

REUSABLE HIGH PERFORMANCE WATER BASED DRILLING FLUIDS

[0001] This application claims the benefit of and provisional priority to United States Applications Serial Nos. 61/888,325 filed 08 October 2013 and 14/506137 filed 3 October 2014.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] Embodiments of this invention relates to reusable high performance water based drilling fluids.

[0003] In particular, embodiments of this invention relates to reusable high performance water based drilling fluids, where the fluids include a water based continuous aqueous phase and discontinuous non-aqueous phase, where the aqueous phase is a brine and the non-aqueous phase is composed of glycerols, polyglycerols, poly hydroxyl alcohols, poly hydroxyl alcohols, monosaccharide derivatives, polysaccharide derivatives, or mixtures and combinations thereof.

2. Description of the Related Art

[0004] Oil based drilling fluids have historically been the preferred choice for exploration and development of drilling projects. These fluids are often reused from well to well and guarantee among other things: reasonable costs, good inhibiting properties, and good lubricity properties. Against these advantages, there are several disadvantages including high environmental impact such as spillage risks, significant cuttings disposal costs and location remedial costs. These fluids also entail logistics issues in moving large volumes of organic base fluids and salts, increased costs on solids control equipments and an undesirable dependency on the type of organic base fluids chosen for a given project.

[0005] Many principles have been addressed to control shale hydration due to drilling fluids used in the oil industry. Some of these control technologies include the use of lime and gypsum calcic fluids, salts dissolved in the aqueous phase up to saturation, silicate fluids, shale encapsulating polymers, amines, amphoteric polymers, inverted emulsion fluids, pore pressure transmission blocking mechanisms, glycol based fluids and many intermediate combinations of the above. Most fluids are based on one principle and often fail to address geological conditions and environmental regulation.

[0006] Historically, water based fluids have been a one interval disposable volume. Thus, there is a need in the art for reusable high performance water based drilling fluids.

SUMMARY OF THE INVENTION

[0007] Embodiments of the present invention provide different inhibition mechanisms to cope with reactive formations such as a formation including swellable clays. The present compositions emulate oil based fluids by having an organic internal phase, which creates an osmotic membrane. The osmotic membrane allows hydration-dehydration mechanisms to be in place and control interactions between the formation and the fluid. The non-aqueous phase, on the inhibition side, comprises or is composed of glycerols, polyglycerols, poly hydroxyl alcohols, monosaccharide derivatives, polysaccharide derivatives, or mixtures and combinations thereof, while the aqueous phase contains ingredients to impart different inhibiting mechanisms to the overall composition, where the ingredients and/or mechanisms include, without limitation, amphoteric polymers, potassium and/or sodium salts of up to saturation and/or polyacrylamides. In certain embodiments, the compositions may also include silicates. The compositions of this invention allow the drilled cuttings to travel up the annular gap, avoiding dissolution. Also fluid dilution is minimized. Pore pressure transmission blocking mechanisms are present in the fluids enhancing well stability and widening the pressure window between hydrostatic pressure and fracture gradient. The fluids have low environmental impact, which will save on solids control equipment requirements and will minimize disposal and remedial costs.

[0008] Embodiments of the present invention also provide methods for making or preparing compositions of this invention.

[0009] Embodiments of the present invention also provide methods for drilling a borehole comprising circulating, *e.g.*, in the borehole, a composition of the present invention.

[0010] Embodiments of the present invention also provide reusable high performance water based drilling fluids and other reusable high performance water based downhole fluids having low toxicity and reduced environmental impact. This reduces operating costs by improving material logistics and providing high drilling performance to operators.

DETAILED DESCRIPTION OF THE INVENTION

[0011] The inventors have found that a reusable high performance water based fluids may be formulated having a full range of densities. The reusable high performance water based fluids include a continuous aqueous phase and a discontinuous organic or non-aqueous phase forming an osmotic membrane. The aqueous phase comprises a brine having certain controlled properties and the non-aqueous phase comprises glycerols, polyglycerols, poly hydroxyl alcohols, monosaccharide derivatives, polysaccharide derivatives, or mixtures and combinations thereof. The term reusable, in the context of oil-based drilling muds or fluids, means that when a particular drilling job is finished or completed, the mud or drilling fluid may be stored in tanks until it is needed for drilling another well. The fluids of this invention remain complete, high performance water based drilling fluids that may be used over and over again for drilling. The drilling fluids of this invention, therefore, are capable of being used from job to job, with make-up fluid volume being added as needed and drilling fluid treatments made to the drilling fluids of this invention to maintain, modify, and/or alter desired fluid properties.

[0012] The inventors have found that by using a storage facility nearby the location in between jobs, the water based fluid may be rendered reusable. The present fluids will reduce liability for environmental integrated projects.

[0013] The inventors have also found that reusable high performance water based fluids may be formulated having density over a wide density range. In certain embodiments, the density of the fluids ranges between about 8.6 ppg and one 20 ppg and the fluids may be formulated for both low, moderate, and high temperature applications. In certain embodiments, the density of the fluids is between about 8.6 ppg and 18 ppg. In other embodiments, the density of the fluids is between about 8.6 ppg and 16 ppg. In other embodiments, the density of the fluids is between about 8.6 ppg and 14 ppg. In other embodiments, the density of the fluids is between about 8.6 ppg and 12 ppg. In other embodiments, the density of the fluids is between about 8.6 ppg and 10 ppg. The term "ppg" will be herein understood to mean "pounds per gallon".

[0014] Multi-functional additives have been developed that improve drilling fluid lubricity as well as the penetration rate and improve inhibiting properties of reactive shale. The new additives have been used at various volume % (vol.%) concentrations, based on the total fluid composition, e.g., drilling fluid composition, in formulations having varying densities. In certain embodiments, the concentration is at least 5% by volume. In certain embodiments, the

concentration is at least 10% by volume. In certain embodiments, the concentration is at least 16% by volume. In certain embodiments, the concentration is at least 18% by volume. In certain embodiments, the concentration is up to 20% by volume.

[0015] In certain embodiments, the compositions include from about 51 wt.% to about 95 wt.% of the aqueous phase and from about 5 wt.% to about 49 wt.% of the non-aqueous phase. In other embodiments, the compositions include from about 55 wt.% to about 95 wt.% of the aqueous phase and from about 5 wt.% to and about 45 wt.% of the non-aqueous phase. In other embodiments, the compositions include from about 60 wt.% to about 95 wt.% of the aqueous phase and from about 5 wt.% to and about 40 wt.% of the non-aqueous phase. In other embodiments, the compositions include from about 65 wt.% to about 95 wt.% of the aqueous phase and from about 5 wt.% to and about 35 wt.% of the non-aqueous phase. In other embodiments, the compositions include from about 75 wt.% to about 95 wt.% of the aqueous phase and from about 5 wt.% to about 25 wt.% of the non-aqueous phase.

[0016] Embodiments of this invention broadly relate to reusable fluid compositions including (a) an aqueous continuous phase including an additive composition to change certain properties of the aqueous continuous phase, where the additive composition comprises amphoteric polymers, salts up to saturation, polyacrylamides, and mixtures or combinations thereof, and (b) an organic internal phase including glycerols, polyglycerols, poly hydroxyl alcohols, monosaccharide derivatives, polysaccharide derivatives, or mixtures and combinations thereof, where the organic internal phase forms an osmotic membrane within the continuous aqueous phase and where the osmotic membrane allows hydration-dehydration mechanisms to be in place and control interactions between formation and fluid. In other embodiments, the additive composition includes hydratable polymers. In other embodiments, the additive composition includes a humalite product, high molecular weight xanthan gum and/or a complex mixture of natural polysaccharides, high-quality, low-viscosity, sodium salt of carboxymethyl celluloses, polyanionic cellulose, glycol-based anti-foaming agents, white calcium carbonate, barium sulfate mineral, and/or shale inhibitor. Humalite may be described as a natural derivative from sub-bituminous coal, containing substances such as humic acid, fulvic acid and/or humin. In other embodiments, the compositions have a density between about 8.6 ppg and about 20 ppg. In other embodiments, the compositions have a density between about 8.6 ppg and about 18 ppg. In other embodiments, the aqueous phase is present in an amount between about 51 wt.% and

about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 49 wt.%. In other embodiments, the aqueous phase is present in an amount between about 55 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 45 wt.%. In other embodiments, the aqueous phase is present in an amount between about 65 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 35 wt.%. In other embodiments, the aqueous phase comprises a brine. In other embodiments, the brine comprises a fresh water brine formed by adding the salts to fresh water.

[0017] Embodiments of this invention broadly relates to reusable drilling fluid compositions including (a) an aqueous continuous phase including an additive composition to change certain properties of the aqueous continuous phase, where the additive composition includes amphoteric polymers, salts up to saturation, polyacrylamides, or mixtures and combinations thereof, and (b) an organic internal phase including glycerols, polyglycerols, poly hydroxyl alcohols, monosaccharide derivatives, polysaccharide derivatives, or mixtures and combinations thereof, where the organic internal phase creates an osmotic membrane within the continuous aqueous phase and where the osmotic membrane allows hydration-dehydration mechanisms to be in place and control interactions between formation and fluid. In certain embodiments, the compositions have a density between about 8.6 ppg and about 20 ppg. In other embodiments, the compositions have a density between about 8.6 ppg and about 18 ppg. In other embodiments, the aqueous phase is present in an amount between about 51 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 49 wt.%. In other embodiments, the aqueous phase is present in an amount between about 55 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 45 wt.%. In other embodiments, the aqueous phase is present in an amount between about 65 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 35 wt.%. In other embodiments, the aqueous phase comprises a brine. In other embodiments, the brine comprises a fresh water brine formed by adding the salts to fresh water.

[0018] Embodiments of this invention broadly relates to methods for drilling a borehole including the step of (a) while drilling, circulating a fluid composition of this invention. The fluid composition comprises (a) an aqueous continuous phase including an additive composition to change certain properties of the aqueous continuous phase, where the additive composition

comprises amphoteric polymers, salts up to saturation, polyacrylamides or mixtures and combinations thereof, and (b) an organic internal phase including glycerols, polyglycerols, poly hydroxyl alcohols, monosaccharide derivatives, polysaccharide derivatives, or mixtures and combinations thereof, where the organic internal phase creates an osmotic membrane within the continuous aqueous phase, where the osmotic membrane allows hydration-dehydration mechanisms to be in place and control interactions between formation and fluid and where the drilling fluid composition is reusable and the fluid has improved lubricity and improved cutting lift properties. In certain embodiments, the compositions have a density between about 8.6 ppg and about 20 ppg. In other embodiments, the compositions have a density between about 8.6 ppg and about 18 ppg. In other embodiments, the aqueous phase is present in an amount between about 51 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 49 wt.%. In other embodiments, the aqueous phase is present in an amount between about 55 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 45 wt.%. In other embodiments, the aqueous phase is present in an amount between about 65 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 35 wt.%. In other embodiments, the aqueous phase comprises a brine. In other embodiments, the brine comprises a fresh water brine formed by adding the salts to fresh water.

SUITABLE REAGENTS

[0019] Suitable non-aqueous phase compositions include, without limitation, polyglycerol blends. Exemplary examples include a specific commercial mixture of mono, di, and triglycerins or a polyglycerol blend such as Oxi-Cure products from Cargill, Incorporated including Oxi-Cure 500 bearing CAS# 25618-55-7 with synonymous products including glycerol homopolymers, glycerol polymers, polyglycerols, and/or 1,2,3-propanetriol homopolymers. One polyglycerol blend used in the compositions of the present invention had the following specification:

Structure	$\text{HO}(\text{CH}_2\text{CH}(\text{CH}_2\text{OH})\text{O})_n\text{H}$
Mol. Formula	$\text{HO}(\text{C}_3\text{H}_6\text{O}_2)_n\text{H}$
Test	Specification

Appearance		Pale yellow sticky liquid
Water		≤ 1 %
Viscosity		~ 41 Pa.s (dynamic)
Assay (glpc)		
	Triglycerol	from 35 wt.% to 55 wt.%
	Diglycerol	from 15 wt.% to 30 wt.%
	Tetraglycerol	from 10 wt.% to 25 wt.%
	Pentaglycerol	less than or equal to ($\leq$) 10 wt.%
	Higher oligomers	less than or equal to ($\leq$) 5 wt.%
RI, $\eta_D^{20^\circ C}$		1.491 @ 25°C
Heavy metals		less than (<) 10 ppm
As		less than (<) 3 ppm
Chloride		less than (<) 0.1 %

[0020] Suitable aqueous phase compositions include, without limitation, sodium brines, potassium brines, calcium brines, other brines, or mixtures and combinations thereof. The brines are made by adding sodium, potassium, and/or calcium salts to water up to saturation.

Exemplary examples of sodium, potassium, and/or calcium salts include NaCl, KCl, CaCl₂, and/or equivalent sodium, potassium and/or calcium salts.

[0021] Suitable polyols, monosaccharides, and/or polysaccharides include, without limitation, six carbon sugars and their derivatives (*e.g.*, allose, altrose, glucose, mannose, gulose, idose, galactose, talose, and cyclic hemiacetals or other derivatives), sorbitol, sorbitan, agar, agarose, alginic acid, alguronic acid, alpha glucan, amylopectin, amylose, arabinoxylan, beta-glucan, biocell collagen, callose, capsulan, carrageenan, cellodextrin, cellulin, cellulose, chitin, chitin nanofibril, chitosan, chrysolaminarin, curdlan, cyclodextrin, deae-sepharose, dextran, dextrin, exopolysaccharide, alpha-cyclodextrin, ficoll, fructan, fucoidan, galactoglucomannan, galactomannan, gellan gum, glucan, glucomannan, glucuronoxylan, glycocalyx, glycogen, hemicellulose, homopolysaccharide, hypromellose, icodextrin, inulin, kefiran, laminarin,

lentinan, levan polysaccharide, lichenin, matrixdb, mixed-linkage glucan, mucilage, natural gum, oxidized cellulose, paramylon, pectic acid, pectin, pentastarch, pleuran, polydextrose, polysaccharide peptide, porphyran, pullulan, schizophyllan, selective relaxant binding agent, sepharose, sinistrin, sizofiran, sugammadex, unhydrolysable glucose polymers, welan gum, xanthan gum, xylan, xyloglucan, zymosan or mixtures or combinations thereof.

[0022] Suitable hydratable polymers that may be used in embodiments of the invention include any of the hydratable polysaccharides which are capable of forming a gel in the presence of a crosslinking agent. For instance, suitable hydratable polysaccharides include, but are not limited to, xanthan gums, galactomannan gums, glucomannan gums, guar, derived guar, and cellulose derivatives. Specific examples are guar gum, guar gum derivatives, locust bean gum, Karaya gum, carboxymethyl cellulose, carboxymethyl hydroxyethyl cellulose, and hydroxyethyl cellulose. Exemplary examples include, but are not limited to, guar gums, hydroxypropyl guar, carboxymethyl hydroxypropyl guar, carboxymethyl guar, and carboxymethyl hydroxyethyl cellulose. Suitable hydratable polymers may also include synthetic polymers, such as polyvinyl alcohol, polyacrylamides, poly-2-amino-2-methyl propane sulfonic acid, and various other synthetic polymers and copolymers. The hydratable polymer may be present in the fluid in concentrations ranging from about 0.10% to about 5.0% by weight of the aqueous fluid. A preferred range for the hydratable polymer is about 0.20% to about 0.80% by weight.

[0023] Suitable amphoteric polymers include, without limitation, branched and/or cross-linked associative amphoteric polymers. The usable branching agents (cross-linking agents) are N-methylol acrylamide, methylene bis acrylamide, allyl ethers of sucrose, diacrylates, divinyls and all other multifunction compounds which can cause branching. One could also use one of the known branching agents for diallylated compounds such as methyl triallyl ammonium chloride, triallylamine, tetraallyl ammonium chloride, tetra allyl oxyethane, tetra allyl ethylene diamine and, more generally, all polyallylated compounds. It is also possible to make post-cross-linked polymers, for example by amidation reaction, esterification reaction, gamma ray treatment, *etc.*

[0024] An example of an amphoteric polymer is described in U.S. Patent No. 7,700,702 B2. An example of such amphoteric polymer may comprise at least one acrylamide-derived cationic monomer containing a hydrophobic chain and with the general formula:



where: R^1 , R^2 , R^3 , R^4 , R^5 , and R^6 are independently, a hydrogen or an alkyl chain containing 1 to 4, carbons, Q is an alkyl chain containing 1 to 8 carbons, R^7 is an alkyl or arylalkyl chain containing 8 to 30 carbons, X is a halide selected from the group including bromide, chloride, iodide, fluoride or a counterion with a negative charge;

between 1 and 99.9 mole % of at least one anionic monomer, and

between 1 and 99 mole% at least one non-ionic hydrosoluble monomer.

[0025] The anionic monomers can be selected from a wide group. These monomers may present acrylic, vinyl, maleic, fumaric or allyl functionalities and may contain a carboxy, phosphonate, sulfonate or other group with an anionic charge, or the ammonium salt or alkaline-earth metal salt or alkaline metal salt corresponding to such a monomer. Examples of suitable monomers include acrylic acid, methacrylic acid, itaconic acid, crotonic acid, maleic acid, fumaric acid and strong-acid monomers, for example with a sulfonic or phosphonic acid-type function such as 2-acrylamido-2-methylpropane sulfonic acid, vinylsulfonic acid, vinylphosphonic acid, allylsulfonic acid, allylphosphonic acid, styrene sulfonic acid and their water-soluble salts of an alkali metal, alkaline-earth metal and ammonium.

[0026] The at least one non-ionic hydrosoluble monomer can be selected from the group including water-soluble vinyl monomers. In certain embodiments, the monomers belonging to this category are advantageously selected from the group including acrylamide and methacrylamide, N-isopropylacrylamide, N,N-dimethylacrylamide and N-methylolacrylamide. N-vinylformamide, N-vinyl acetamide, N-vinylpyridine and/or N-vinylpyrrolidone can also be used. Acrylamide may be the preferred non-ionic monomer.

[0027] Other amphoteric polymers include polymers having between 0.005 and 10 mole % hydrophobic cationic monomers, between 5 and 90 mole % of at least one anionic monomer, advantageously acrylic acid and/or methacrylic acid and/or 2-acrylamido-2-methylpropane sulfonic acid and their salts; and between 5 and 90 mole % of at least one hydrosoluble non-ionic monomer, advantageously acrylamide and/or methacrylamide and/or N-isopropylacrylamide and/or N,N-dimethylacrylamide and/or N-vinylformamide and/or N-vinyl acetamide and/or N-vinylpyrrolidone. Other polymers contain between 0.01 and 5 mole % of hydrophobic monomers and between 10 and 60 mole % of an anionic monomer and between 35 and 90 mole % of a non-ionic monomer. Other polymers contain between 0.02 and 2 mole % of hydrophobic monomers and between 10 and 50 mole % of an anionic monomer: acrylic acid, methacrylic acid

and/or 2-acrylamido-2-methylpropane sulfonic acid and their salts, and between 48 and 90 mole % of a non-ionic monomer: acrylamide and/or methacrylamide and/or N-isopropylacrylamide and/or N,N-dimethylacrylamide and/or N-vinylformamide and/or N-vinyl acetamide and/or N-vinylpyrrolidone. Other polymers include acrylamide-derived hydrophobic cationic monomers preferred for the invention are N-acrylamidopropyl-N,N-dimethyl-N-dodecyl ammonium chloride (DMPA C1(C₁₂)), N-methacrylamidopropyl-N,N-dimethyl-N-dodecyl ammonium chloride (DMPMA C1(C₁₂)), N-acrylamidopropyl-N,N-dimethyl-N-dodecyl ammonium bromide (DMPA Br(C₁₂)), N-methacrylamidopropyl-N,N-dimethyl-N-dodecyl ammonium bromide (DMPMA Br(C₁₂)), N-acrylamidopropyl-N,N-dimethyl-N-octadecyl ammonium chloride (DMPA C1(C₁₈)), N-methacrylamidopropyl-N,N-dimethyl-N-octadecyl ammonium chloride (DMPMA C1(C₁₈)), N-acrylamidopropyl-N,N-dimethyl-N-octadecyl ammonium bromide (DMPA Br(C₁₈)), N-methacrylamidopropyl-N,N-dimethyl-N-octadecyl ammonium bromide (DMPMA Br(C₁₈)).

[0023] Suitable silicates that may be used in the fluids of this invention include, without limitation, hydrated or anhydrous silicate minerals with a layered structure and include, for example, aluminosilicate clays such as kaolins including hallyosite, smectites including montmorillonite, illite, and the like. Exemplary silicates include those marketed under the tradename CLOISITE® marketed by Southern Clay Additives, Inc. In an embodiment, silicates are exfoliated to separate individual sheets, or are non-exfoliated. Other silicates of similar structure can also be included such as, for example, talc, micas including muscovite, phlogopite, or phengite, or the like.

EXPERIMENTS OF THE INVENTION

EXAMPLE 1

[0028] This example illustrates the preparation of reusable high performance water based drilling fluid having a density of 10 ppg.

[0029] 18.0 wt.% of sorbitol powder was dissolved in 23.3 wt.% deionized water. The resulting aqueous solution was then mixed into 56.7 wt.% of a polyglycerol blend such as Oxi-Cure 500 and mixing was continued until fluid was completely blended. To this fluid, 2.0 wt.% of a 50 wt.% KOH solution (1.0 % equivalent KOH) was added. The KOH was added to the 13.1 wt.% NaCl brine, then pre-solubilize the 10 ppb HUMALITE in the aqueous mixture. The resulting polyglycerol blend was used successfully at a 14% concentration level in 10 ppg and 12 ppg

formulations of a 13.1% by weight NaCl water-base system. The initial pH was 12.34 at 72.2°F. The pH after 30 days was 11.22 at 71.0°F. The pH after 71 days was 9.84 at 71.0°F.

[0030] The neat composition of **Example 1** was a viscous liquid and had a brownish amber color, a specific gravity between 1.23 and 1.28, a density in pounds per gallon (ppg) between 10.26 ppg and 10.68 ppg, a flash point >392°F (>200°C), a pH between 9.5 and 10.5, mild odor, and freeze point <-36.4°F (<-38°C).

TABLE 1
Composition of the Example 1

FORMULATION		SP. GR.	GRAMS	WT. %
Aqueous Component				86.0
	13.1 wt. % NaCl brine, ppb	1.09	297.52	
	KOH, ppb	2.06	1.50	
	WRD-6003, ppb	1.30	10.00	
	Wel-Zan D, ppb	1.55	0.60	
	Wel-Pac LV, ppb	1.60	4.00	
	Wel-Defoam G, ppb		2 drops	
	ExCAL CW 325 ppb	2.70	20.00	
	Barite, ppb	4.20	10.70	
	KCl, ppb	1.98	14.00	
	Wel-Hib NPH, ppb	1.07	8.00	
Non-Aqueous Component				14.0
	Polyglycerol blend*	1.26	53.81	
Total Weight (g)			419.53	
Total Volume (cc)			350.00	
WBM Weight (ppg)			10.00	
SG			1.199	

WRD-6003 is a humalite product available from Canadian Humalite International Inc.

Wel-Zan™ D – high molecular weight xanthan gum, a complex mixture of natural polysaccharides available from Weatherford.

Wel-Pac™ LV – high-quality, low-viscosity, sodium salt of carboxymethyl cellulose—commonly referred to as polyanionic cellulose available from Weatherford.

Wel-Defoam™ G – a glycol-based anti-foaming agent formulated for use in polymer systems available from Weatherford.

EwxCal - white calcium carbonate 325 mesh available SpecialChem

Barite – barium sulfate mineral

Wel-Hib NPH a shale inhibitor available from Weatherford.

Polyglycerol blend* was Oxi-cure 500 from Cargill, Inc.

TABLE 2
Example 1 Selected Properties

Property	OFI#	Cell #
	Rheology at 120°F	
	Before Hot Rolling	After Hot Rolling at 250°F

Property	OFI#	Cell #
600 rmp	98	92
300 rmp	61	59
200 rmp	47	45
100 rmp	29	28
6 rmp	4	5
3 rmp	3	4
10" Second Gel	2	4
10' Minute Gel	3	5
PV, cp	37	33
YP, lb/100 ft ²	24	26
API Fluid Loss, mL		2.5
HTHP Fluid Loss at 250°F, mL		13.6
pH	10.8 @ 68.5°F	9.25 @ 70.8°F
Mud Weight, ppg	10.09	10.01
Specific Gravity	1.21	1.20

[0031] **Example 1** had a pH:13.17 @ 68.8°F, a specific gravity of 1.24, and a brownish amber color. The freezing point of the composition was supposed to be -38°F. When the sample was left in the chiller for 24 hours at -38°F, the sample was very thick with very slow flow fluid, but was not frozen. When the sample was left for 48 hours at -38°F, the sample was still very thick with very slow flow, but still not frozen. After sitting at room temperature for about 7 minutes to 8 minutes after being left in the chiller for 48 hours, the sample was back to flowing the same as the 0°F. After the sample was in the chiller for 24 hours at 0°F, the sample was normal. After the sample was in the chiller for 24 hours at -20°F, the sample was very thick and very slow flow.

EXAMPLE 2

[0032] This example illustrates reusable high performance water based fluid having a density of 12.80 ppg. This fluid was prepared in accord with the preparation method of **Example 1**.

TABLE 4
Composition of the Example 2

FORMULATION		SP. GR.	GRAMS	WT.%
Aqueous Component				86.0
	13.1 wt.% NaCl brine, ppb	1.09	272.40	
	KOH, ppb	2.06	1.00	
	WRD-6003, ppb	1.30	10.00	

FORMULATION		SP. GR.	GRAMS	WT. %
	Wel-Zan D, ppb	1.55	0.75	
	Wel-Pac LV, ppb	1.60	3.25	
	Wel-Defoam G		2 drops	
	ExCAL CW 325 ppb	2.70	20.00	
	Barite, ppb	4.20	125.50	
	KCl, ppb	1.98	14.00	
	Wel-Hib NPH, ppb	1.07	8.00	
Non-Aqueous Component				14.0
	Polyglycerol blend*	1.26	48.48	
Weight (g)			503.38	
Volume (cc)			350.00	
Mud Weight (ppg)			12.00	
Specific Gravity			1.438	

WRD-6003 is a humalite product available from Canadian Humalite International Inc.

Wel-Zan™ D – high molecular weight xanthan gum, a complex mixture of natural polysaccharides available from Weatherford.

Wel-Pac™ LV – high-quality, low-viscosity, sodium salt of carboxymethyl cellulose—commonly referred to as polyanionic cellulose available from Weatherford.

Wel-Defoam™ G – a glycol-based anti-foaming agent formulated for use in polymer systems available from Weatherford.

EwxCal - white calcium carbonate 325 mesh available SpecialChem

Barite – barium sulfate mineral

Wel-Hib NPH a shale inhibitor available from Weatherford.

Polyglycerol blend* was Oxi-cure 500 from Cargill, Inc.

TABLE 5
Example 2 Selected Properties

Properties	OFI#	Cell #
	Rheology at 120°F	
	Before Hot Rolling	After Hot Rolling at 250°F
600 rpm	146	141
300 rpm	98	94
200 rpm	81	74
100 rpm	51	48
6 rpm	7	10
3 rpm	6	7
10" second Gel	6	8
10' minute Gel	7	10
PV, cp	48	47
YP, lb/100ft ²	50	47
API Fluid Loss, mL	#3	1.9
HTHP Fluid Loss at 250°F, mL		15.2
pH	10.03 @ 74°F	8.45 @ 72°F
Mud Weight (ppg)	12.18	12.01
Specific Gravity	1.46	1.44

[0033] All references cited herein are incorporated by reference. Although the invention has been disclosed with reference to its preferred embodiments, from reading this description those of skill in the art may appreciate changes and modification that may be made which do not depart from the scope and spirit of the invention as described above and claimed hereafter.

CLAIMS

We claim:

1. A reusable fluid composition comprising:
an aqueous continuous phase including an additive composition to change certain properties of the aqueous continuous phase, where the additive composition comprises an amphoteric polymer, a salt up to saturation, a polyacrylamide, or mixtures and combinations thereof, and
an organic internal phase including a glycerol, a polyglycerol, a poly hydroxyl alcohol, a monosaccharide derivative, a polysaccharide derivative, or mixtures and combinations thereof,
where the organic internal phase creates an osmotic membrane within the continuous aqueous phase and where the osmotic membrane allows hydration-dehydration mechanisms to be in place and control interactions between formation and fluid.
2. The composition of claim 1, wherein the composition has a density between about 8.6 ppg and about 20 ppg and wherein the aqueous phase is present in an amount between about 51 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 49 wt.%.
3. The composition of any preceding claim, wherein the composition has a density between about 8.6 ppg and about 20 ppg and wherein the aqueous phase is present in an amount between about 55 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 45 wt.%.

4. The composition of any preceding claim, wherein the composition has a density between about 8.6 ppg and about 20 ppg and wherein the aqueous phase is present in an amount between about 65 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 35 wt.%.

5. The composition of any preceding claim, wherein the aqueous phase comprises a brine and wherein the salt includes sodium, potassium, calcium salts, or mixtures and combinations thereof.

6. The composition of claim 5, wherein the brine comprises a fresh water brine and wherein the salt includes NaCl, KCl, CaCl₂, and/or equivalent sodium, potassium and/or calcium salts.

7. A reusable drilling fluid composition comprising:

an aqueous continuous phase including an additive composition to change certain properties of the aqueous continuous phase, where the additive composition comprises an amphoteric polymer, a potassium and/or sodium salt up to saturation and/or a polyacrylamide, and

an organic internal phase, which creates an osmotic membrane within the continuous aqueous phase, where the osmotic membrane allows hydration-dehydration mechanisms to be in place and control interactions between formation and fluid and where the organic phase comprises a glycerol, a polyglycerol, a poly hydroxyl alcohol, a monosaccharide derivative, a polysaccharide derivative, or mixtures and combinations thereof.

8. The composition of claim 7, wherein the composition has a density between about 8.6 ppg and about 20 ppg and wherein the aqueous phase is present in an amount between about 51 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 49 wt.%.

9. The composition of any of claims 7 to 8, wherein the composition has a density between about 8.6 ppg and about 20 ppg and wherein the aqueous phase is present in an amount between about 55 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 45 wt.%.

10. The composition of any of claims 7 to 9, wherein the composition has a density between about 8.6 ppg and about 20 ppg and wherein the aqueous phase is present in an amount between about 65 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 35 wt.%.

11. The composition of any of claims 7 to 10, wherein the aqueous phase comprises a brine and wherein the salt includes sodium, potassium, calcium salts, or mixtures and combinations thereof.

12. The composition of claim 11, wherein the brine comprises a fresh water brine and wherein the salt includes NaCl, KCl, CaCl₂, and/or equivalent sodium, potassium and/or calcium salts.

13. A method for drilling a borehole comprising the step of:
while drilling, circulating a fluid composition comprising:
an aqueous continuous phase including an additive composition to change certain properties of the aqueous continuous phase, where the additive composition comprises an amphoteric polymer, a potassium and/or sodium salt up to saturation and/or a polyacrylamide, and
an organic internal phase, which creates an osmotic membrane within the continuous aqueous phase, where the osmotic membrane allows hydration-dehydration mechanisms to be in place and control interactions between formation and fluid and where the organic phase comprises a glycerol, a polyglycerol, a poly hydroxyl alcohol, a monosaccharide derivative, a polysaccharide derivative, or mixtures and combinations thereof,
where the drilling fluid composition is reusable and the fluid has improved lubricity and improved cutting lift properties.
14. The method of claim 13, wherein the composition has a density between about 8.6 ppg and about 20 ppg and wherein the aqueous phase is present in an amount between about 51 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 49 wt.%.
15. The method of any of claims 13 to 14, wherein the composition has a density between about 8.6 ppg and about 20 ppg and wherein the aqueous phase is present in an amount between about 55 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 45 wt.%.

16. The method of any of claims 13 to 15, wherein the composition has a density between about 8.6 ppg and about 20 ppg and wherein the aqueous phase is present in an amount between about 65 wt.% and about 95 wt.% and the non-aqueous phase is present in an amount between about 5 wt.% and about 35 wt.%.

17. The method of any of claims 13 to 16, wherein the aqueous phase comprises a brine and wherein the salt includes sodium, potassium, calcium salts, or mixtures and combinations thereof.

18. The method of claim 17, wherein the brine comprises a fresh water brine and wherein the salt includes NaCl, KCl, CaCl₂, and/or equivalent sodium, potassium and/or calcium salts.