NAPLES, ITALY 23-27 JUNE
DSL2025 NAPLES
21st International Conference on Diffusion in Solids and Liquids

ABSTRACT

Advanced Nanotechnology for Enhanced Oil Recovery: Optimizing Nanomaterial Performance for Sustainable and Efficient Extraction

Maziyar Sabet

Chemical and Energy Engineering, Universiti Teknologi Brunei, Bandar Seri Begawan, Brunei Darussalam
(maziyar.sabet@utb.edu.bn or mazyiar.sabet@yahoo.com)

Enhanced Oil Recovery (EOR) methods are increasingly essential as traditional extraction techniques face declining efficiency and mounting environmental concerns. Nanotechnology offers a promising approach by integrating engineered nanomaterials such as carbon nanotubes (CNTs), graphene oxide, and metal oxide nanoparticles to improve oil displacement. This study evaluates the role of nanomaterials in modifying wettability, reducing interfacial tension, and enhancing mobility control in reservoirs. Experimental results show that optimized CNT concentrations increase oil recovery by up to 18%, while graphene oxide achieves a 22% enhancement. Additionally, the integration of artificial intelligence (AI) with nano-EOR enables real-time optimization of nanofluid deployment. Despite notable progress, challenges such as nanoparticle stability, economic feasibility, and environmental impact remain. Addressing these challenges through advanced synthesis methods, scalable nanofluid production, and AI-driven predictive modeling will accelerate the commercialization of nano-EOR technologies, facilitating more sustainable and efficient oil extraction.

Keywords: Nanotechnology, Enhanced Oil Recovery, Carbon Nanotubes, Graphene Oxide, Wettability Alteration, AI Optimization, Sustainable Oil Extraction