Contribution ID: **550** Type: **Oral Presentation**

Wettability effect on flow-driven deformation using hydro-mechanically coupled pore network model

Tuesday, 23 May 2023 09:30 (15 minutes)

Wettability has an enormous impact on the effectiveness of enhanced oil recovery (EOR) techniques and geologic carbon storage (GCS). Water flooding or carbon dioxide injection in EOR or GCS imposes pore pressure on the media, which can induce deformation or even failure of porous media. Experimental studies have shown that wettability is a key factor in determining flow patterns along with fluid characteristics and injection conditions. However, most previous research has been conducted in non-deformable media. As some studies performed in deformable media are limited to macroscopic scale, pore-scale study on simultaneous deformation or failure by immiscible flow is still lacking. This study attempted to examine the effect of wettability on hydromechanical behavior using pore-scale modeling. Fluid injection pressure alters the porous structure by mechanical deformation, causing a change in flow characteristics with the re-distribution of pore pressure. Therefore, a two-way coupling between hydraulic and mechanical behavior is required to mimic this process. To achieve two-way coupling, force equilibrium at each node was assumed in pore network model and block-spring model. Flow pattern and mechanical behavior under various wettability were explored using a two-way hydro-mechanically coupled pore network model.

Acknowledgment
This work was supported by the Korea Institute of Energy Technology Evaluation and Planning (KETEP) grant, funded by the Korean Ministry of Trade, Industry & Energy (No. 20212010200020)

Participation

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References

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Session Classification: MS09

Track Classification: (MS09) Pore-scale modelling