

# MicroCaRES – A JOINT INDUSTRY PROJECT

## DECISION SUPPORT FOR EOR AND CONFORMANCE IN FRACTURED CARBONATE RESERVOIRS USING MICROFLUIDIC TECHNOLOGY

### Introduction

Carbonate reservoirs hold a major share of global oil reserves but remain among the most complex EOR targets. Heterogeneous pore structures, fractures, and evolving wettability make laboratory results difficult to interpret and scale to field performance. Operators must often decide what to test, eliminate, or escalate with limited mechanistic insight and fragmented evidence.

### 1 WHAT IS MicroCaRES?

**MicroCaRES** is an operator-driven Joint Industry Project focused on improving early-stage EOR and conformance decision-making in fractured carbonate reservoirs. It addresses a key limitation in carbonate EOR evaluation: the lack of reproducible and comparable experimental evidence caused by strong heterogeneity and variability between fractured core samples.

**MicroCaRES** combines field-specific, bespoke microfluidic chips, designed to reflect key reservoir geometry and fracture characteristics, with the systematic evaluation of surface treatment approaches to identify reproducible methods that capture key carbonate surface properties. This enables controlled, repeatable pore- and fracture-scale experiments that isolate dominant mechanisms rather than sample-to-sample effects.

By providing this reproducible experimental basis, **MicroCaRES** enables operators to identify which EOR or conformance concepts should be eliminated early, which warrant escalation to further investigation or pilots, where dominant risks lie (wettability, fractures, transport, robustness), and how concepts compare across carbonate assets using consistent criteria.

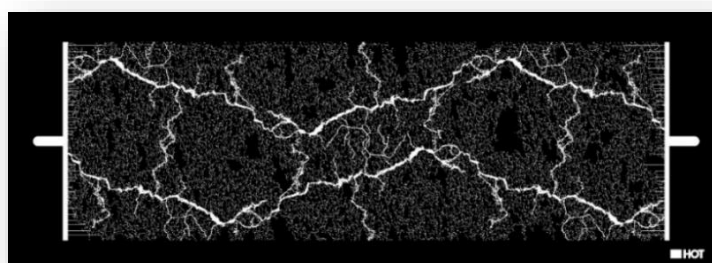
### 2 THE CONSORTIUM SOLUTION: BESPOKE MICROCHIPS AS THE ENGINE

At the core of **MicroCaRES** is the use of carbonate-representative microfluidic chips enabling real-time visualization of pore- and fracture-scale processes that govern carbonate EOR behavior. Experiments operate under representative reservoir conditions, including live oil, controlled wettability, and high pressure and temperature, and quantify:

- Sweep efficiency and flow diversions
- Capillary trapping and mobilisation
- Wettability alteration effects
- Chemical transport, adsorption, and retention
- Fracture-matrix exchange dynamics

#### THE RESULT:

- Fewer dead-end studies
- Fewer failed pilots
- Faster learning cycles



## 3 NOVELTY AND VALUE ADDED

The novelty of this consortium lies in shifting early EOR decisions from recovery numbers to mechanism-based, comparative evidence using carbonate-representative microchips. **MicroCaRES** does not replace coreflooding or simulation; it identifies which technologies merit escalation. Selective coreflooding is used for confirmation, not blind screening.

### Conformance Technologies Considered

- Delayed gels
- Microgels and nanogels
- Preformed gels and preformed particle gels
- Thermosensitive polymers
- Delayed-viscosity polymers

### EOR Technologies Considered

- Waterflooding and smart water
- Chemical EOR: alkali/surfactant/polymer
- Gas-based EOR: low-tension gas and CO<sub>2</sub>
- Water-Alternating-Gas (WAG) and foam
- Hybrid and combined EOR concepts

## 4 HOW WE WORK WITH OPERATORS

**MicroCaRES** is structured to align with operator decision gates and field deployment workflows. Screening priorities are defined by members and translated into targeted microfluidic experiments, mechanism-based interpretation, and shared carbonate datasets. The workflow combines:

- Operator-defined screening context and priorities
- Targeted laboratory experimentation focused on key uncertainties
- Mechanistic interpretation at pore-scale and fracture-scale
- Iterative feedback with technical teams
- Shared carbonate EOR database and knowledge base
- Consensus-based ranking and selective validation



In many cases, **one consortium cycle costs a fraction of a single coreflood campaign**, while delivering broader comparative insight.

Confidentiality is central to the consortium model. Proprietary operator inputs remain protected, with anonymized sharing and clear separation between shared and private datasets.

## 5 CONSORTIUM STRUCTURE & TIMING

- **Membership entitlements:** Shared, anonymized results, comparative insights, and decision-ready outputs
- **What members get:** Participation in joint technical discussions, rankings, and screening conclusions
- **Governance:** One seat per member in the committee; shared priority setting and workplan definition
- **Meeting participation:** Up to three nominated participants per member company
- **Confidentiality:** Proprietary operator inputs protected; shared results anonymized
- **Timing & cost:** Consortium starts with a minimum of five (5) member companies
  - Expected start: **Q3 2026**
  - Annual fee: **€48,500** per member company (fee valid for starting members only)

