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Improving CO2 Injectivity with Surfactant-Driven Methods in Geological Storage

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Injectivity is an important factor in the carbon dioxide (CO2) geological storage, as it determines how quickly and efficiently CO2 can be injected into underground reservoirs. Improved injectivity not only enables more effective use of storage space but also makes it easier and more cost-efficient to store CO2 in challenging reservoirs. Surfactants, which have both hydrophilic and hydrophobic components, can significantly alter the rocks and fluids interactions. They reduce the interfacial tension between CO2 and brine and modify the wettability of rock surfaces, facilitating CO2 flow through smaller pores. To investigate these effects, detailed experiments were conducted, including measurements of interfacial tension and contact angles under varying conditions such as different surfactant types, temperatures, and pressures. Utilizing a synchrotron-based 3D computed tomography (CT) scanner, advanced imaging techniques were also employed to visualize CO2 flow dynamics at the pore scale during injection. At the core scale, multiphase fluid flooding experiments were performed to measure saturation and relative permeability using 2D X-ray imaging equipment. These experimental results demonstrated that surfactants can increase CO2 saturation and relative permeability while significantly reducing injection pressure, thereby improving injectivity. These findings highlight the potential of surfactant-based methods to optimize CO2 injectivity, contributing to more effective and economical geological storage solutions.

Country

Republic of Korea (South)

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References

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