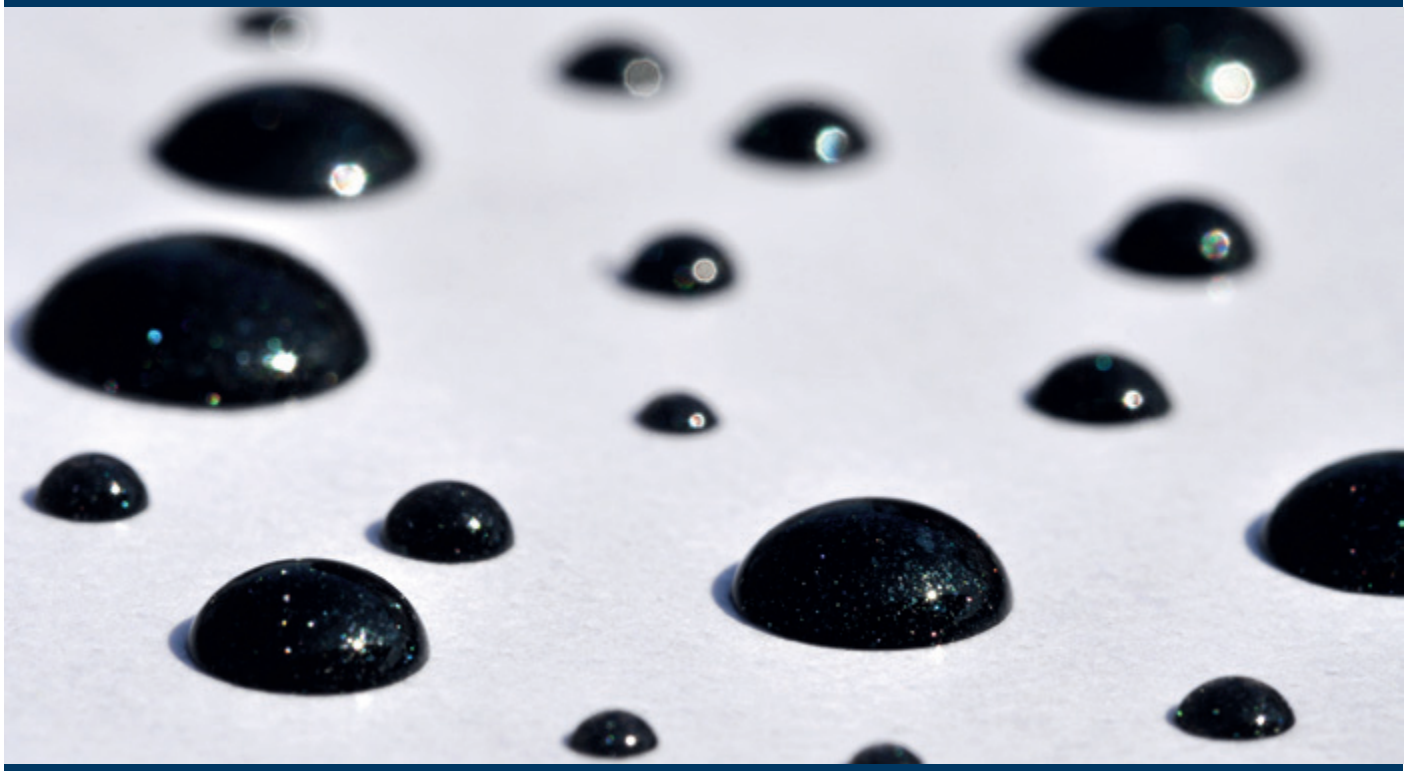
Surfactants for Thermal Enhanced Oil Recovery

Sasol Performance Chemicals



Surfactants for Thermal Enhanced Oil Recovery

Enhance Crude Oil Production from Steam Operations

Sasol offers a line of surfactants specifically formulated to address the challenges of heavy oil and bitumen recovery in high temperature applications. These products are ideally single surfactants but may also consist of one or more co-surfactants, assuring that each formulation is designed to meet the specific conditions of your reservoir.

Sasol's high temperature surfactants can be used in applications such as:

- SAGD (Steam Assisted Gravity Drainage)
- Steam Flooding
- CSS (Cyclic Steam Stimulation)
- Thermal Steam Foam Flooding
- High Temperature Surfactant Flooding

Surfactants for Thermal Applications

To address the needs of enhancing oil recovery in thermal applications, Sasol has developed the SOLOTERRA series product line. SOLOTERRA Surfactants exhibit the following properties.

- High temperature stability, up to 250 °C
- Excellent brine stability
- Low interfacial tension
- High oil solubilization (SP*)
- Stable foam formation

The SOLOTERRA Surfactant product line is composed of alkyl aryl sulfonates, alcohol ether carboxylates, and solvents.

Surfactants can improve steam floods or SAGD by lowering the interfacial tension of the oil, by forming lower viscosity oil emulsions or by altering the wettability of the rock. Surfactants can also disperse asphaltenes or paraffins.

Surfactants may be added to steam or gas processes to generate foam for mobility control, improving vertical or horizontal sweep efficiency.

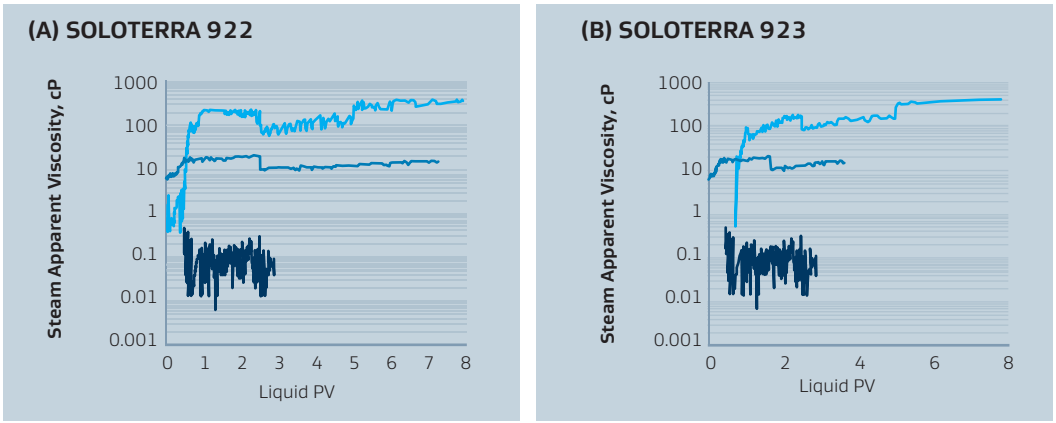
Surfactants for Steam Foam Applications

Sasol's SOLOTERRA surfactants are formulated to generate stable foam under steam conditions. SOLOTERRA surfactants can generate foam for steam mobility control, helping reduce steam override, improve conformance to alternate flow paths, and improve sweep efficiency while remaining stable.

Testing of bitumen with a viscosity of 915,000 cP at 20 °C (6.1 cP at 200 °C) and density 929 kg/m^3 (20.8 oAPI) in an Ottawa sand-packed column showed that both SOLOTERRA 922 and SOLOTERRA 923 surfactant foams were excellent candidates for additional testing.

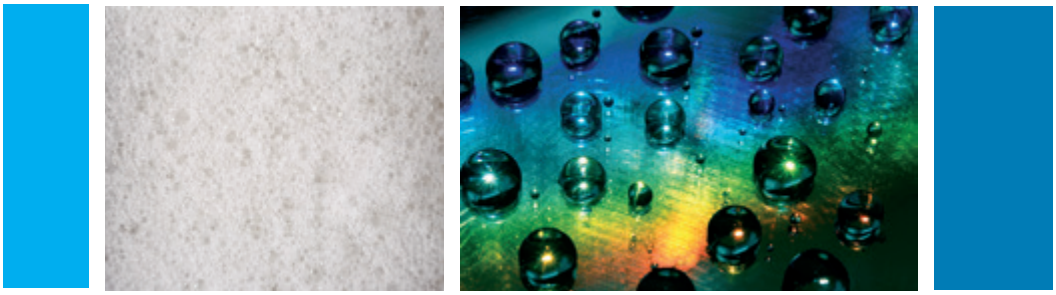
Both surfactants show increases in the apparent viscosity of steam by three orders of magnitude without the presence of bitumen. In the presence of bitumen, the apparent viscosity of steam is still increased by two orders of magnitude by the surfactant foam.

Figure 1:
Steam apparent viscosity at 250 °C in sand-packed columns with and without the presence of bitumen due to generation of stable foam using (A) SOLOTERRA 922 surfactant, and (B) SOLOTERRA 923 surfactant



Key Results from Steam Foam Laboratory Test at 250 °C:

- High-temperature stability, up to 250 °C
- Stable foam formation
- Increase apparent steam viscosity by 2 to 3 orders of magnitude in the presence of bitumen



At Your Service

Sasol Performance Chemicals
Anckelmannsplatz 1
20537 Hamburg
Germany

For further information on these or other Sasol products please contact a sales representative at:
EOR@sasol.com

For technical inquiries or product samples please contact:
techinfo@us.sasol.com

www.sasol.com

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