

天然氣水合物儲集層開採工程之技術研發

執行單位

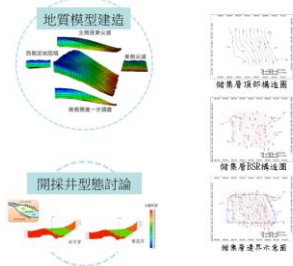
國立台灣大學

計畫主持人

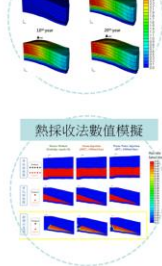
林祥泰

評估台灣西南海域天然氣水合物賦存區天然氣開採效益，包括產氣/水速率、產氣量、生產年限、採收率、海床沉陷量等。儲集層工程模擬包含多尺度、多成分之複雜物理現象，可靠度取決於理論模型、地質資料與物性參數。因此，本團隊與地質、理論、實驗專家合作建立可靠模型，提供未來鑽井與開採工程的先期評估。

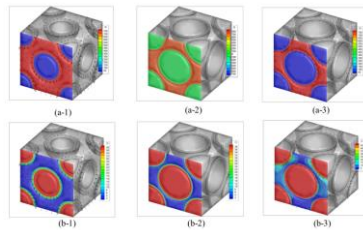
大尺度模擬



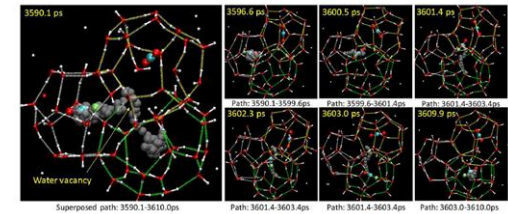
地層沉陷量數值模擬



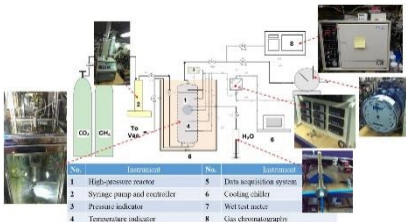
中尺度模擬



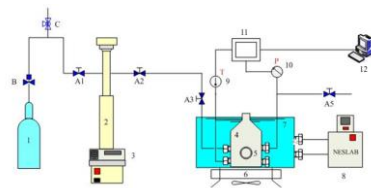
微觀尺度分子模擬



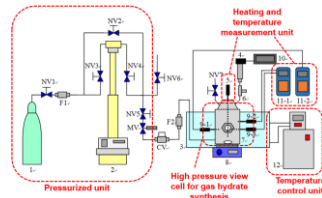
中尺度實驗



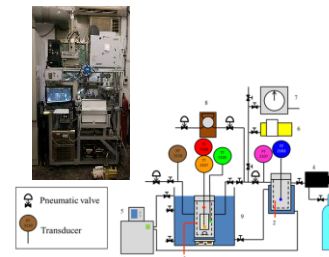
動力學與熱力學實驗



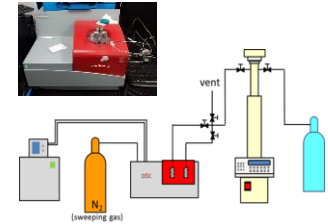
熱擴散係數實驗



冰晶法實驗



DSC 實驗



- 建立天然氣水合物生產模擬流程，可有系統分析不同開採策略與效益。
- 建立減壓與熱採收等不同水合物開採方法的模擬技術。
- 完成岩石力學模組與水合物生產模組耦合技術建立，使得生產評估方法可以考慮海床沉陷量影響。
- 完成永安、四方圈合、以及前緣海脊開採模擬。
- 建立實驗設備，能提供模擬器所需之熱力學(解離溫度、融解熱)、動力學(解離速率)、熱質傳特性等各類物性參數，並與模擬結果相互驗證。
- 中尺度實驗可進行二氧化碳置換甲烷水合物的實驗。
- 中小尺度模擬能提供水合物顆粒分解速率，並在分子尺度上觀察氣體擴散機制，有助於了解CO₂置換CH₄之過程。

Development of Reservoir Engineering Technologies for the Exploitation of Natural Gas Hydrates

Execution Unit

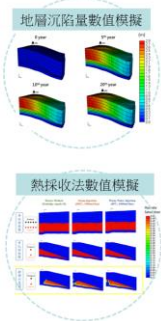
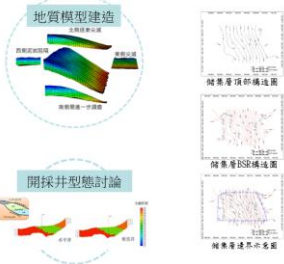
National Taiwan University

Project Director

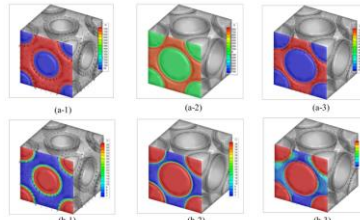
Shiang-Tai Lin

The purpose of this work is to assess the gas hydrate recovery characteristics (gas and water production rate, production duration, recovery yield, seabed subsidence, etc.) offshore southwestern Taiwan. Reservoir engineering simulation considers multi-scale, multi-component complex physical phenomena, and its reliability depends on the theoretical model, geological data and physical parameters. Therefore, our team worked with experts in geology, theory and experiment to establish a reliable assessment for gas hydrate production.

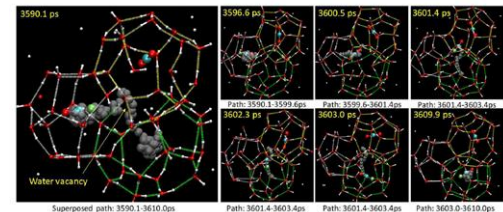
Field-scale simulation



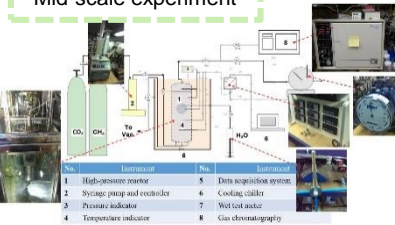
Meso-scale simulation



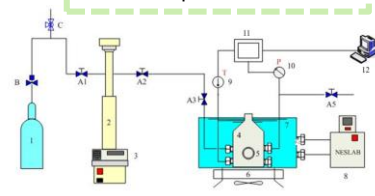
Molecular Dynamic simulation



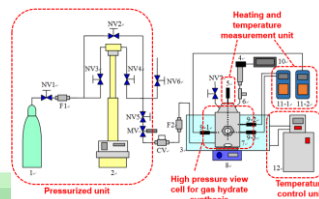
Mid-scale experiment



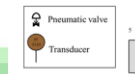
Kinetic and thermodynamic experiments



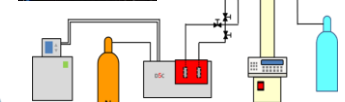
Thermal diffusion coefficient experiment



Ice conversion experiment



DSC experiment



- Establish a standard procedure for simulating gas hydrate production, allowing a systematic evaluation of different exploitation strategies.
- Establish simulation technique of gas hydrate production via depressurization and thermal stimulation.
- Established the technology for assessing seabed subsidence during gas hydrate production
- Completed reservoir simulations for Yuan, Four Way Closure, and Frontal ridges
- Established experimental apparatus for transport, kinetic and equilibrium properties of gas hydrates.
- Capable of conducting the production of methane with CO₂ injection
- Capable of simulating the dissociation and gas exchange process at molecular level.