

**DEVELOPMENT OF CAPILLARY FLOW TECHNIQUE TO INVESTIGATE
THE MECHANISM OF BARIUM SULFATE DEPOSITION**



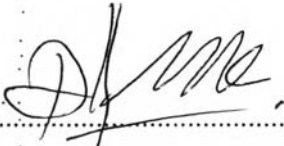
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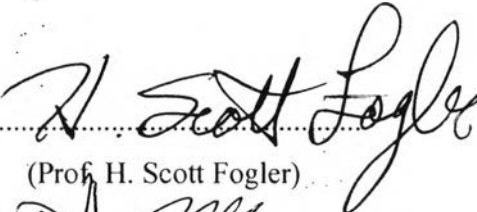
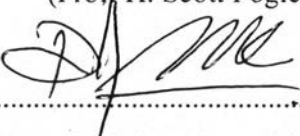
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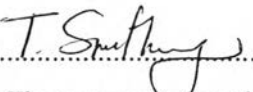
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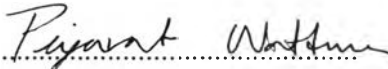
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ABSTRACT

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Mechanism/ Smooth Surface/ Rough Surface/ Pre-scaled Surface

Barium sulfate (BaSO_4) deposition is a significant and costly problem in oilfields which can occur when two incompatible waters mix. The precipitation of barium sulfate normally occurs in the bulk solution but for the deposition, it is not clear how barium sulfate deposits in the pipelines. In this research two possible mechanisms were proposed. First, since barium sulfate nucleation and before growth has completed, barium sulfate can deposit in pipelines. Second, after barium sulfate has completed their growth, barium sulfate can deposit in pipelines. To elucidate the possible mechanism, barium sulfate deposition experiments were conducted by flowing barium chloride and sodium sulfate solutions through a smooth and rough capillary. Results show that barium sulfate deposition is non-uniform and most of the deposition is observed at the beginning of the capillary. Moreover, the deposition is almost the same on both smooth and rough surfaces. In order to investigate the second mechanism, precipitated barium sulfate solution was flowed through a capillary. Results reveal that barium sulfate particles will not deposit on either of the surfaces after they precipitated and grew in the bulk solution. However, after a capillary was pre-scaled and precipitated barium sulfate solution was flowed through it, barium sulfate particles would slowly deposit inside the pre-scaled capillary.

บทคัดย่อ

รัชภูมิ เจริญไทยพานิช : การพัฒนาเทคนิคการไหลผ่านท่อแคปิลลารีเพื่อศึกษากลไกการเกาะติดของแบเรียมซัลเฟต (Development of Capillary Flow Technique to Investigate the Mechanism of Barium Sulfate Deposition) อ. ที่ปรึกษา: ศ. เอช สกอตต์ ฟอกเลอร์ และ ผศ.ดร. ปมทอง มาลากุล ณ อยุธยา 54 หน้า

การเกาะติดของเกลือแบเรียมซัลเฟตเนื่องจากการผสมกันของน้ำสองชนิดที่ไม่เข้ากัน เป็นปัญหาที่รุนแรงและมีค่าใช้จ่ายสูงในกระบวนการขุดเจาะน้ำมัน โดยปกติ การตกตะกอนของแบเรียมซัลเฟตมักเกิดขึ้นในวฏภาคของสารละลาย แต่สำหรับการเกาะติดของแบเรียมซัลเฟตในท่อนั้นยังเป็นที่ไม่ทราบแน่ชัดถึงขั้นตอนการเกิด งานวิจัยนี้จึงนำเสนอกลไกที่น่าจะเป็นไปได้ในการเกาะติดสองกลไก โดยในกลไกที่หนึ่ง เริ่มจากการเกิดนิวเคลียสของแบเรียมซัลเฟตที่เกาะติดบนผิวท่อ และเกิดการเติบโตโดยขยายขนาดของแบเรียมซัลเฟตต่อบนผิวท่อ ส่วนในกลไกที่สองนั้น แบเรียมซัลเฟตจะตกตะกอนในสารละลายก่อน แล้วจึงไปเกาะบนผิวท่อต่อไป เพื่อที่จะเข้าใจถึงกลไกที่เป็นไปได้ จึงได้ทำการทดลองการเกาะติดของแบเรียมซัลเฟตโดยการไหลของสารละลายแบเรียมคลอไรด์และ โซเดียมซัลเฟตผ่านท่อแคปิลลารีแบบที่มีผิวเรียบและแบบผิวขรุขระ จากผลการศึกษาพบว่าการเกาะติดของแบเรียมซัลเฟตเป็นไปแบบไม่สม่ำเสมอ โดยส่วนใหญ่เกาะอยู่ที่ผิวช่วงหน้าของท่อแคปิลลารีและการเกาะติดมีลักษณะคล้ายกันทั้งแบบผิวเรียบหรือแบบผิวขรุขระ สำหรับการศึกษากลไกการเกาะติดแบบที่สองนั้นใช้สารละลายที่มีตะกอนแบเรียมซัลเฟตไหลผ่านท่อแคปิลลารี จากผลการศึกษาพบว่าแบเรียมซัลเฟตไม่เกาะบนผิวของแคปิลลารีไม่ว่าจะเป็นผิวแบบเรียบหรือแบบผิวขรุขระ อย่างไรก็ตามผลการศึกษาเพิ่มเติมพบว่าแบเรียมซัลเฟตสามารถเกาะติดอย่างช้าๆบนผิวที่มีชั้นของแบเรียมซัลเฟตเกาะอยู่แล้วได้

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