

# Optimized gas injections: Additives for gas foams



## Description:

Dedicated surfactants are used to generate gas conformance foam in oil reservoirs, with possible in-depth mobility control using repeated treatments. These foams improve gas utilization and accelerate recovery, resulting in gas savings and increased production.



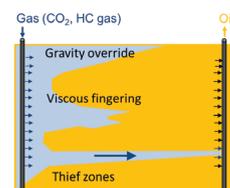
## Application:

Gas conformance control, Gas Oil Ratio, gas shut-off, in-depth gas mobility control.



## Results:

Foaming formulations are optimized in the lab using robotics and petrophysics experiments. Application tests demonstrate efficient gas mobility control results in various sets of conditions, including in presence of light oil, in hard produced water or for CO<sub>2</sub> injection. The formulations are successfully applied at pilot scale resulting in better sweep efficiency at injectors and GOR control at producers.



Issues in gas injections such as high GOR, thief zones, preferential paths can be solved by foam injection

## Challenges:

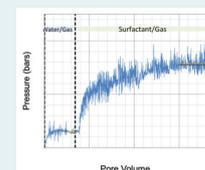
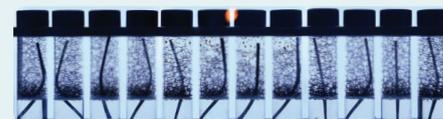
- Thief zones & poor conformance limit gas EOR efficiency at reservoir scale: gas produces less oil than expected and its cost per barrel increases.
- Classical Water-based gel conformance treatments are not hardly applicable to gas processes.
- Current foam treatments are not optimized from the formulation and an execution standpoint and for harsh conditions of reservoir (brine, temperature).

## Solutions:

- Ease of on-field application with on-site assistance (plug-n-play execution in some cases).
- Gas foam conformance effect is reversible: no permanent changes to the reservoir.
- Economical gas conformance optimizes gas utilization at reservoir scale.

## Objectives:

- Design an industrially realistic foam solution fitted to specific reservoir conditions: from lab screening & characterization to pilot
- Provide on-site assistance for pilot deployment and expertise in reservoir engineering (ex: treatment zones selection).



Workflow for foam formulation design: from highthroughput foam stability tests with crude oil, to careful characterization in coreflood tests



Formulation truck directly connected to injection pump for in-line mixing and direct injection of the foaming formulation.

References: SPE154147, SPE169116, SPE179855, SPE179632, SPE183352  
<https://www.onepetro.org/conference-paper/SPE-183352-MSSPE183326.0>  
 E. Chevallier, 2019, Trans. In Por. Med. <https://link.springer.com/article/10.1007/s11242-018-01226-2>

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