

ENERGY

INDUSTRY

INSIDER



Q1 2020 | Pulse Advanced Drilling Technology

FutureBridge

WHAT'S INSIDE!

- Q1, 2020 developments
 - Nanofluids
- Pulse theme:
 - Hybrid nanomaterials and nanofluids
 - Eco-friendly nanofluids
- Q1, 2020 patenting activity
 - Nanofluids
- COVID-19 impact on
 - Oil & gas industry

01

Emerging trends

- Hybrid nanofluids
- Environment friendly nanofluids



02

Quarterly technology review

- Patenting activity in Q1, 2020
- Most referred patent in nanofluid EOR technology



03

COVID-19 impact – Oil & Gas industry



01

Emerging trends

Hybrid nanofluids

26 January 2020

Universiti Teknologi Petronas, Malaysia, MacEwan Universiti, Canada and Schlumberger, UAE evaluating scattering parameters of sandstone saturated with brine and nanofluids for the application in EOR.

Zinc Oxide (ZnO) and Bismuth ferrite BiFeO₃ (BFO) nanoparticles were synthesized via facile sol-gel method followed by nanofluid preparation.

8 February 2020

University of North Dakota, USA, and Northeast Petroleum University, China experimenting polymer nanoparticles based nano-fluid for EOR.

The results showed that the water-oil interfacial tension of the Bakken crude oil decreased by 99.49% and the contact angle increased by 125.73% compared to the original values.

25 March 2020

Research Institute of Petroleum Industry (RIPI), Iran experimenting on Hybrid of quantum dots for interfacial tension reduction and reservoir alteration wettability for EOR

Coreflooding test revealed the high oil recovery efficiency (22%) at very low nanofluid concentration (0.01 wt%).

Research focus area in hybrid type nanofluids for Q1, 2020:

- **Zinc Oxide and Bismuth ferrite nanoparticles and evaluation of scattering parameters of sandstone saturated with brine**
- **Novel nano-fluid was developed by using nano-composite formed with polymer nanoparticles and a betaine-type zwitterionic surfactant**
- **N-doped Graphene quantum dots (N-GQDs)/MoS₂ quantum dots (MQDs) nanohybrids for preparing different percentage of Nanoemulsions which can reduce interfacial tension significantly so it can be used for Enhanced Oil Recovery (EOR) application**



DEVELOPMENTS Emerging Trends



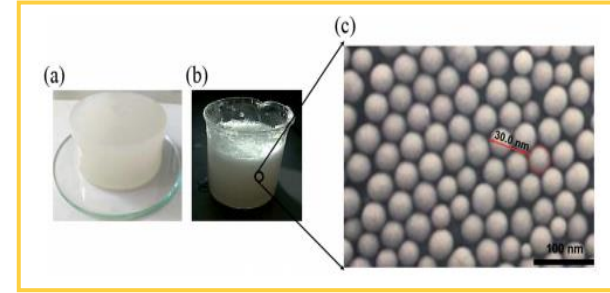
- Hybrids such as surfactant-polymer, polymer-nanomaterial, surfactant-nanomaterial and polymer-surfactant-nanomaterial had prevailed the effects of harsh reservoir conditions
- Synergistic effects between the hybrid components play major roles in improving the properties that could withstand the effect of extreme reservoir conditions and changes in crude oil properties
- Silicon based nanofluids are prevalent in EOR process; The effect of SiO₂ nanoparticles in the hybrid had been established to improve the relative foamability, thermal stability and IFT reduction between crude oil and brine
- Researchers are focusing on developing effective hybrid nanoparticles based nanofluids and conducting experiments to understand its rheological and fluid loss property, stabilization process in high-temperature and high-salinity brines, wettability and interfacial tension alteration etc.

Environment friendly nanofluids

26 February 2020

China University of Petroleum - Beijing, experimenting on high-viscosity alpha-starch nanogel particles for EOR.

- Gel particles regarded as materials for the conformance improvement of water for increasing the sweep efficiency but no effect on oil displacement efficiency.
- High-viscosity alpha-starch nanogel particles were synthesized through a free radical reaction to combine the synergistic role of gel and nanoparticles. The high viscosity of the nanogel particle dispersion with 250 mPa s at 90 deg.C was utilized to plug water channels and drag oil droplets out of the remaining oil.
- Results showed that, nanogel particle dispersions with high viscosity can increase the sweep efficiency and also improve oil displacement efficiency.

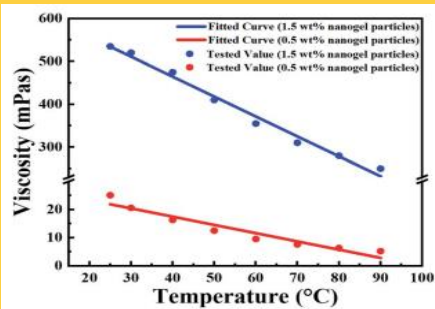


(a–c) a-Starch gel, nanogel particle dispersion, and SEM image of the nanogel particles, respectively

Nanocellulose is a renewable, biodegradable, and easily available material that is considered as an attractive resource for many different value-added applications in the emerging EOR process.

Research focus area in environment friendly nanofluids for Q1, 2020:

- Economical high-viscosity alpha-starch nanogel particles



Fitted (curves) and measured (points) viscosity of the nanogel particle dispersion versus the temperature and concentration of nanogel particles



DEVELOPMENTS
Emerging Trends



- Researchers are working on Nanocellulose as green and environmental friendly alternative to existing EOR polymers as it imparts many distinctive properties, for example, high strength, chemical accessibility, large surface area, etc., that can increase the EOR process efficiency.
 - Nanocellulose particles (cellulose nanofibrils and cellulose nanocrystals) can be designed in such a way to have adequate dimensions and surface chemistry
- Researchers are investing on microcellulose coating and its effect on contact angle and wettability properties, physical properties, size distribution and crystalline structures etc.
 - Cellulose nanomaterials (micro- and nanosized cellulose) can be divided into categories such as microcrystalline cellulose (MCC), cellulose nanocrystals (CNCs), cellulose nanofibers (or nanofibrils; CNFs) etc.

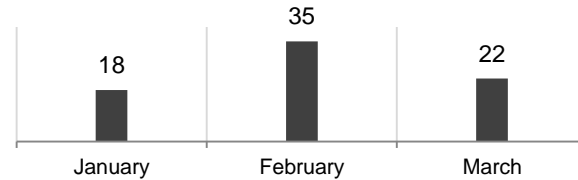
02

Technology review

Patenting Activity in Nanofluids, Q1 2020

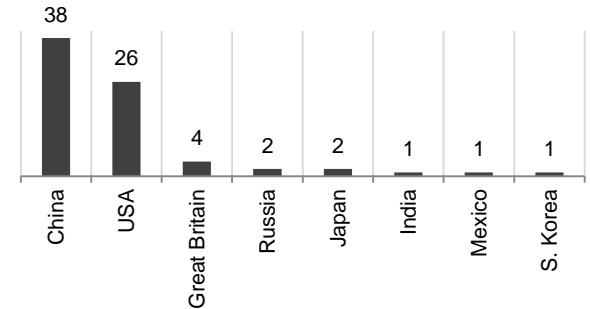
Patent publication

Total no. of patents: 75



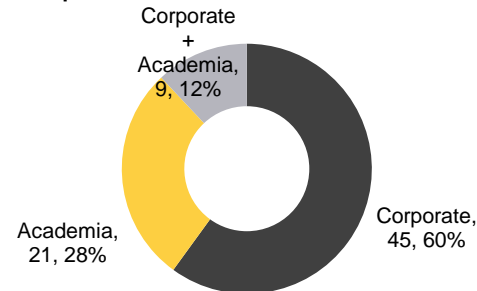
Distribution of patents between w.r.t. country of origin

Total no. of patents: 75

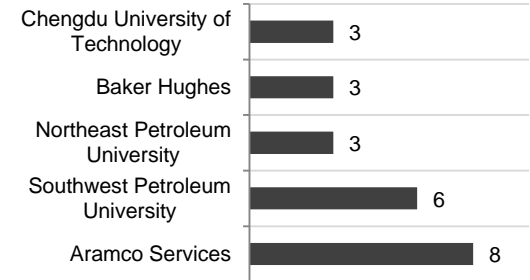


Distribution of patents between corporate & academics

Total no. of patents: 75



Top 5 patent holders



Research focus – Aramco Services

- Encapsulated nanocompositions
- Nanosurfactants
- Metal oxide nanoparticles
- Smart water flooding processes
- High temperature fracturing fluids with nano-crosslinkers
- three-phase emulsion based fracturing fluid
- Invert emulsion drilling fluids

Research focus – Southwest Petroleum University

- Micro-nano plugging anti-collapse drilling fluid
- Nano-composite capable of preventing CO₂ channeling

Research focus – Northeast Petroleum University

- Micro-foam temporary plugging agent
- Intelligent micro-nano capsule

Research focus – Baker Hughes

- Aqueous downhole fluids having charged nano-particles and polymers
- Microemulsions used as spacer fluids

Research focus – Chengdu University of Technology

- Organic porous nano-particle/surfactant composite oil displacement system

Most referred patent for Q1, 2020

Publication no: [CA2868279](#)

Title: Fluids and methods including nanocellulose

Patent owner: Schlumberger

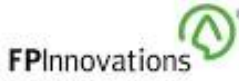
No. of forward citation / Citing patent: 58

Abstract: Treatment fluids and methods for treating a subterranean formation are disclosed that include introducing a treatment fluid into a subterranean formation, the treatment fluid containing a nanocrystalline cellulose.

Top corporates who are taking reference from this patent



HALLIBURTON



FPInnovations



Unilever



ConocoPhillips



Baker Hughes



UPM



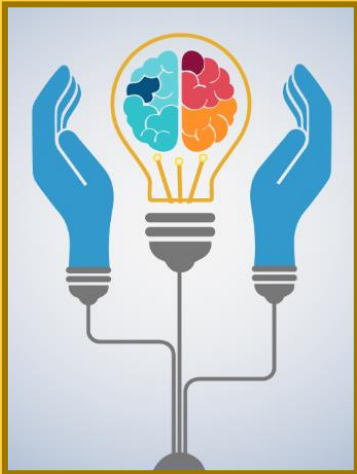
3M

Objective of the invention:

- Method for treating a subterranean formation, the method including preparing a treatment fluid containing a solvent, and a nanocrystalline cellulose; and introducing the treatment fluid into a wellbore.

Nanoparticles used:

- Nanocrystalline cellulose comprises rod-like nanocrystalline cellulose particles (NCC particles) having a crystalline structure.



03

COVID-19 impact

Note: FutureBridge has not found any new start-up activity / updates on existing players for Q4, 2019

COVID – 19 impact on oil & gas industry

#AnalystViewpoint

- The spread of Covid-19 poses a significant threat to the global oil and gas industry. Due to the outbreak, a huge downfall in demand for petroleum products has been witnessed globally.
- Offshore oil production is being significantly affected due to the coronavirus outbreak, several oil companies are reducing offshore workers to prevent the spread of COVID-19.
- Oil, gas, and petrochemical producers were facing financial uncertainties even before COVID-19 began to spread internationally.



Short term and long term effects of COVID-19



COVID-19 could slash two-thirds of 2020 oil and gas project sanctioning

- Exploration and production (E&P) companies are likely to reduce project sanctioning by up to [\\$131 billion](#), or about 68% year-on-year
- In North America, LLOG-operated Shenandoah Phase 1 and the Shell-operated Whale development, could face short-term delays in the offshore sector
- In the onshore sector operators are expected to wait for the situation to stabilize before committing to new projects



Cut in oil production due to shortage of storage

- [ConocoPhillips plans to cut production](#) (to reduce production at Surmont by approximately 100,000 barrels of oil per day to 35,000 by May) at its Surmont oilsands operation in northern Alberta due to low oil prices until market conditions improve



Hard time for oil & gas players - Persistent negative returns

- The economic impact of the pandemic is posing major challenges to oil and gas companies that were already struggling to meet their bottom line
- more than 200 oil and gas companies have [filed for bankruptcy](#) in North America in the past five years. Investors are no longer interested in propping up failing companies

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