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Research from Khalifa University may help Abu Dhabi achieve 70% oil recovery goal







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Research breakthrough from Khalifa University may help Abu Dhabi achieve 70% oil recovery goal.

A team of researchers from the Masdar Institute of Science and Technology have proposed a quantum mechanical simulation technique to predict how liquids move across the surface of solid crystalline structures, which could enhance energy production from the region's geological petroleum reservoirs.

The Masdar Institute is part of the Khalifa University of Science and Technology.

"The new technique for accurately predicting the wetting properties of carbonate minerals will play a key role in the reservoir characterisation and modeling needed for Abu Dhabi to advance towards its ambitious enhanced oil recovery targets," said Dr. Steve Griffiths, Interim Executive Vice President for Research, Khalifa University of Science and Technology.

Dr. TieJun Zhang, from the faculty of Mechanical and Materials Engineering, has been leading a wettability research team, which includes post-Doctoral researchers, Dr. Jin-You Lu and Dr. Aikifa Raza, and Ph.D. students, Qiaoyu Ge and Hongxia Li.

A paper written by the research team that describes the novel simulation technique, entitled, "Direct Prediction of Calcite Surface Wettability with First-Principles Quantum Simulation", was published in the latest edition of the Journal of Physical Chemistry Letters, which is a leading international scientific journal published by the American Chemical Society.





The study of how a liquid interacts with, and spreads out on, the surface of a solid material is known as wettability. Understanding this fundamental phenomenon enables scientists and engineers to evaluate how easily one fluid can spread on, or adhere to, a solid surface in a certain environment.

It has important implications for rock-geofluid interactions in hydrocarbon reservoirs, advanced materials in renewable energy production and water desalination, among many other applications.

With the ability to predict the subsurface wettability and its impact on the region's carbonate reservoirs, new protocols can be developed to enhance oil recovery efforts and geological carbon sequestration, says Dr. Zhang.



To predict subsurface wettability, the team conducted a series of quantum simulations at the atomic level, which capture interactions between the molecules of a rock's surface and various fluid molecules, such as water or oil.

Running the quantum simulation requires an enormous amount of computing power. In addition to the high-performance research computing facility at Masdar Institute, Dr. Zhang leveraged high-performance cloud computing support from Alibaba Cloud – Middle East and Africa, which is headquartered in Dubai.

The team then validated the simulation results through experiments in Masdar Institute's state-of-the-art materials research labs.

principles quantum mechanical simulation.

This research helps to advance the UAE's goal of harvesting more of its natural resources in an energy- and cost-efficient way," said Dr. Zhang.

This groundbreaking research reflects the Khalifa University of Science and Technology's commitment to ramping up fundamental local research efforts to support the evolution of key sectors in the UAE.

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