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WELLDONE CHEMICAL GROUP

威尔顿化学集团

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WELLDONE CHEMICAL GROUP

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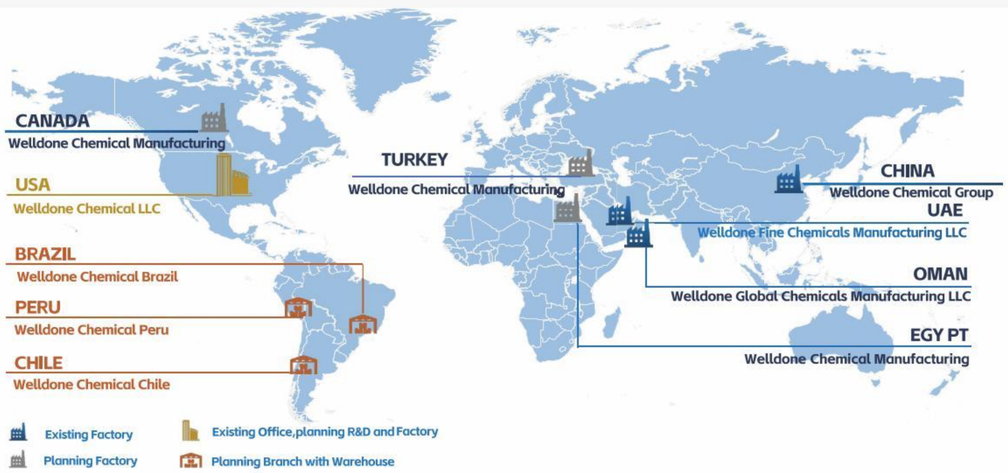
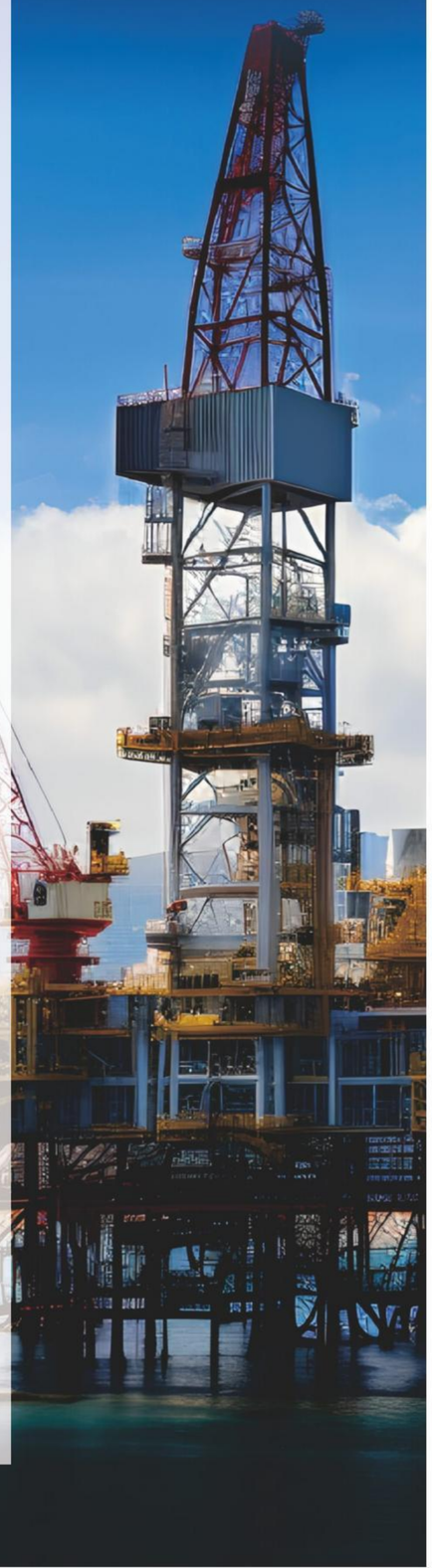
Global Network Presence

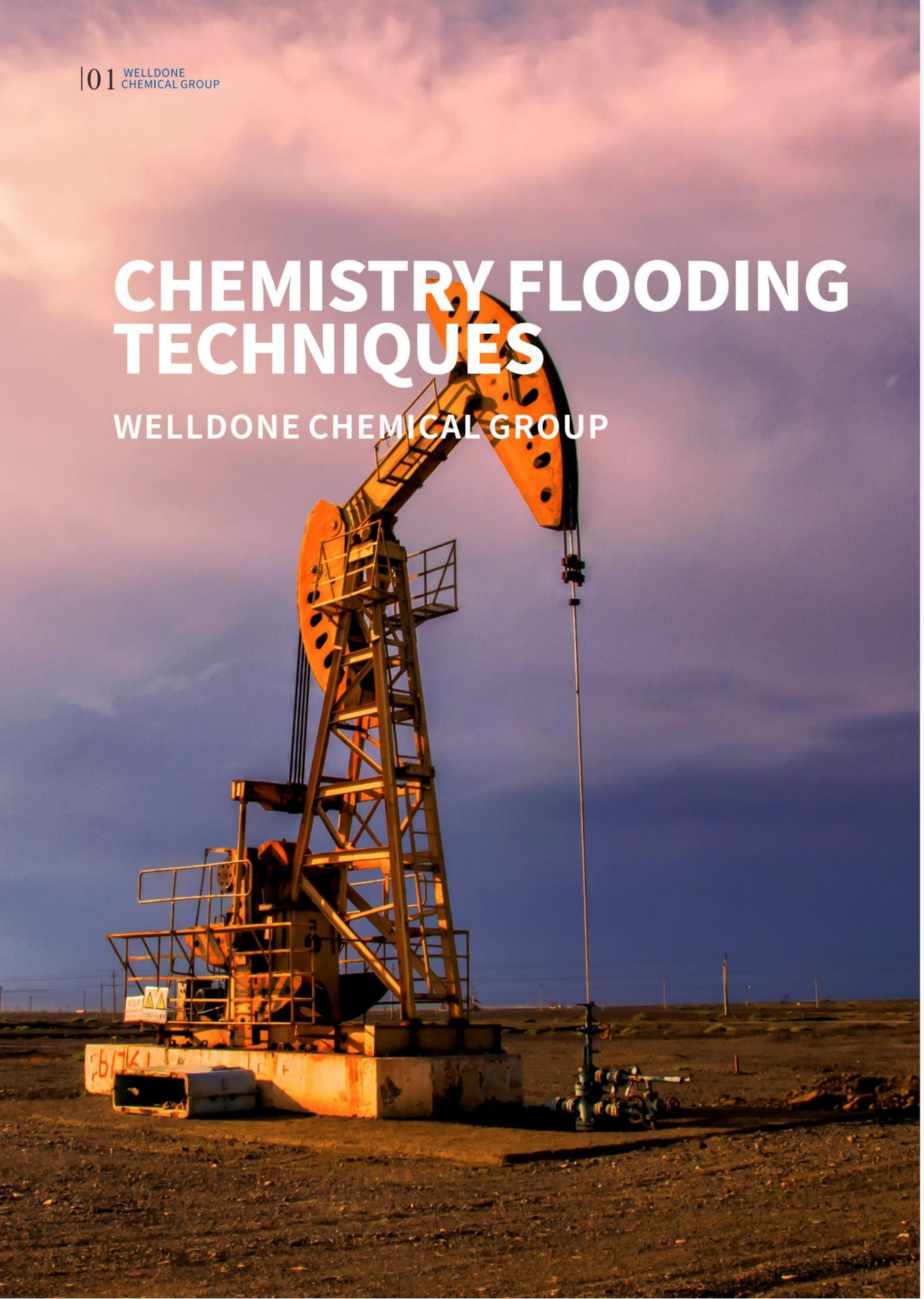




CONTENT

CHEMISTRY FLOODING TECHNIQUES

WELLDONE CHEMICAL GROUP



HIGH TEMPERATURE AND HIGH SALT MICRO-FRACTURE CARBONATE RESERVOIR FLOODING TECHNOLOGY - LOW COST TO ACTIVATE DEEP RESERVOIR VALUE

Technical introduction

30% of the world's difficult-to-access reserves are concentrated in high-temperature and high-salinity fractured carbonate reservoirs. There is a significant difference in seepage between the matrix and fractures, which easily leads to channeling and ineffective circulation, with water flooding efficiency being less than 10%. Traditional chemical flooding is prone to failure in high-temperature and high-salinity environments, and the product cost is high.

By adopting high-temperature and high-salinity resistant self-growing soft gel dispersion profile control agent and high-temperature and high-salinity resistant composite gel fracture regulation technology, the "blockage - regulation - flooding" synergy is achieved, and the remaining oil in deep layers is exploited at low cost.

Action mechanism

◆ **Temperature and salt resistant composite gel:** The strong sealing ability of composite gel is used to seal the advantageous channel of water channeling phase and water channeling crack, and open the secondary seepage channel.

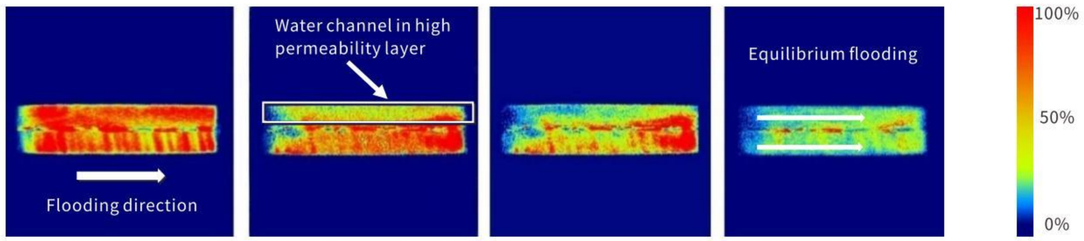
◆ **Self-Growing Hydrogel Particle System:** Through the self-growth, accumulation and retention of gel dispersion in the water phase to regulate the oil flow ratio, the main slug can be efficiently and deeply regulated.

Technical index

◆ Applicable temperature≤150℃
◆ Tolerance to salinity≤200,000mg/L
◆ Permeability：0.1mD~500mD
◆ Applicable crack width：0.05-20mm

Target Applications

◆ Carbonate microfracture pore reservoir;
◆ High temperature and salt sandstone reservoir;
◆ Medium and low permeability sandstone reservoir



1. Initial state　2. After first water flooding　3. After DPG injection　4. After subsequent water flooding

NANO-COMPOSITE OIL FLOODING TECHNOLOGY FOR LOW PERMEABILITY RESERVOIRS - BREAKING THE LIMIT AND RELEASING THE POTENTIAL OF LOW PERMEABILITY RESERVOIRS

Technical background

The pore structure of low permeability (< 50mD) reservoir is complex, the heterogeneity is strong, the traditional water flooding effect is poor, and the recovery rate is low (< 25%). The water injection pressure is high, which is easy to form the dilemma of " It cannot be injected and oil cannot be extracted".

Through the flexible combination of nano oil flooding agent, surfactant and polymer, low interfacial tension can be reduced, oil flow ratio can be improved, micro-oil flooding efficiency can be improved, and the development effect of low permeability reservoir can be improved.

Action mechanism

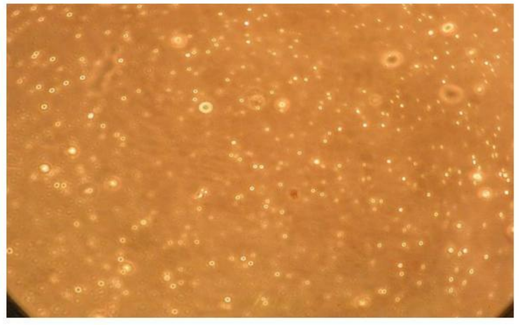
◆ **Nano oil flooding system:** nano particles (diameter < 100nm) penetrate into the microchannel and peel off the residual oil film.
◆ **Low interfacial tension surfactants:** The water interfacial tension drops to 10-^{3}mN/m level, initiating the remaining oil at the blind end.
◆ **Shear resistant polymers:** Dynamically adjust mobility ratio to expand sweep volume.

Technical index

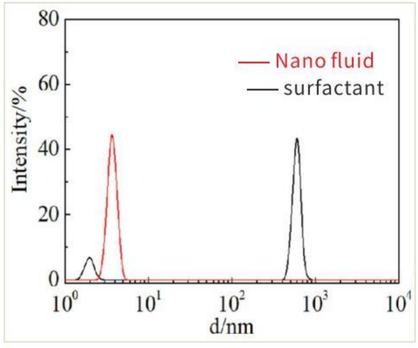
◆ Permeability range：0.1mD-50mD
◆ Temperature adaptability：60℃~120℃
◆ Salinity adaptability≤200,000mg/L
◆ Porosity range：3%-15%

Target Applications

◆ Tight sandstone reservoirs: permeability 1-50mD, porosity < 15%.
◆ Fractured carbonate reservoir: strong heterogeneity, natural micro-fracture development.
◆ Shale reservoir: nanometer pore throat, traditional technology is difficult to use effectively.



10,000-fold magnification of Nano oil-displacement agent



Comparison of average particle sizes

POLYMER FLOODING TECHNOLOGY FOR HETEROGENEOUS RESERVOIRS WITH MEDIUM AND LOW PERMEABILITY - INTELLIGENT REGULATION TO BREAK THROUGH THE DILEMMA OF INEFFICIENT DEVELOPMENT

Technical introduction

The high permeability channel of heterogeneous reservoir has serious cross-flow, the crude oil stays in the low permeability area, and the sweep efficiency is less than 40%.

Through the "plugging, flooding and regulating" technology composed of nano-microspheres and salt-resistant and shear-resistant polymer, the oil washing efficiency and recovery efficiency were improved.

Action mechanism

◆ **Nano-microspheres:** 50-200nm particle size nano-microspheres are injected to selectively block the hyperpermeability channel, forcing the flooding liquid to shift to the low-permeability zone, and improving the sweep efficiency
◆ **Salt-resistant and shear-resistant polymers:** Dynamically adjust mobility ratio to expand sweep volume.

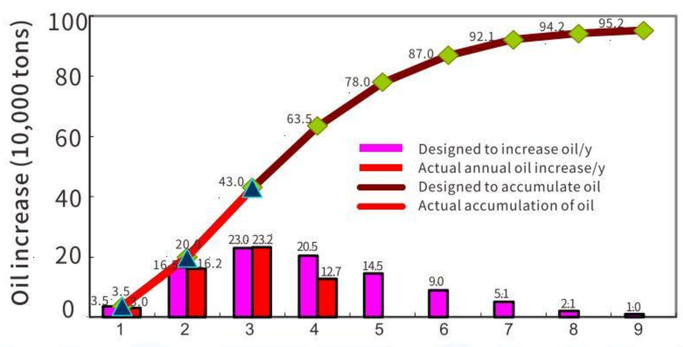
Technical index

◆ Permeability range 10-500 mD
◆ Temperature≤90℃
◆ Degree of mineralization≤50,000 mg/L

Target Applications

◆ Heterogeneous sandstone/fractured reservoir: low permeability sand conglomerate, fractured and porous dual medium reservoir.
◆ Complex fault-block reservoir: permeability difference >5, water drive sweep efficiency is low.

Oil-increase plot of a poly-injection block



High permeability layer plugging

POLYSURFACE COMBINED OIL FLOODING TECHNOLOGY FOR MEDIUM AND HIGH PERMEABILITY RESERVOIRS - EFFICIENT FLOODING AND PRECISE EFFICIENCY INCREASE

Technical introduction

For medium and high permeability reservoirs, chemical flooding technology can significantly reduce the residual oil saturation of the reservoir, increase the recovery rate by 15-30% compared with traditional water flooding, and effectively extend the economic life of the oilfield

Polymer is more likely to form a stable flow state in the high permeability layer, and high porosity is conducive to the diffusion and retention of chemical agents in the formation. The binary composite system combines the advantages of polymer and surfactant, and can significantly improve the recovery efficiency of medium and high permeability reservoirs.

Action mechanism

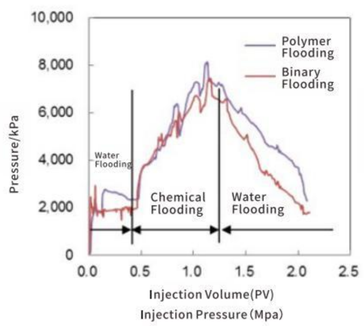
◆ By increasing the viscosity of the solution and improving the water-oil mobility ratio, the polymer improves the conformance coefficient and recovery efficiency of the reservoir.
◆ Surfactants improve the oil washing efficiency by reducing the interfacial tension of oil and water.

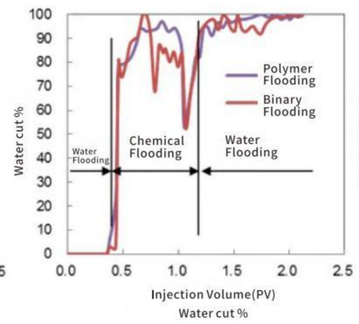
Technical index

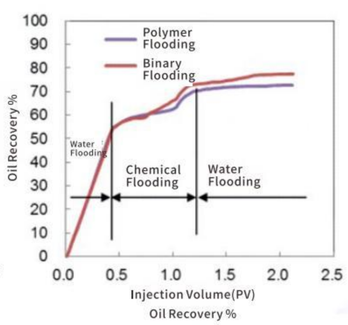
◆ Permeability range 50-2000 mD
◆ Crude oil viscosity<200 mPa · s
◆ Formation temperature<90°C
◆ Degree of mineralization ⩽50,000 mg/L

Target Applications

◆ Secondary development of mature oilfield
◆ Reservoir water control and oil increase in high water cut period
◆ Efficient production of homogeneous thick reservoir







VISCOSITY REDUCTION COMBINED FLOODING TECHNOLOGY FOR HEAVY OIL RESERVOIRS - UNLOCKING NEW KINETIC ENERGY FOR HEAVY OIL RECOVERY

Technical introduction

Due to the high viscosity and poor fluidity of heavy oil, conventional water flooding/thermal recovery cost is high, recovery efficiency is low (<30%), traditional chemical flooding is easy to pollute the formation, poor adaptability, and carbon emission environmental protection pressure.

Through the synergistic effect of high viscoelastic polymer, multi-functional surfactants that can reduce adhesion work and interfacial tension, and viscosity reducing oil flooding agent, a high-efficiency compound oil flooding system suitable for viscous oil with viscosity of 200-2000mPa.s is constructed to realize low temperature, low carbon and efficient green mining.

Action mechanism

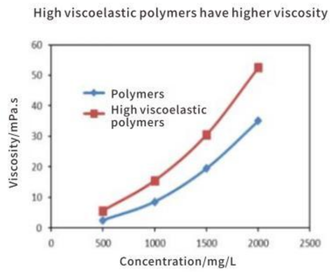
◆ **High viscoelastic polymer:** improve water phase viscosity, regulate mobility ratio, expand sweep volume, and improve oil flooding efficiency.
◆ **Multifunctional surfactant:** oil-water interfacial tension is reduced to 10-2mN/m, effectively stripping residual oil.
◆ **Viscosity reducing oil flooding agent:** For the viscosity of 1000-2000mPa.s heavy oil, by reducing the oil-water interfacial tension, changing the emulsification state to reduce the viscosity of heavy oil, improve the flow and recovery rate, viscosity reduction rate > 80%.
◆ **Compound synergist and stabilizer:** improve the temperature and salt stability of the system.

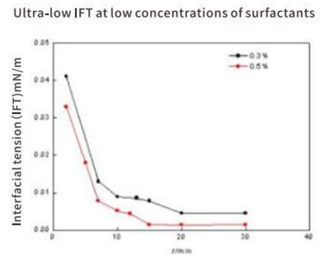
Technical index

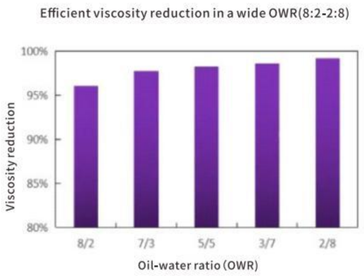
◆ Viscosity reduction efficiency＞80%
◆ Temperature resistance⩽120℃
◆ Salt tolerance⩽20×104mg/L

Target Applications

◆ Heterogeneous sandstone/fractured reservoir: low permeability sand conglomerate, fractured and porous dual medium reservoir.
◆ Complex fault-block reservoir: permeability difference >5, water drive sweep efficiency is low.







EOR & FLOODING CHEMICALS

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HIGH-EFFICIENCY POLYACRYLAMIDE (HPAM) FOR FLOODING

Product Description

This product is a high molecular polymer designed for tertiary oil recovery in oil fields. It can effectivelydrive underground residual crude oil by significantlyimproving water injection viscosity and fluidity control capabilities. The product adopts advanced polymerization technology, has both high molecular weight and excellentsalt resistance and shear resistance, and can increase the recovery rate of water flooding reservoirs by 15%-30%.

Index	Parameter Range
Appearance	White to liaht yellow granules or powder
Molecular Weight	8-25 million
Solid Content	≥88%
Apparent Viscosity	50-150 mPa·s (0.1% solution)
Degree of Hydrolysis	10-30% adjustable
Dissolving Time	≤60 min (0.1% solution)
Thermal Stability	≤80°C stable for long time
Salt Tolerance	≤20,000mg/L
Treatment&Preparation	Recommended Concentration：500-3000ppm
Package	25kg/pack damp-proof or supersack

Function & Application

Key Features:

- For enhanced oil recovery, profile control and water shutoff, and synergistic effects in compound flooding.

Target Applications:

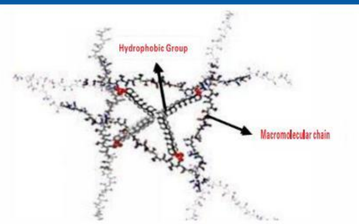
- Heterogeneous sedimentary sandstone and carbonate reservoirs.

HYDROPHOBICALLY ASSOCIATING POLYMER (HAP) FOR FLOODING

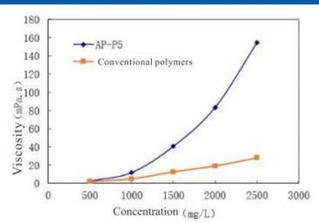
Product Description

The product forms a dynamic physical cross-linked network via the association of hydrophobic groups within the polymer chains. This structure substantially enhances viscosity and shear resistance, while also improving thermal stability and salt tolerance—enabling effective performance in challenging reservoir environments.

Index	Parameter Range
Appearance	Light yellow to amber-colored granules or powder
Molecular Weight	8-25 million
Solid Content	≥90%
Apparent Viscosity	80-300 mPa · s (0.1% solution)
Hydrophobe Content	0.5%-5.0% customizable
Dissolving Time	≤60 min (0.1% solution)
Thermal Stability	≤95°C
Salt tolerance	≤50,000mg/L
Treatment&Preparation	Recommended Concentration:500-3000ppm (Adjustable based on formation permeability)
Package	20kg anti-static aluminum foil bags (vacuum-sealed), or customized IBC tote packaging available upon request.



Structural schematic diagram

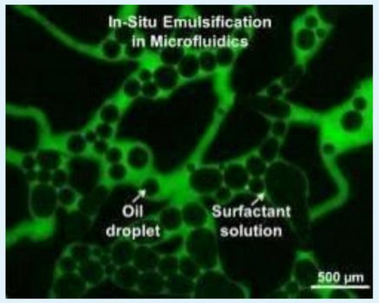


Viscosity increase curve

Function & Application
Key Features:
- Suitable for EOR in high salinity reservoirs
- Enables deep profile control and flooding integration
- Enhances overall recovery efficiency through synergistic compound flooding mechanisms

Target Applications:
- Offshore high-salinity reservoirs
- High-temperature sandstone and carbonate reservoirs
- Mature oilfields in high water cut stage

HIGH-TEMPERATURE, HIGH-SALINITY (HTHS) RESERVOIR SURFACTANT FOR FLOODING



Product Description

Formulated with ultra-low interfacial tension (IFT) technology and a high-performance temperature- and salt-resistant system, this product significantly reduces oil–water interfacial tension ($\leq 5\times10^{-3}$ mN/m) and enhances oil-washing efficiency (≥60%). It is designed to perform effectively in extreme reservoir conditions with temperatures ranging from 80°C to 130°C and salinity up to 200,000 mg/L.

Index	Parameter Range
Appearance	Uniform and transparent liquid
Solid Content	≥50%
pH (1% solution)	7.0-9.0
Interfacial tension (IFT)	≤5×10-3 mN/m (0.4% solution)
Oil-washing efficiency	Oil-washing efficiency
Treatment&Preparation	0.1%-0.6% (Adjustable based on reservoir permeability and crude oil viscosity)
Package	Liquid type: Packed in 25kg PE drums or 1000kg IBC tanks with nitrogen sealing to prevent oxidation. Solid powder type: Supplied in 20kg aluminum foil moisture-resistant bags. Spray-dried for improved transport efficiency.

Function & Application
Key Features:
- Ultra-low interfacial tension
- High temperature and salinity resistance

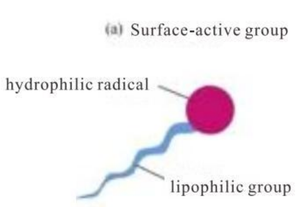
Target Applications:
- Low-permeability sandstone reservoirs
- High-temperature, high-salinity carbonate reservoirs
- Mature oilfields with high water cut for tapping residual oil potential

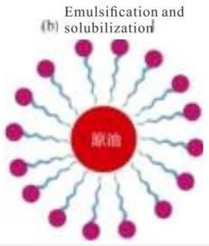
SURFACTANT FOR BINARY COMPOSITE FLOODING

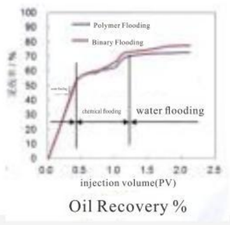
Product Description

This product is capable of generating ultra-low interfacial tension with oil and water, thereby increasing the capillary number, reducing injection pressure, and enhancing sweep efficiency. It exhibits strong emulsification and oil-washing capabilities, effectively improving flooding efficiency. Compatibility with water flooding and polymer flooding: The system is fully compatible with existing water flooding operations and exhibits excellent compatibility with polymers, enabling seamless integration. When used in polymer–surfactant binary flooding, it can significantly enhance oil recovery in mature reservoirs.

Index	Parameter Range
Appearance	Flowable liquid (at 20℃) /powder
Solid Content	≥45%
pH (1% solution)	7.0-9.0
Interfacial tension (IFT)	≤5×10-3 mN/m (0.4% solution)
IFT with polymer compatibility	<8×10-3 mN/m
Oil-washing efficiency	≥60% (0.4% solution)
Compatibility with polymer systems, %	Viscosity stability rate≥95.0
Treatment&Preparation	0.1%-0.6% (adjustable based on formation permeability and crude oil viscosity)
Package	Liquid: 25kg polyethylene drums or 1000kg IBC totes Powder: 20kg aluminum foil damp-proof sacks







Function & Application

Key Features:

- Through the synergistic effect of ultra-low interfacial tension and dynamic
- Emulsification, this product significantly improves oil washing efficiency and sweep volume.

Target Applications:

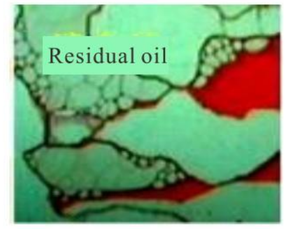
- Temperature: < 90°C
- Salinity: < 100,000 mg/L (Ca^{2+}, Mg^{2+} < 2,000 mg/L)

NANO-SCALE FLOODING AGENT

Product Description

This product is a high-efficiency flooding agent developed based on nanotechnology. Through nanomolecular design and interfacial control technology, it achieves ultra-low interfacial tension and exceptional permeability. The product is capable of precisely targeting residual oil films in rock pores, significantly reducing oil-water interfacial tension and greatly increasing capillary number, resulting in an average increase in recovery rate by 15%–25%.

Index	Parameter Range
Appearance	Clear to light yellow liquid
Active content	20%-50% (customizable)
Interfacial tension (oil/water)	≤0.001 mN/m
Average particle size	10-50 nm
Thermal Stability	≤130°C (stable for long time)
Salt tolerance	≤150,000mg/L adaptability to salinity
pH range	4.0-10.0
Solubility	Rapidly miscible with water and alcohol-based solvents
Treatment&Preparation	Recommended Concentration: 0.05%–0.5% (optimized based on formation properties)
Package	25kg polyethylene drum/200kg galvanized iron drum (with anti-corrosion lining)



Function & Application

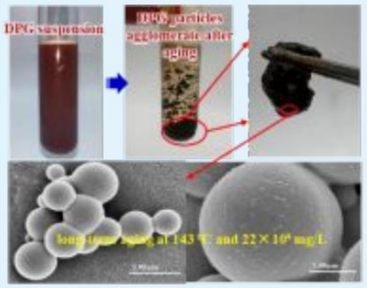
Key Features:

- Superior oil-washing efficiency >90%
- Self-adaptive rheology adjustment, increasing sweep volume by 30%-50%
- Nano-scale particle size enables penetration into micro-fractures, releasing crude oil trapped in closed pores

Target Applications:

- Low-permeability reservoirs such as shale oil and tight oil formations
- Carbonate reservoirs
- High water-cut oilfields (water cut >90%)
- Enhanced oil recovery (EOR) after chemical flooding, targeting residual oil in deep zones

SELF-GROWING HYDROGEL PARTICLE SYSTEM



Coalescence and stability of particles in water phase
(143 ℃ and 22×10⁴ mg/L)

Product Description

This product is formed on the surface into a bulk gel using specific crosslinking technology, then processed into a uniformly dispersed aqueous solution system with various particle size distributions through water-based dispersion and mechanical granulation. The system features self-growing viscoelastic gel particles, which can migrate into the deep formation, performing plugging, profile control, and flooding functions across multiple layers. This enhances water control and significantly improves oil recovery efficiency.

Index	Parameter Range
Appearance	Uniformly dispersed liquid in light yellow or dark brown color
Density (20℃), g/cm3	8-25 million
Solid Content	≥88%
PH	7.5-8.5
Viscosity (20℃), mPa·s	≤10mPa.s
Particle Size	nm & μm adjustable
Coalescence Ratio	10-30 times
Thermal Resistance	≤150℃
Salt Tolerance	Salt Tolerance
Package	200kg plastic drum

Function & Application
Key Features:
• Compatible with skid-mounted integrated equipment, supporting integrated production, mixing, and injection; suitable for mobile operations.
• Surface crosslinking of gel particles with controllable particle size; particle sizes can be customized based on pore throat dimensions. In subsurface conditions, intermolecular coalescence occurs, achieving a coalescence multiple of 10–30 times.
• Excellent thermal resistance, salt tolerance, and high shear stability.
Target Applications:
• Medium- and low-permeability reservoirs
• Shale formations
• Carbonate reservoirs

NANO MICROSPHERES FOR PROFILE&PLUGGING

Product Description

This nano-scale plugging agent is designed based on smart responsive materials, featuring controllable expansion and a self-adaptive accumulation mechanism to precisely block high-permeability channels and fractures in the reservoir. Under formation temperature, the microspheres expand 2–10 times, forming a dense physical barrier that improves sweep efficiency and reduces ineffective water cycling. The product is suitable for high-temperature (≤150°C) and high-salinity (≤200,000 mg/L) reservoirs, enhancing oil recovery by 10%–20%, and achieving long-term profile control and water shutoff synergy.

Index	Parameter Range
Appearance	Milky White Suspension
Initial Particle Size	50-500nm (customizable)
Particle Size after Expansion	0.5-5μm (expansion ratio: 2–10 times)
Expansion Trigger Conditions	Temperature ≥60°C or Salinity ≥5,000 mg/L
Viscosity (20℃), mPa·s	≤10mPa.s
Solid Content (suspension)	10%-30%
Coalescence Ratio	10-30 times
pH range	6.0-9.0
Treatment&Preparation	0.1%–1.0% (adjustable based on formation permeability and fracture size)
Package	25kg polyethylene drums or 1000kg IBC.

Function & Application
Key Features:
• Deep profile control and water shutoff
• Plugging of fractured reservoirs
• Flow control and flooding synergy
Target Applications:
• High-water cut oil fields (water cut >90%) for ineffective water circulation management
• Fractured-pore dual-media reservoirs for balanced flooding
• Injection well group interflow suppression

HIGH-TEMPERATURE&SALT-RESISTANT COMPOSITE GEL PLUGGING AGENT

Product Description

This plugging agent is based on salt-resistant polymers as the core, combined with environmentally friendly, efficient crosslinking agents and nano-enhanced materials. Through molecular simulation technology, the polymer structure is optimized, incorporating a multi-crosslinking mechanism and nano-enhanced stability, significantly improving the gel's thermal and salt resistance, with a plugging strength > 5 MPa.

Index	Parameter Range
Appearance	All components are solid particles
Temperature Resistance Range	130-150°C
Salt Resistance (salinity)	> 200,000 ppm, Ca^2/$Mg^2$8000ppm
Plugging strength (MPa)	5-7
Gelation time	Controllable Adjustment
Flowability	Low viscosity, easy injection
Treatment&Preparation	Formulation designed based on reservoir conditions
Package	Liquid form, packaged in drums (customizable specifications), requires onsite mixing for use

Function & Application

Key Features:

- Fracture Plugging & Profile Control

Target Applications

- Deep, high-temperature, high-salinity reservoirs
- Salt-alkali formations or offshore oilfields with salinity > 200,000 ppm

HEAVY OIL VISCOSITY REDUCER FOR FLOODING

Product Description

This product is a functional chemical agent designed through specific molecular structure engineering to efficiently reduce the viscosity of complex fluids. It can lower the oil–water interfacial tension to the range of 10^{-1} to 10^{-3} mN/m, converting water-in-oil emulsions into oil-in-water states, thereby significantly reducing crude oil viscosity and enhancing fluidity. The product is compatible with polymers and can be blended at desired ratios to optimize mobility control.

Index	Parameter Range
Appearance	All components are solid particles
pH (1% solution)	7.0-9.0
Viscosity Reduction Rate (at 50°C)	≥95%
Temperature Resistance	Viscosity retention rate ≥ 95% after 24 hours at 300°C
Dehydration rate after high-temperature settling	≥80%
Oil Washing Efficiency	<1×10-1mN/m
Injection Concentration	0.1%-1.0% (adjusted according to reservoir viscosity)
Package	Liquid: 25kg polyethylene drums / 1000kg IBC totes Powder: 20kg aluminum foil damp-proof bags

Function & Application

Key Features:

- Reduces crude oil viscosity and oil–water interfacial tension

Target Applications:

- Providing effective viscosity reduction and flooding for crude oil viscosity ≥5000 mPa.s

High-Activity Viscosity-Reducing Flooding Agent

Product Description

This product is a single-component nanofluid for viscosity reduction and oil displacement, synthesized by copolymerizing viscosity-reducing monomers and amphoteric monomers onto a hyperbranched polymer backbone. It exhibits high activity and integrates viscosity reduction and interfacial tension lowering functions. It delivers excellent performance in reducing the viscosity and lowering the oil–water interfacial tension for heavy oils with viscosities ranging from 200 to 2000 mPa·s.

Index	Parameter Range
Appearance	Milky white to light brown uniform liquid
Viscosity reduction rate after stirring	≥95%
Viscosity reduction rate after adsorption	≥90%
Thermal Resistance	≤150°C
Salt Tolerance	≤200,000 mg/L
Interfacial Tension	≤0.01 mN/m
pH range	6.0-7.0
Oil Washing Efficiency	≥60%
Waterseparation rate afterhigh-temperatureaging	≥80%
Treatment&Preparation	Recommended concentration: 0.2% – 0.4% (adjusted according to reservoir viscosity)
Package	25kg polyethylene drum / 1000kg IBC

Function & Application
Key Features:
• Reduces crude oil viscosity and oil-water interfacial tension
Target Applications:
• Reduce viscosity for water flooding of heavy oils with crude oil viscosity ranging from 200 to 2000 mPa·s, composite chemical flooding.

Polymer Degradation Inhibitor

Product Description

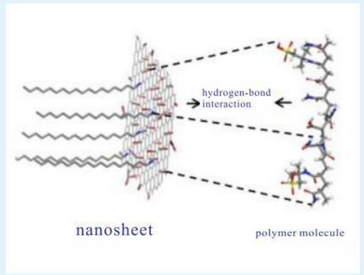
The active components in the product can preferentially combine with certain impurities in the wastewater, preventing and inhibiting their degradation and damage to the polymer, thereby enhancing the polymer's viscosity.

Index	Parameter Range
Appearance	White solid granules
pH	6.0-8.0
Solid Content	≥98.0%
Insoluble Matter	≤0.5%
Viscosity Increase Rate	≥30%
Viscosity Thermal Stability Increase Ratio	≥30%
Treatment&Preparation	Recommended Concentration：0.3%-1%
Package	≥60%
Water separation rate after high-temperature aging	≥80%
Treatment&Preparation	25kg/pack damp-proof

Function & Application
Key Features:
• At low dosages, the product can maintain a high viscosity in polymer solutions prepared with wastewater.
Target Applications:
• Reservoirs using polymer chemical flooding for oil recovery.

POLYMER VISCOSITY THICKENER FOR HIGH CA^{2+}/MG^{2+} RESERVOIRS

Product Description



This product utilizes unique modifying groups on nanosheet layers to shield calcium and magnesium, reducing their activity. By employing the unique hydrogen bonding of modified nanomaterials, it forms a three-dimensional network structure with the polymer, enhancing polymer viscosity under harsh reservoir conditions. This significantly increases the viscosity, elasticity, shear resistance, and long-term thermal stability of the polymer system at low injection concentrations.

Index	Parameter Range
Appearance	Brown to black, free-flowing liquid
Solid Content by wt%	≥1.5
pH	6.0-10.0
Polymer viscosity increase rate, %	≥200
Treatment&Preparation	Recommended Concentration：0.5%-1.4%
Package	25kg polyethylene drum or 1000kg IBC

Function & Application

Key Features:

• Polymer viscosity enhancement: Directly add to the polymer base solution and dilute with on-site wastewater to the desired concentration.

Target Applications:

• Temperature < 90°C, Salinity < 100,000 mg/L (Ca^{2+}, Mg^{2+} < 2,000 mg/L), for polymer flooding, binary/tertiary composite flooding.

Welldone Chemical Group