Contribution ID: **90** Type: **Poster Presentation**

Digital Rock Techniques to Study Physical Properties of Hydrate-Bearing Sediments: Considering Hydrate Distribution Patterns

Tuesday, 31 May 2022 09:20 (1h 10m)

It is of great significance to study the physical properties of hydrate-bearing sediments (HBSs) for improving the recovery of the gas hydrate resource. Previous studies reveal that the hydrate distribution patterns and saturations affect the physical properties of HBSs. However, the experimental techniques are difficult to investigate the effects of hydrate distribution patterns and current numerical modeling methods cannot precisely control the hydrate saturations and distribution patterns. Therefore, a new hybrid and robust modeling method (CT-MO-QSGSM) for generating different distribution patterns and specific saturations of hydrates in digital models was proposed, which integrates the X-ray CT technique, morphological operation algorithm, and quartet structure generation set method. The presented method is used to produce a series of digital models containing pore-floating, cementing, and bridging hydrates with predefined saturations. Based on the digital models, a comprehensive investigation of the effects of the hydrate distribution patterns and saturations on pore/throat radius, coordination number, correlation functions, permeability, electrical conductivity, and elastic moduli of HBSs is implemented. The results indicate that the pore-floating hydrates lead to the most rapid decline in the pore/throat radius and correlation probability of pore space among the three types of hydrates, but they increase the average coordination number while others decrease the number. Moreover, the cementing and pore-floating patterns bring about the weakest and strongest damages to the permeability and electrical conductivity of HBSs containing low hydrate saturations, respectively. Among three patterns, the bridging type results in a rapid decline in these two properties when the hydrate saturation is high. Furthermore, the pore-floating and bridging patterns cause the largest and smallest increase in the elastic moduli. In addition, the physical properties of HBSs from the numerical simulations are consistent with the laboratory measurements, which proves that the generated digital models containing different hydrate distribution patterns are reliable.

Acceptance of the Terms & Conditions

Click here to agree

MDPI Energies Student Poster Award

Yes, I would like to submit this presentation into the student poster award.

Country

China

References

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

Primary authors: WU, Yuqi; Prof. LIU, Keyu (China University of Petroleum (East China)); Mr AN, Senyou (University of Manchester); Prof. LIN, Chengyan (China University of Petroleum (East China))

Presenter: WU, Yuqi

Session Classification: Poster

Track Classification: (MS12) Advances in modeling and simulation of poromechanics