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THE KINETICS, GROWTH AND DEPOSITION OF SILICA PARTICLES

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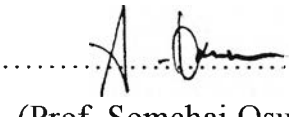

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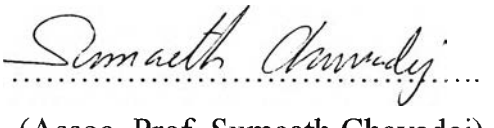

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การชะล้างโดยใช้น้ำ (Water flooding) เป็นวิธีการทั่วไปที่ใช้สำหรับเพิ่มการนำกลับคืนมาของน้ำมัน (Oil recovery) ครั้งที่สองและสาม บริเวณหินน้ำมันไม่เคยมีความสม่ำเสมอ ในความเป็นจริงแล้วบริเวณที่มีการแพร่ผ่านได้ง่ายมีมากมายหลายส่วน เปรียบเสมือนกับท่อส่งผ่านน้ำจากบริเวณบ่อสูบฉีด (Injection well) ไปยังบ่อผลิต (Production well) ส่งผลให้เกิดอัตราส่วนที่ไม่เหมาะสมระหว่างน้ำและน้ำมัน วัตถุประสงค์หลักของงานวิจัยนี้ คือ ลดความสามารถในการแพร่ผ่านของตัวกลางที่มีรูพรุน โดยการสร้างอนุภาคซิลิกา (Silica particle) ขึ้นภายใน (in-situ) การสังเคราะห์อนุภาคซิลิกาทำได้โดยนำเตตระเอทิลออโทซิลิเกต (Tetraethyl orthosilicate, TEOS) มาทำปฏิกิริยากับน้ำโดยใช้สารละลายแอมโมเนียเป็นสารเร่งปฏิกิริยา ได้ทำการศึกษาระบบของไมโครอิมัลชันน้ำในน้ำมัน ซึ่งใช้สารลดแรงตึงผิวประเภทไร้ประจุ ว่าชนิดและความเข้มข้นของสารช่วยสารลดแรงตึงผิว รวมทั้งความเข้มข้นของแอมโมเนีย มีผลต่อจลนพลศาสตร์และอัตราเร็วของการเกิดอนุภาคซิลิกาในระบบไมโครอิมัลชัน การประยุกต์ข้อมูลการทดลองต่อการเกิดอนุภาคภายใน coreflood ได้รับการพิสูจน์ ผลของการทดลอง coreflood แสดงให้เห็นมีความเป็นไปได้ในการนำอนุภาคซิลิกาไปใช้ประโยชน์ในการลดความสามารถในการแพร่ผ่านของตัวกลางที่มีรูพรุน

ABSTRACT

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Water flooding is a common procedure used to enhance the secondary and tertiary oil recovery. The porous rock matrix of a petroleum reservoir is never completely homogeneous. In fact, there are numerous zones of high permeability that act as conduits for almost direct transfer of water from the injection well to the production well resulting in an unfavorable ratio of the water and oil. The main objective of this work was to reduce the permeability of porous media by the in-situ formation of silica particles. Batch experiments were carried out to synthesize silica particles by the hydrolysis of tetraethyl orthosilicate (TEOS) via the aqueous ammonia based catalyst in nonionic surfactant W/O microemulsion system. The effects of the type and concentration of co-surfactant as well as the ammonia concentration on the kinetics and growth rate of silica particles formation in microemulsion were also investigated. The applicability of these batch data to the formation of particles within the coreflood experiment was elucidated. The results of coreflood experiment indicated a clearly promising prospect of the usage of the in-situ silica particles to reduce the permeability of porous media.

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