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Geochemical Behavior and Reaction Mechanisms between Residual Oil and supercritical CO2 in Depleted Reservoirs

SHERRY (XIAOWEI) ZHENG[1], FUJIE JIANG[1], CHUNXU ZHOU[1], SHIQING LIU[1], ZHENGUO QI[1], WEIBING SHEN[2] AND DI CHEN[1]

[1]China University of petroleum,Beijing
[2]Institute of Geology, Chinese Academy of Geological Sciences

Oil reservoirs are considered as the optimal geological bodies for CO2 geological storage due to their abundant pre-existing data, infrastructure, high safety, and economic benefits. It has been preliminarily recognized that the process of asphaltenes precipitation induced by CO2 injection involves both intermolecular forces and interactions with specific functional groups[1], yet the mechanisms remain unclear. This study focuses on the issue of asphaltenes precipitation during the CO2 injection process in depleted oil reservoirs, aiming to deeply analyze the geochemical behavior and reaction mechanisms of residual oil under the interaction of CO2 and crude oil. By integrating core displacement experiments with artificial cores, organic geochemical analysis[2], multiple microscopy observations[3], and data analysis, this study aims to reveal the micro-distribution patterns and compositional changes of residual oil in depleted oil reservoirs after CO2 injection, as well as its impact on the occurrence state and molecular structure of asphaltenes. It attempts to elucidate the mechanism of action on aggregability, stability, and precipitation behavior of asphaltenes from internal factors such as functional groups and intermolecular forces. Furthermore, the project will explore and establish quantitative geochemical indicators of residual oil differentiation and asphaltenes deposition models, aiming to investigate the connections and indicative functions between geochemical information and physical characteristics, to provide theoretical basis and support for predicting and assessing the distribution patterns of asphaltenes deposition caused by CO2 injection.

References:

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