Applied PVT & Phase behavior of Hydrocarbon Reservoir Fluids

17th – 21st August 2015 – Kuala Lumpur, Malaysia

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

Your Expert Trainer:
Bahman Tohidi

Bahman a veteran experts with over 30 years of experiences and research in PVT phase behaviour and properties of reservoir fluids and CO2-rich system, Gas hydrates and flow assurance. He is also a director of centre gas hydrates research (C-FAR) at institute of petroleum engineering, Heriot Watt University. Throughout his experience, he had managed more than 300 relevant projects for various oil & gas companies; Total, BP, Statoil, Shell, Talisman, Chevron, INPEX, PETRONAS, Schlumberger, Halliburton and many more.

“Lots of applied skills instead of theoretical lessons. Excellent will recommend to other technical personnel” – Newfield Peninsular.

“Instructor is very experience in the topic and able to ‘cook’ the material in such an easy way to let participant ‘digest’ fully.” – Tasliman Malaysia Limited.

“Great and Detailed Explanation.” – Scomi Oil Tools.

Media Partners: Worldoils, VungtacHR, PTIT FOCUS, OilVoice, PSMB (HRDF) Claimable

Supported software: HydraFLASH

Hydrate and PVT Prediction Software
From reservoir estimation to hydrocarbon reservoir modeling to Oil Recovery, 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) tests for different types of fluids, 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 trainer will go over several PVT reports for various fluids system, identifying the key data usage as well as giving few examples on how to tune the PVT software. Trial version of Hydrafact software (HydraFLASH) will be share 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 behaviour, correlations and classification.
- Design fluid sampling for most representative sample.
- Establish PVT testing requirements and extract the most important data from PVT reports.
- Appraise PVT analysis by compositional methods.
- Prepare the results of PVT analysis for use in reservoir modelling and reservoir engineering studies.
- Characterize sources of error in PVT modelling and evaluate case studies
- USE PVT data in EoSs tuning and reservoir simulation

**TECHNICAL CONTENT**

<table>
<thead>
<tr>
<th>Fundamentals</th>
<th>Reservoir fluid composition; basic concepts of phase behaviour; classification of reservoir fluids.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid Sampling</td>
<td>Well stabilization and optimum production rate; multi-phase sampling; oil based mud filtrate contamination sample evaluation.</td>
</tr>
<tr>
<td>PVT tests and correlations</td>
<td>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.</td>
</tr>
<tr>
<td>PVT report</td>
<td>Its evaluation, data processing and application of test results.</td>
</tr>
<tr>
<td>PVT analysis by compositional methods</td>
<td>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 injection</td>
</tr>
<tr>
<td>Applications in reservoir simulation</td>
<td>Pseudo components and grouping; optimum fluid characterisation; tuning equation of state data; measurement and prediction of interfacial tension; viscosity correlations and prediction by compositional methods; gas injection and multi-contact miscibility.</td>
</tr>
<tr>
<td>Other Topics</td>
<td>Causes of errors in PVT modelling, case studies Specialized topics and current research topics.</td>
</tr>
</tbody>
</table>

The course is designed for Upstream Oil & Gas:
- Reservoir Engineers.
- Process Engineers.
- Production Engineers.
- Geoscientists.
- Lab/Researcher.
- PVT analysts/engineer
- Chemist
- Or engineers who need to understand what types of fluids are available and how the result can be used.
Applied PVT and Phase Behavior of Hydrocarbon Reservoir Fluids (5 Days)

Day 1 - PVT in hydrocarbon reservoirs and fluid sampling

- Pressure-Temperature diagram for pure compounds.
- Critical point.
- Ideal and real gases.
- Corresponding state.
- Acentric factor.
- Phase behaviour of binary and multicomponent systems.
- Phase envelope.
- Classifications of hydrocarbon reservoirs.
- Retrograde condensation, cricondenbar and cricondentherm.
- Effect of composition on phase envelop.
- Behaviour of dry/wet gas, volatile/black oil at reservoir and separator conditions.
- 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
- 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
- Gas injection
- Ternary diagram
- First contact miscible
- Vaporizing gas drive
- Condensing gas drive
- Limitations of ternary diagram
- Slim tube
- Rising bubble
- Minimum Miscibility Pressure and Minimum Miscibility Enrichment
- 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
- Gas and Liquid Volumes
- Robustness
- Tuning of EOS
- Fluid Characterisation
- Selection of EOS
- Experimental Data
- Selection of Regression Variables
- Limits of Tuned Parameters
- Methodology
- Tuning of EoS for an oil using a commercial software
- Tuning of EoS for a gas condensate a commercial software
- Case studies

** A 30 days Trial version of Hydrafact software (HydraFLASH) will be share for some of the calculations.

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.

Laptop is required.

“Have a session to play around with the PVT software based on different type of reservoir.”

“I want to use HydraFLASH program. I cannot imagine without it when we have a problem with work.”
Bahman Tohidi Ph.D, Hydrafact Limited UK

- 30 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 (C-FAR) at institute of petroleum engineering, Heriot-Watt University.
- Published more than 200 papers and holds 9 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, Dana, DONG Energy, Halliburton, Cameron and others.

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, BP, 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 Equilibrium 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.

PETRO1 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.

- Total E&P
- Petronas
- Murphy Oil
- JX Nippon
- Scomi Oil
- Hess
- Saipem
- Clough
- Mukaddala Petroleum
- Bureau Veritas
- Pertamina
- Peritus international
- Petrofac
- Keppel Corporation
- Singapore refining Company
- Salamander Energy
- Binh Son Refining Vietnam
- PTT Global
- Newfield
- Atkins Australasia
- Brunei Methanol
- Curtin university
- Technip
- Premier Oil
- SGS
- PTT EP
- Halliburton
- Brunei LNG
- Shell Chemical
- Worley Parson
- China university of petroleum
- Beijing
- Thaioil
- Aker Solutions
- Star Petroleum
- Jurong Shipyard
Investment Packages

<table>
<thead>
<tr>
<th>Applied PVT and phase behavior of hydrocarbon reservoir fluids</th>
<th>Early Bird Full 5 Days</th>
<th>Standard Price Full 5 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Delegate</td>
<td>SGD 6143 ( )</td>
<td>SGD 6355 ( )</td>
</tr>
</tbody>
</table>

TEAM DISCOUNT of 3 or more off 10%
- Team discount are not applicable to early bird pricing.
- For 5 or more, please do contact us to get attractive price.
- The price above are inclusive of GST 6%.

Delegate 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 Details

*Invoice Attention to: ___________________________
*Company: ________________________________
*Industry: ________________________________
*Address: ________________________________
*Postcode: ____________ *Country: __________
*Telephone: ____________ Fax: ____________
*Email: _____________________________

*Authorized Signature: ______________________

REGISTER FORM

PROGRAM DETAILS
Venue: Kuala Lumpur, Malaysia
Date: 17th – 21st August 2015

Payment by Credit card:

Please Debit my credit card:

☐ VISA ☐ MASTERCARD

Card Number: __________ - __________ - __________ - __________

Security Code: __________ Expiry Date: __________

Named printed on card: ___________________________

Signature: ___________________________

Payment Method
By cheque/ Bank Draft: Made Payable to PETRO1 SDN BHD
By Direct Transfer: Please quote invoice numbers on remittance advice.

GST input Tax claim
Organization who have register under GST is allow to claim on any GST incurred (Known as input tax) on their purchase to the business.

ACCOUNT NAME: PETRO1 SDN BHD
BANK: HSBC Amanah Malaysia Berhad
ACCOUNT NO: 054 – 048061 – 701 (SGD)
SWIFT CODE: HIMABMYKL

All bank charges to be borne by payers. Please ensure that PETRO1 SDN BHD received the full invoice amount.

* Credit card payment will include a charges 2.8%

Payment Policy: 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. Payment is required with registration and must be received prior to the event to guarantee the seat. Payment has to be received 7 working days prior to the event date to confirm registration.

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 comes to protection of our client data.

Cancellation & Substitutions: Upon receipt of a completed registration form, if 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 the 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.