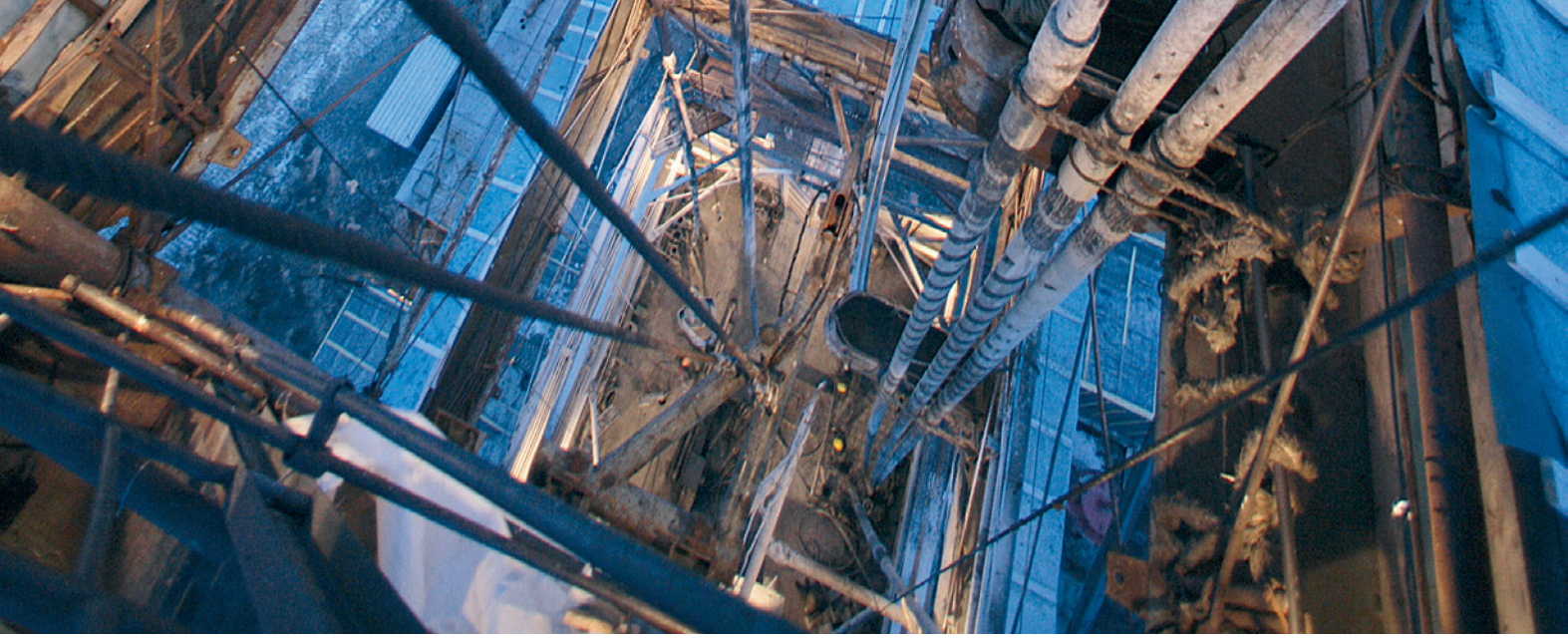
Applications

BASF's Liquiment® dispersants, also known as friction reducers, thinners or turbulence inducers, improve the rheological profile of cement slurries by breaking up cement agglomerates and freeing the water. Dispersed slurries exhibit lower viscosities, which allow for easier mixing and turbulent flow conditions at lower pump pressures. Additionally, dispersed cement slurries show lower fluid loss.

With sufficient Liquiment® dispersant, a cement slurry has a zero yield value and behaves as a Newtonian fluid, thus lowering the horsepower needed for the job. It also reduces the risk of fracturing weak formations and losing circulation when applying weighted cement or during slimhole well cementing.



Cover picture: Cryo-SEM (Scanning Electron Microscopy) image of a cement slurry containing dispersant.



Initial recommendation

Over-dispersion should be avoided as this will de-stabilize the cement slurry, therefore we recommend not to exceed typical dosage rates.

Typical dosage rates (bwoc) are as follows:

- Liquiment® F-10X: ≤ 2%
- Liquiment® K3F: ≤ 1%
- Liquiment® Bio: ≤ 1%
- Liquiment® 1641F: ≤ 0.25%
- Liquiment® 5581F: ≤ 0.25%

To leverage synergistic effects when combining Liquiment® dispersants with certain fluid loss additives, we recommend to include Polytrol® fluid loss additives (as noted in summary table) to the slurry design.

BASF's technical service in their fully equipped cementing laboratory are able to assist you with product recommendations and additional testing you might require.

Product range

Group 1

Classical resin based-dispersants

Our classical dispersants help you to customize your slurry design by covering a wide temperature range. All products are characterized by low cement retardation compared to lignosulfonates or polyaspartic acid.

Liquiment® F-10X:
is a standard cement slurry dispersant based on sulfonated melamine polycondensate chemistry for temperatures up to 60 °C (140 °F). It helps to improve rheological properties of a cement to provide easier mixing, lower friction during pumping and turbulent flow at lower pumping rates.

Liquiment® K3F:
is our high performance resin based dispersant, based on sulfonated acetone polycondensate chemistry. It is a non-toxic and non-hazardous (see SDS prior to use), industry-proven product which is applicable in a wide temperature range from 4 °C (40 °F) to 200 °C (400 °F). Excellent compatibility with high NaCl concentrations up to saturation makes this the dispersant of choice when cementing across water-sensitive formations. Even bivalent ion-containing sea water does not impair product performance.

Liquiment® oilwell cement dispersants

General information

Group	Product	Chemistry	Physical form	Temperature stability
1	Liquiment® F-10X	Sulfonated melamin resin	Powder	up to 140 °F / 60 °C
	Liquiment® K3F	Sulfonated acetone resin	Powder or 33% liquid	up to 400 °F / 200 °C
2	Liquiment® Bio	Grafted sulfonated acetone resin	Powder or 40% liquid	up to 350 °F / 150 °C
3	Liquiment® 1641 F	Polycarboxylate ether (PCE)	Powder	up to 250 °F / 120 °C
	Liquiment® 5581 F	Polycarboxylate ether (PCE)	Powder	up to 250 °F / 120 °C

Group 2

Green dispersants

Our green dispersant helps you to keep up with tightening regulations.

Liquiment® Bio:
is based on a grafted sulfonated acetone resin. It combines a superior performance among the classical dispersants, which is comparable to Liquiment® K3 F, with a distinguished environmental profile. Liquiment® Bio is non-toxic to marine organisms and biodegradable according to OECD 306 standards.

Group 3

High performance dispersants

BASF's high performance dispersants can help you to decrease your chemical demand while delivering outstanding dispersant performance. The portfolio of so-called superplasticizers, comprises two products which are based on polycarboxylate ether (PCE) chemistry.

Liquiment® 1641 F:
provides superior liquefying power compared to conventional dispersants up to minimum 120 °C (250 °F). Low and stable rheology is achieved at significantly lower dosage rates than with standard dispersants and a remarkable salt tolerance of up to 18% NaCl widens the field of potential applications significantly. It shows retarding properties and is often used in $CaCl_2$ accelerated cement slurries where otherwise false set problems are observed. In some applications, reduced shrinkage during cement hardening can be observed.

Liquiment® 5581 F:
represents the next generation of highly effective cement slurry dispersants. It addresses a long-existing need of the industry by providing a superior performance comparable to Liquiment® 1641 F combined with being a non-retarding dispersant. Liquiment® 5581 F also interacts synergistically with fluid loss control additives such as e.g. Polytrol® FL 34 to minimize water leak-off.

Electrolyte tolerance					Availability			
Sea water	NaCl	Dosage [% bwoc]	Retarding effect	Recommended fluid loss additive	Region			
					NA	SA	EU	AP
	+	0.5 – 2.0	Mild	Polytrol® FL 29	■	■	■	■
++	++	0.25 – 1.0	Mild	Polytrol® FL 45	■	■	■	■
++	++	0.25 – 1.0	Mild	Polytrol® FL 45	■	■	■	■
++	++	0.1 – 0.25	Strong	Polytrol® FL 45 / FL 34	■	■	■	■
++	++	0.1 – 0.25	Very mild	Polytrol® FL 34 / FL 24	■	■	■	■

North America – Global Headquarters

BASF Corporation
Global Oilfield Solutions
3120 Hayes Road
Suite 200
Houston, TX 77082
US
Phone: +1 800 7941019
Fax: +1 877 2451806

Europe

BASF SE
Global Oilfield Solutions
G-EVG/GM – J542 S
67056 Ludwigshafen
Germany
Phone: +49 621 60-0

Asia

BASF South East Asia Pte. Ltd.
Global Oilfield Solutions
33 Tuas Avenue 11,
Singapore 639090
Singapore
Phone: +65 6860 7051

South America

BASF S.A.
Global Oilfield Solutions
Avenida das Nações Unidas,
14.171 Morumbi
04794-000 São Paulo
Brazil
Phone: +55 11 2039-3482
Fax: +55 11 2039-2786

Middle East / North Africa

BASF Middle East LLC
Global Oilfield Solutions
P. O. Box 2996
Dubai
United Arab Emirates
Phone: +971 4 8072222
Fax: +971 4 8072149

For further information:
oilfieldsolutions@basf.com
www.oilfield-solutions.basf.com

EVG1450e

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