Advanced Drilling Technology

May | 2020

BULLETIN

ENERGY INDUSTRY INSIDER

WHAT'S INSIDE!

- Stabilization of CO_2 foams using 3-aminopropyltriethoxysilane (APTES) surface-modified nanosilica
- Wettability alteration of sandstone rock by surfactant stabilized nanoemulsion for enhanced oil recovery
- CO_2 N_2-Responsive nanoparticles for EOR during CO_2 flooding
- Fe_3O_4 nanoparticles as surfactant carriers for enhanced oil recovery and scale prevention

01

Isfahan University of Technology (Iran) working on stabilization of CO_2 foams using 3-aminopropyltriethoxysilane (APTES) surface-modified nanosilica

02

Indian Institute of Technology, Dhanbad (India) experimenting on wettability alteration of sandstone rock by surfactant stabilized nanoemulsion for enhanced oil recovery

03

Southwest Petroleum Univ., Chengdu Univ. of Techn., CNPC Xibu Drilling Engineering Comp. Ltd., China National Offshore Oil Corporation Energy Development Comp. Ltd. experimenting on CO_2 N_2-Responsive nanoparticles for EOR during CO_2 flooding

04

Federal University of Rio de Janeiro and Instituto Nacional de Metrologia developing Fe_3O_4 nanoparticles as surfactant carriers for enhanced oil recovery and scale prevention

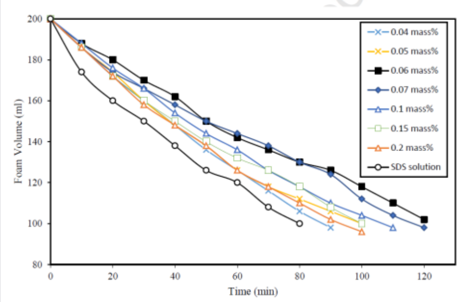

Fig 1: CO_2 foam stability in the presence of SDS and various concentrations of Silica NPs

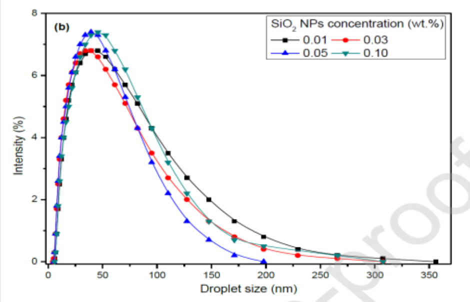

Fig 2: Droplet size distribution of nanoemulsion at (a) varying Tween 40 surfactant and (b) varying SiO_2 NPs concentrations.

1 May 2020

Isfahan University of Technology (Iran) working on stabilization of CO_2 foams using 3-aminopropyltriethoxysilane (APTES) surface-modified nanosilica

- The modification of nanoparticles was performed using 3-aminopropyltriethoxysilane (APTES). Foam generation and stability were investigated using static experiments.
- The experiments were performed at different concentrations of nanoparticles (0.04 to 0.20 mass%), two concentrations of SDS (0.236 and 0.472 mass%), and in the presence and absence of MgCl2 salt.

The results showed that the surface modification of Silica using the APTES makes the nanoparticles more oil-wet in oil-water system and more gas-wet in air-water system. The stability of foams is reduced in the presence of Mg_2+ ions.

Read this story

19 May 2020

Indian Institute of Technology, Dhanbad (India) experimenting on wettability alteration of sandstone rock by surfactant stabilized nanoemulsion for enhanced oil recovery

- The objective of the experiment was to investigate the capacity of nanoemulsion systems (nanoemulsion and nanoemulsion + SiO_2 nanoparticles) for enhanced oil recovery (EOR) application.
- Nanoemulsions were prepared at 5 different concentrations (0.1, 0.2, 0.5, 1.0 and 2.0) in wt. %. of Tween 40. A two-step emulsion preparation method was followed.

Results showed that tertiary oil recovery of 26.40 % and 34.94 % of OOIP was gained by nanoemulsion and nanoemulsion + SiO_2 NPs systems respectively after secondary recovery.

Read this story

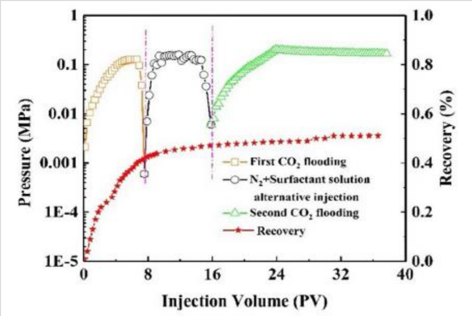

Fig 3: Pressure and recovery factor during the core #3 flooding experiment (black line: alternate N2 and surfactant solution injection)

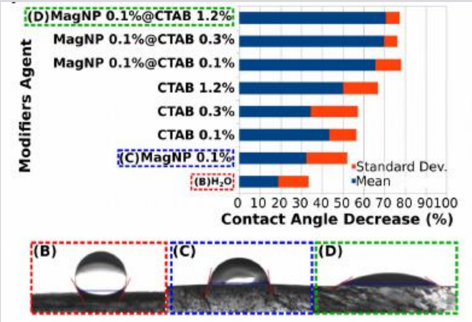

Fig 4: Contact angle reduction after treatment with WM agents, performed in triplicate

21 May 2020

Southwest Petroleum Univ., Chengdu Univ. of Techn., CNPC Xibu Drilling Engineering Comp. Ltd., China National Offshore Oil Corporation Energy Development Comp. Ltd. experimenting on CO_2 N_2-Responsive nanoparticles for EOR during CO_2 flooding

- Responsive nanoparticles were developed based on the modification of nano-silica (SiO_2) by 3-aminopropyltrimethoxysilane (KH540). The performances of responsive nanoparticles, including CO_2,N_2 response, wettability alteration, interfacial behavior, displacement behavior, etc., were examined.
- Responsive nanoparticles exhibited a good CO_2,N_2 response by bubbling in CO_2,N_2 to control nanoparticle dispersity due to electrostatic interaction.

Responsive nanoparticles showed a better plugging capacity of 93.3% to control CO_2 mobility, and more than 26% of the original oil was recovered.

Read this story

21 May 2020

Federal University of Rio de Janeiro and Instituto Nacional de Metrologia developing Fe_3O_4 nanoparticles as surfactant carriers for enhanced oil recovery and scale prevention

Universidade Federal do Rio de Janeiro

Instituto Nacional de Metrología de Colombia

- Nanofluid containing Fe_3O_4 nanoparticles with the ability to carry surfactants such as cetyltrimethylammonium bromide (CTAB) was synthesized.
- The presence of CTAB improved nanoparticle mobility in limestone porous medium during flooding experiments. Nanofluid has ability to slow down $CaCO_3$ scale formation and its also contributing to the flow assurance during the nanoflooding process.

These combined effects improve nanofluid efficiency in tertiary oil recovery as observed during the flooding tests in an unconsolidated porous medium, giving a recovery factor up to 60%.

Read this story

SPOTLIGHT

Stabilization of CO2 foams using 3-aminopropyltriethoxysilane (APTES) surface-modified nanosilica

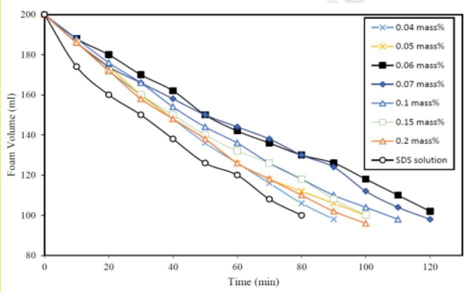

Fig 5: CO_2 foam stability in the presence of SDS and various concentrations of Silica NPs

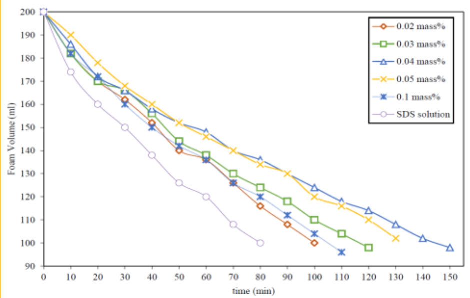

Fig 6: CO_2 foam stability in the presence of SDS and various concentrations of ZnO NPs

- Foam stability and the improvement of its transport from fracture to matrix are two major issues in the field of foam injection into fractured petroleum reservoirs.
- CO_2 foams were stabilized using surface modified silica nanoparticles.
- Foam generation and stability were investigated using static experiments.
- The modification of nanoparticles was performed using 3-aminopropyltriethoxysilane (APTES).
- The experiments were performed at different concentrations of nanoparticles (0.04 to 0.20 mass%), two concentrations of SDS (0.236 and 0.472 mass%), and in the presence and absence of $MgCl_2$ salt.
- The results showed that the surface modification of Silica using the APTES makes the nanoparticles more oil-wet in oil-water system and more gas-wet in air-water system. The stability of foams is reduced in the presence of Mg_2+ ions.

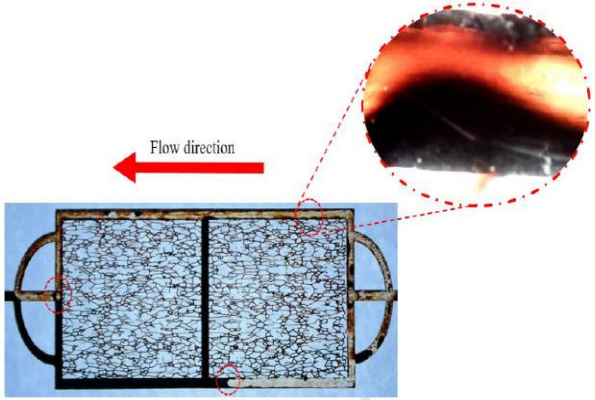

Fig 7: Surfactant solution flooding into the micromodel

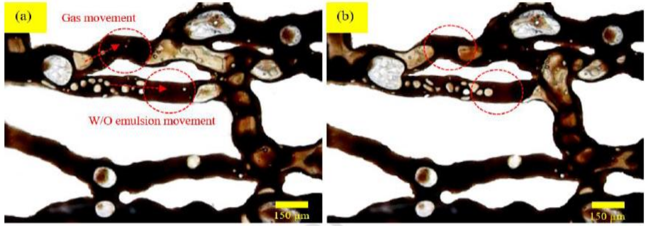

Fig 8: Consecutive stages of CO2 gas bubbles and W/O emulsions movement in the matrix pores/throats. Image (a) was taken before image (b)

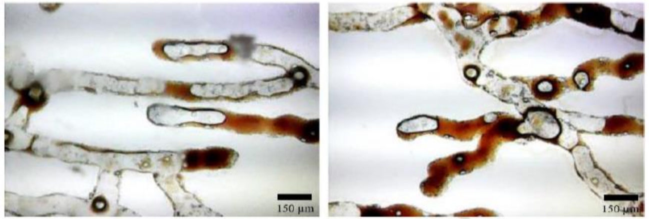

Fig 9: Penetration of injected fluid into dead-end pores in two different regions of the matrix zone

FutureBridge

North America
55 Madison Ave, Suite 400
Morristown, NJ 07960
USA
T: +1 212 835 1590

Europe
328-334 Graadt van Roggenweg
4th Floor, Utrecht, 3531 AH
Netherlands
T: +31 30 298 2108

United Kingdom
5 Chancery Lane
London EC4A 1BL
United Kingdom
T: +44 207 406 7548

Asia Pacific
Millennium Business Park
Sector 3, Building # 4, Mahape
Navi Mumbai 400 710
India
T: +91 22 6772 5700