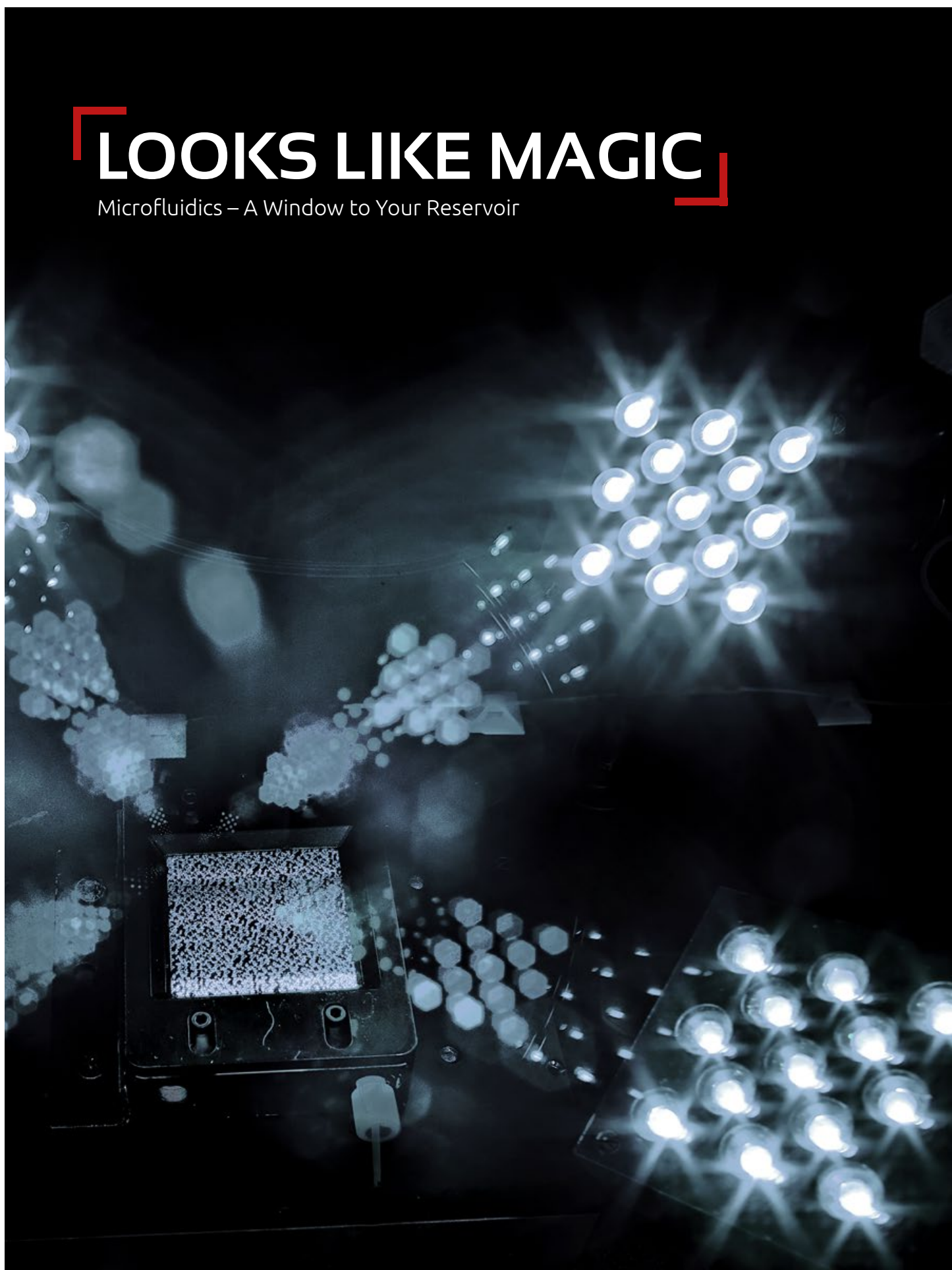


HOT

LOOKS LIKE MAGIC

Microfluidics – A Window to Your Reservoir

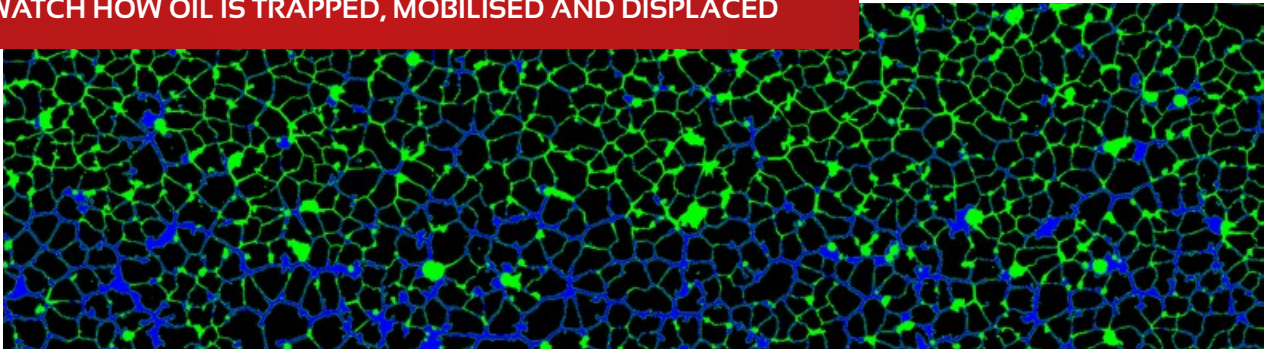


MICROFLUIDICS – AN EMERGING TECHNOLOGY FOR EOR OPTIMISATION

Rock-on-a-Chip microfluidics opens a new era of screening EOR chemicals and designing IOR / EOR field applications. Our advanced microfluidics technology is based on 10-year R&D in collaboration with industry and academia:

- It visualises real time the fluid flow in porous media,
- Requires only small fluid volumes (typically 1 - 3ml/experiment) and
- Takes only a few hours to conduct an EOR flooding experiment.

YOU WATCH HOW OIL IS TRAPPED, MOBILISED AND DISPLACED



Water flooding sandstone analogue with permeability contrast

WHY USE MICROFLUIDICS FOR IOR / EOR FIELD APPLICATION PLANNING?

When designing and preparing an EOR field application, a large number of chemicals need to be tested to identify the optimum chemical formula for a specific reservoir. The industry standard is to de-risk chemical EOR technology by a sequence of phase behaviour tests and core floods before conducting field tests.

However, the information from classical experiments is rather limited as the phase behaviour is typically measured in test tubes and not under realistic flow (mixing) conditions in porous media, and core floods do not directly give insights to the details of oil mobilisation and displacement.

MICROMODELS ARE USED AS AN EOR SCREENING, PLANNING AND OPTIMISATION TOOL BECAUSE:

- They combine aspects of phase behaviour and flow (while the traditional phase behaviour tests only test aspects of phase behaviour).
- They give insight to the oil mobilisation and displacement process in porous media such as phase trapping, displacement efficiency, front stability, tortuosity, break-through performance, residual oil saturation.
- They visualise what drives flow behaviour, such as fluid-fluid interaction, wettability modification, emulsification, foam.
- They allow fast and systematic screening of EOR chemicals as well as EOR process optimisation.



WE PROVIDE TURNKEY MICROFLUIDIC SOLUTIONS

InspIOR, our flagship microfluidic flooding device, and our transparent micromodels are the basis for our turnkey microfluidic solutions that include hardware and software components as well as chip design, flooding experiments and interpretation services.

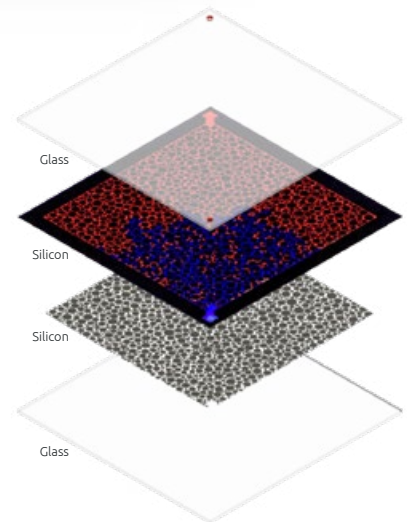
InspIOR – A PROFESSIONAL MICROFLUIDIC FLOODING SYSTEM

Our InspIOR Microfluidic System is built for ambient and reservoir condition IOR / EOR flooding experiments. It is operated via InspIOR Vision, a process control, visualisation and data management software, enabling an efficient use with minimal human interaction.

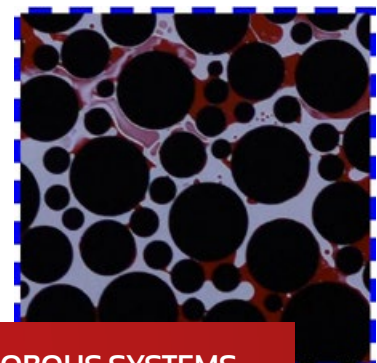
OUR ROCK-ON-A-CHIP MICROMODELS ARE RESERVOIR ANALOGUES

Our transparent glass-silicon-glass (GSG) micromodels are reservoir rock analogues fabricated by etching the porous structure into silicon and allow:

- Full visual access
- Small pore throats and complex flow geometries
- Reservoir condition experiments
- Wettability control



Multiple micromodels can be fabricated with identical properties, but chips can also be re-used multiple times. This is important for the repeatability and comparison of flooding experiments.



OBSERVE YOUR CHEMICALS REACT WITH OIL AND WATER IN POROUS SYSTEMS

BENEFIT FROM OUR MICROFLUIDIC EOR FLOODING SERVICES

Our transparent micromodels together with our InspIOR experimental setup are utilised to generate real time high-resolution images of flooding processes which are then analysed through image analysis.

We run reservoir condition IOR / EOR flooding experiments including water, polymer, surfactant, alkaline and nano-particles applications, gas injection and foam processes:

- ▮ We visualise oil mobilisation and trapping mechanisms and determine recovery curve and remaining oil distribution.
- ▮ We analyse what drives flow behaviour, such as fluid-fluid interaction, wettability modification, emulsification, foam.
- ▮ We visualise pore-scale phenomena such as viscoelastic turbulences and facilitate streamlines and particle tracing.



A MICROFLUIDIC EOR EXPERIMENT TAKES ONLY A FEW HOURS – UNIMAGINABLE WITH CONVENTIONAL CORE FLOODING

ABOUT HOT

HOT Microfluidics, a Member of the HOT Energy Group, is the leading provider of turnkey microfluidic solutions for IOR / EOR applications.

Our pioneering, fast and cost-effective Rock-on-a-Chip approach provides unmatched IOR / EOR process visualisation, chemicals screening and EOR process optimization capabilities and yields an unrivalled understanding of EOR processes, pore-scale oil mobilisation and trapping mechanisms.

BENEFIT FROM THE NO. 1 IN MICROFLUIDICS FOR IOR / EOR APPLICATIONS

WE...

- ▮ ...perform and analyse Rock-on-a-Chip IOR / EOR flooding experiments to aid you with your EOR field application planning and optimisation (water, polymer (P), alkaline (A), surfactant (S), AP, SP, ASP, nano-particles, foam, gas injection).
- ▮ ...design and fabricate transparent micromodel analogues of your reservoir rock (linear, 5-spot and bespoke geometry, water or oil wet, fractured, etc).
- ▮ ...deliver turnkey microfluidic solutions comprising
 - ▮ InspIOR, our flagship microfluidic flooding device,
 - ▮ InspIOR Vision, our process control and data management software,
 - ▮ InspIOR Vision Pro, our image analysis software,
 - ▮ our bespoke Rock-on-a-Chip micromodels, and
 - ▮ our training, mentoring and after-sales services.

INTERESTED IN OUR EXTENDED EOR LAB SERVICES?

WE...

- ▮ ...perform reservoir condition core flooding experiments
- ▮ ...characterise EOR fluids (rheology, HPLC, GC, NMR, UV-VIS spectroscopy, MADLS, ELS, etc.)
- ▮ ...assess fluid-fluid and rock-fluid interaction (IFT, phase behaviour, contact angle, imbibition, gravimetric sorption, etc.)
- ▮ ...do petrophysical measurements (XRD, RFA, CT & micro-CT, MICP, FIB-SEM EDS)

KEY PUBLICATIONS

- ▮ How Microfluidic Solutions using a Rock-on-a-Chip Approach look set to Revolutionise IOR / EOR Process Visualisation. Oilfield Technology, 2017 June Edition
- ▮ "Rock-on-a-Chip" Devices for High p, T Conditions and Wettability Control for the Screening of EOR Chemicals. SPE-185820-MS.

THE WAY TO YOUR ROCK-ON-A-CHIP SOLUTION


Contact us at microfluidics@hoteng.com

LOOKING FOR A PARTNER WHO'LL
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