Advanced PVT and Phase Behaviour of Hydrocarbon & Reservoir Fluids

To assist in the development and application of reservoir fluid information in reservoir studies, production operation and recovery processes

23rd – 27th September 2019 | Kuala Lumpur, Malaysia

Bahman Tohidi expertise

35 years of experience and research interest in PVT Phase behaviour and properties of reservoir fluids and CO2-rich system, Gas hydrates and flow assurance. Director of centre for Gas Hydrates Research and the centre for Flow Assurance Research (C-FAR) at Institute of petroleum Engineering, Heriot-Watt University. Published more than 450 papers and holds 13 patents mainly in gas hydrates and PVT. SPE Distinguished lecturer with his talk entitled, "Gas hydrates: Friend or Foes?" Recently presented at 1st International AIChE Conference on Upstream Engineering and Flow Assurance in Houston on 2012 with the title "Do We Have New Solutions to the Old Problem of Gas Hydrates?" Consultant to major Oil & Gas companies worldwide Lifetime Achiement "Life Time Achievement" from the 9th International Conference on Gas Hydrate, Denver, USA, in June 2017 for significant, continuous contributions to the area of hydrate research, practice, and/or exploration, for a period of over twenty five years. Also, his research group work was recognised as one of the top 10 UK examples of the role of Chemical Engineering in Modern World by the IChemE. His research played a major role in Heriot-Watt University winning the Queen's Anniversary Awards in 2016.

In Collaborations with:

Supported software:

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HYDRAFACT

HydraFLASH®
Hydrate and PVT Prediction Software

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Advanced PVT and Phase Behaviour of Hydrocarbon Reservoir Fluids (5 Days)

From reserve estimation, to hydrocarbon reservoir modeling, to Enhanced Oil Recovery (EOR), the knowledge of Phase behavior plays a crucial role in providing critical information resulting in efficient and profitable extraction, production and processing of fluids in the oil & gas industry.

This Masterclass is designed for upstream oil & gas production, reservoir/production engineers and Geoscientists who need to understand PVT (Pressure Volume Temperature) phase behavior and tests for different types of fluids (dry gas, wet gas, gas condensate, volatile oil, and black oil), how the data are presented in PVT reports, identifying relevant data and how the results can be used for Equation of State tuning and modelling. A familiarity with basic petroleum and reservoir engineering principles is a prerequisite. Topics ranging from reservoir fluid composition, phase behavior and reservoir fluids classification; optimally obtaining high quality PVT fluid samples; effect of contamination; PVT tests and correlations/modeling; the evaluation and application of PVT reports; fluid analysis and characterization, Equation of State (EoS) tuning using a commercial model and applications in reservoir simulation. There will be a discussion of potential causes of errors and several case studies. Considerable time will be allocated to reviewing PVT reports and extracting relevant data and using the data in tuning of EoS.

The course initially covers some fundamentals 1) Why do we do the PVT tests 2) how do we use the results with various examples to be shown during the masterclass. The instructor will go over several PVT reports for various fluid systems (including the effect contamination), identifying the key data usage as well as giving few examples on how to tune the PVT software. A free 30-day copy of Hydrafact software (HydraFLASH) will be given to the participant for some of the calculations. Participants will have an opportunity to discuss their own PVT data.

Attend this course to Master:
- Demonstrate the fundamentals of reservoir fluid composition, phase behavior, correlations and classification.
- Discussed and design fluid sampling for most representative sample, effect of contamination and how to remove it.
- Establish PVT testing requirements and extract the most important data from PVT reports.
- Fluid characterization, Gas Chromatography (GC), Distillation, Single Carbon Number (SCN), fluid description
- Equation of State (EoS) tuning, parameters required, generating black oil table from EoS
- An introduction to EOR processes, in particular gas injection, first contact miscible, multiple contact miscible (vaporizing/condensing gas drive)
- Prepare the results of PVT analysis for use in reservoir modeling and reservoir engineering studies.
- Characterize sources of error in PVT modelling and evaluate case studies
- Use PVT data in EoS tuning (for a black oil and a gas condensate) and reservoir simulation

TECHNICAL CONTENT:

Fundamentals	Reservoir fluid composition; basic concepts of phase behavior; classification of reservoir fluids (dry gas to black oil). Role of water and salts.
Fluid Sampling	Well stabilization and optimum production rate for oil and gas condensate reservoirs; multi-phase and/or separator sampling; oil based mud filtrate contamination evaluation and removal.
PVT tests and correlations	Compositional analysis by gas chromatography and distillation; conventional PVT tests; gas recycling; well inflow, pressure build-up and gas injection tests; reservoir fluids properties measurement and predictions.
PVT report	It's evaluation, data processing and application of test results, several examples.
PVT analysis by compositional methods	Equilibrium ratio correlations and their application; equation of state modelling; simulation of PVT data using fluid composition; evaluation of PVT data using compositional models, gas drive, first contact miscible, multiple contact miscible (vaporizing/condensing gas drive), Minimum Miscibility Pressure (MMP), slim tube, rising bubble, forward/backward contacts, variation of composition with depth (importance and causes)
Applications in reservoir simulation	Pseudo components and grouping; optimum fluid characterization; tuning equation of state data; measurement and prediction of interfacial tension; viscosity measurement and prediction. Analysis, development & management of reservoirs with complex fluid systems including volatile oil, retrograde condensate. Numerical simulation using black oil, modified black oil & compositional modeling
Other Topics	Causes of errors in PVT modelling, case studies Specialized topics and current research topics.

(HydraFLASH) – Hydrate and PVT prediction software
HydraFLASH is Hydrafact's gas hydrate and PVT prediction software designed to calculate the phase equilibria and physical properties of petroleum reservoir fluids over a wide range of pressure and temperature conditions.
A 30 days Trial version of Hydrafact software (HydraFLASH) will be share for some of the calculations.

This program is intended for:

The Course is designed for upstream oil and production, reservoir/production engineers for Engineers and Geoscientists who need to understand what types of fluids are available, and how the results can be used:
- Reservoir Engineers.
- Process Engineers.
- Production Engineers.
- Geoscientists.
- Lab Manager /Researcher.
- PVT analysts/ engineer
- Chemist

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DAY 1

PVT in hydrocarbon reservoirs and fluid sampling
- Pressure-Temperature diagram for pure compounds
- Critical points
- Ideal and real gases
- Corresponding state
- Acentric factor
- Phase behavior of binary and multicomponent systems
- Phase envelope
- Classifications of hydrocarbon reservoirs
- Retrograde condensation, cricondenbar and cricondentherm
- Effect of composition on phase envelope
- Behavior of dry/wet gas, volatile/black oil at reservoir and separator conditions
- Effect high impurity (in particular CO_2 and H_2S) on phase behavior and property of reservoir fluids
- Hands on experience with HydraFLASH
- An introduction to reservoir fluid sampling and its importance
- Well preparation for sampling for different reservoir fluids
- Downhole, wellhead and separator sampling
- **Identifying relevant data in PVT reports**

DAY 2

Fluid sampling and PVT tests
- Effect of contamination
- Retrieving the original fluid composition from contaminated samples
- How to use test results on contaminated samples to calculate EOS parameters for uncontaminated fluid
- Application of tracers for retrieving composition of the original fluids in gas condensate reservoirs
- PVT tests for dry/wet gas, black/volatile oil and gas condensate
- Determining molecular weight of liquid hydrocarbon
- Constant Composition Expansion
- Differential Liberation
- Separator test
- Constant Volume Depletion
- IFT measurement and prediction
- Viscosity measurement and predictions
- Some useful correlations in Petroleum Industry
- Introduction to gas hydrates
- **Identifying relevant data in PVT reports**

DAY 3

Fundamentals of phase equilibria
- K-value calculations
- Raoult's law
- Henry's law
- Equation of state
- Van der Waals EoS

- SRK EoS
- PR EoS
- Mixing rules
- Binary Interaction Parameters
- Flash, bubble point, dew point calculations
- Algorithm for computer calculations
- Variation of composition with depth, cause and importance
- **Identifying relevant data in PVT reports**

DAY 4

Fluid characterisation
- Distillation
- Gas chromatography
- Single carbon number
- Semi-continuous fluid description
- Calculating physical properties of SCN
- Enhanced Oil Recovery (EOR) processes
- Gas injection
- Ternary diagram
- First contact miscible
- Vaporizing gas drive
- Condensing gas drive
- Limitations of ternary diagram
- Slim tube
- Rising bubble
- Minimum Miscibility Pressure (MMP) and Minimum Miscibility Enrichment (MME)
- Solvent injection
- **Identifying relevant data in PVT reports**

DAY 5

Using data in EoS tuning and reservoir simulation
Application to reservoir simulation
- PVT reports
- Grouping
- Group Selection, Group Properties, Composition Retrieval
- Comparison of EOS
- Phase Composition
- Saturation Pressure
- Density
- Tuning of EOS
- Fluid Characterization
- Experimental Data
- Selection of Regression Variables
- Limits of Tuned Parameters
- Tuning of EoS for an oil using a commercial software
- Tuning of EoS for a gas condensate using a commercial software
- Analysis, development & management of reservoirs with complex fluid systems including volatile oil, retrograde condensate
- **Case studies**

Bahman Tohidi Ph.D, Hydrafact Limited UK expertise

- 35 years of experience and research interest in PVT Phase behaviour and properties of reservoir fluids and CO2-rich system, Gas hydrates and flow assurance.
- Director of centre for Gas Hydrates Research and the centre for Flow Assurance Research (C-FAR) at Institute of petroleum Engineering, Heriot-Watt University.
- Published more than 450 papers and holds 13 patents mainly in gas hydrates and PVT.
- SPE Distinguished lecturer with his talk entitled, "Gas hydrates: Friend or Foes?"
- Extensive hands on experience as production engineering with major oil companies.
- Managed more than 300 relevant projects for various oil & gas companies: **Total, BP, Statoil. Shell, Talisman,Chevron, INPEX, Tullow oil, Petronas, Petrobras, Dolphin Energy, Saudi Aramco, BG Group, DNO, Schlumberger and many more.**

Bahman Tohidi Ph.D. - PROFESSOR, HERIOT-WATT UNIVERSITY, MANAGING DIRECTOR, HYDRAFACT LIMITED

Oil & gas knowledge-based, spin-out company from Heriot-Watt University. It offers a comprehensive range of technical and scientific services in the fields of hydrates, flow assurance, PVT, phase behaviour and properties of reservoir fluids and CO2-rich systems

- Consultancy - offering a wide range of consultancy services both experimental and/or modelling.
- Software - HydraFLASH® is a state-of-the-art Hydrate and PVT software package. It has been ranked the best in two independent evaluations and is currently used by several major operators.
- New Technology - Commercialisation of IP - Hydrafact commercialises relevant IP(mostly developed at Heriot-Watt University). The latest example is HydraCHEK®, a device to monitor hydrate inhibition and safety margins by downstream measurement of hydrate inhibitor concentrations. More recently Hydrafact has developed a technology for removing Kinetic Hydrate Inhibitors (KHI) from produced water.
- Manufacture/supply of laboratory testing equipment - temperatures ranging from -90 °C to +350 °C and pressure up to 3,000 bars
- Managed more than 300 relevant projects for various oil & gas companies: Total, BO, Statoil. Shell, Talisman, Chevron, INPEX, Tullow oil, Petronas, Petrobras, Dolphin Energy, Saudi Aramco, BG Group, DNO, schlumberger, Dana, DONG Energy, Halliburton, Cameron and others.

Director of Centre for Gas Hydrate Research and the Centre for Flow Assurance Research (C-FAR) at Institute of Petroleum Engineering, Heriot-Watt University with several projects on various aspects of gas hydrates and flow assurance, and phase behaviour and properties of reservoir fluids and CO2-rich systems

- Leads Hydrate and Phase Equilibria Research Group at Institute of Petroleum Engineering, Heriot-Watt University.
- Research interests include PVT phase behaviour and properties of reservoir fluids and CO2-rich systems, gas hydrates, flow assurance, and reducing the emission of greenhouse gases.

His teaching activities included Petroleum Engineering and Production Technology, as well as offering several short courses to the industry (including; Flow Assurance and Gas Hydrates, PVT and Phase Behaviour of Reservoir Fluids, and Petroleum Engineering for other Disciplines). He has published more than 200 papers and holds 9 patents mainly in gas hydrates and PVT. He was SPE Distinguished Lecturer in 2004-2005 with his talk entitled, "Gas Hydrates: Friend or Foes?". Bahman is a Professor at the Institute of Petroleum Engineering, Heriot-Watt University and a visiting Professor at Qatar University. Bahman is a member of the Society of Petroleum Engineers and a member of the EPSRC (the UK Engineering and Physical Science Research Council) Peer Review College for 2006-2009 and 2010-2013 and former member of editorial board of Journal of Chemical Engineering Research and Design (2009-12).

Instructor, AIT and Production Engineer (National Iranian Oil Company) NIOC (1984-1991)

After graduation (BSc in Chemical Engineering from Abadan Institute of Technology, Iran), he joined National Iranian Oil Company (NIOC) in 1984 where he worked as Production Engineer as well as University Lecturer for seven years. Bahman Tohidi joined Heriot-Watt University in 1991 and graduated with a PhD in Petroleum Engineering in 1995 with his doctoral work on the phase behaviour of water-hydrocarbon systems and gas hydrates. He started his employment at Heriot-Watt University in January 1994 working in both Hydrate and Reservoir Fluids research projects.

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PETRO1 Asia provides Oil & Gas Trainings & Consultancy services ranging from Petroleum Engineering, Exploration & Production, Subsurface and business related activities in the oil & gas industry. We had successfully made impact to petroleum professional mainly the Top 50 Oil & gas players in the Asia Pacific Region.

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Hess	PTT Global	Worley Parson
Saipem	Newfield	China university of petroleum Beijing
Clough	Atkins Australasia	Thaioil
Mubadala Petroleum	Brunei Methanol	Aker Solutions
Bureau Veritas	Curtin univeristy	Star Petroleum
Pertamina	Technip	Jurong Shipyard
Peritus international	Premier Oil	

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Registration Form

Advanced PVT and Phase Behaviour of Hydrocarbon Reservoir Fluids	3 or more Delegates	Per Delegates
Per Delegate	SGD 4999 ( )	SGD 5299 ( )

PROGRAM DETAILS
Venue: Kuala Lumpur, Malaysia
Date: 23rd – 27th September 2019

STEPS TO REGISTER :
Simply fill up the registration form and email it to:
Email to : registration@petro1.com.my
Call us   : +603 7727 3952 (kelvin)
FAX   : +603 7727 5278

- Please note that all registrations must be made at the same time to qualify.
- The above investment fee are inclusive of course material, tea breaks and lunch.
- The above investment fee is exclude of SST 6%.

(   )   I would like to organize this training on-site and save at least 25% on the total course Fees! Please call +603 7727 3952 for more about our in-house training or email ihtraining@petro1.com.my (Terms & Conditions apply)

Delegates Details

1. Name:_____Mr☐Mrs☐Ms☐Dr☐

Job Title: _____

Email : _____

Contact No: _____

Department:_____

2.Name:_____Mr☐Mrs☐Ms☐Dr☐

Job Title: _____

Email : _____

Contact No: _____

Department:_____

3.Name:_____Mr☐Mrs☐Ms☐Dr☐

Job Title: _____

Email : _____

Contact No: _____

Department:_____

Head of Department:_____

Invoice Attention

Invoice Attention to:_____

Company:_____

Industry:_____

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Postcode:_____ Country:_____

Telephone:_____ Fax:_____

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Signature   : _____

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Please Debit my credit card:

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Sales and service Tax (SST):
The above investment fee is exclude of SST 6%. The SST charges of 6% will be include during issuance of the invoices.

Venue: All of our training courses are held in 4 – 5 star venues.
The course fee does not include accommodation or travel cost. It's recommended to book the hotel room early as there are only limited room available at the discounted corporate rate.

DATA PROTECTION
The information you provide will be safeguarded by Petro1 that may be used to keep you informed of relevant products and services. We take it seriously when it come s to protection of our client data.

Cancellation & Substitutions:
Upon receipt of a completed registration form, it confirms that the organization is registering for the seat(s) of the participant(s) to attend the conference or training workshop. Should you be unable to attend, substitutes are always welcome at no additional cost. Please inform us as early as possible. Payment is non-refundable if cancellation occurs 7 working days prior to event commencement. However a substitute is welcome at no additional charges. If cancellation occurs 5 working days prior to the registration date and there is no substitute, the organizer reserves the right to charge 50% of the total investment from your organization.

PETRO1 SDN BHD is not responsible for any loss or damage as a result of a substitution, alteration or cancellation/postponement of an event. PETRO1 SDN BHD shall assume no liability whatsoever in the event this training course is cancelled, rescheduled or postponed due to a fortuitous event, Act of God, war, fire, labor strike, extreme weather or other emergency.

Walk in Registration:
Walk-in participants with payment will only be admitted on the basis of seat availability at the event and with immediate full payment.

Program Change policy:
The organizer reserves the right to make any amendments and/or changes to the workshop, venue, facilitator replacements and/or modules if warranted by circumstances beyond its control.