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CONTENT



PAGE	
1	Chemical + Biochemical Engineering = ?
2	Launch of SPE Copenhagen Young Professionals
3	Facts on Gas Hydrates
6	Inhibition of gas hydrate formation by low-dosage, environmentally benign inhibitors
7	Opal, not only for fun



Solid hydrate plugging a process line (photo courtesy Petrobras)

Chemical + BIOCHEMICAL ENGINEERING = ?

Our last meeting was busy. We had a presentation on how initial and residual oil saturation measurements could be done incorrectly and another on how a healthy amount of inquisitive analyses led to significant additional oil production. We had an after dinner presentation on how ultrasound may be used for imaging in wells and we started a Young Professionals Section. I want to thank Hess for sponsoring the evening and the excellent dinner. It is much appreciated and I know the bill is not insignificant.

The large turn-out from your side (96) was also much appreciated. Meeting up with former, present, and future colleagues as well as professionals from other parts of the industry is an important part of an SPE meeting. I enjoyed meeting colleagues from Qatar and Kazakhstan who happened to be in Copenhagen and hope you had similar experiences.

The topic of our next meeting is gas hydrates. If gas hydrates are new to you, I invite you to read the article "Facts about Gas Hydrates" written with help from our Student Section. Otherwise, you may already know that DTU for many years have had some of the foremost experts on the topic. You may therefore expect to learn something new, when Nicolas von Solms explains how they are now looking at genetical manipulation of proteins from insects to reduce the amount of inhibition chemicals by factors of 10 – 100 compared to methanol. Perhaps these findings may be attributed to combining chemical engineering and biochemical engineering in an innovative manner. This could be an interesting new combination for the oil industry.

Lastly, 28 people have signed up for the core analysis course on April 23rd, as announced last month. We can accommodate another 22 and invite you to register with Susanne.Poulsen@maerskoil.com. The course is free - courtesy of your local SPE section.

I look forward to meeting many of you at our next meeting on April 16th at DTU.

Per Bak
Section Chariman

FUTURE MEETINGS
FOR MORE INFORMATION
REGARDING THE PROGRAMME
SEE PAGES 4-5

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LAUNCH OF SPE COPENHAGEN YOUNG PROFESSIONALS

SPE recognizes the importance of those who one day will be leaders of the E&P industry. One of the main aims of the Young Professionals (YP) initiative is to engage or re-engage younger members of the SPE and re-connect them with the local section's full activities. Many SPE sections have developed (YP) programs to support and assist those with fewer than 10 years experience or age 35 and under. These YP programs are designed to facilitate networking and professional growth, hence strengthening the career development of SPE young professionals.

SPE Copenhagen has recently assembled an SPE Copenhagen Young Professionals 'start-

up' board that have been charged with establishing the goals and vision for SPE Copenhagen YPs, timeline to official launch and plans for the initial events programme. The 'start-up' board is composed of eight young professionals representing several different companies in the Copenhagen area. It is intended that SPE Copenhagen Young Professionals will be officially launched at the start of the next SPE season (September 2009).

If you would like to get in touch with SPE Copenhagen Young Professionals, please write to spe.cph.jp@gmail.com.

**Natalie Chadud
SPE Copenhagen Board**



This is Noreco

Noreco is a fast growing Norwegian, independent oil and gas company. The company's focus is to explore, develop and produce oil and gas in the North Sea. Since its start in 2005, the company has grown rapidly through license rounds and acquisitions. Noreco operates in Norway, Denmark and United Kingdom, and employs 70 oil and gas professionals. Noreco is listed on the Oslo Børs under ticker NOR.

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A STORY FROM THIS MONTH'S SPONSOR, DTU

FACTS ON GAS HYDRATES

Gas hydrates are solids formed by the complexation of water and suitably sized host molecules. Under the right conditions of temperature, pressure and composition, water molecules form lattice structures on hydrogen bonding, with cavities large enough to incorporate small gas molecules. These small gas molecules stabilize the lattice structure and stable solids form – at temperatures above the freezing point of water. Consideration of the complex structure of solid gas hydrates might lead one to believe that they are a laboratory curiosity, formed under very special conditions of temperature, pressure and composition. However this is not the case. Conditions for hydrate formation occur frequently – especially at the high pressures and low temperatures typical in North Sea reserves. There is great economic incentive to study hydrates in order to find suitable inhibitors and hence prevent hydrate formation.

However there is another, potentially beneficial, side to gas hydrates:

Naturally occurring gas hydrates may be a factor of two greater than the total world supply of fossil fuel. Unfortunately the useful gas is tied up in solid deposits in remote, hostile and dispersed locations, so currently this is an uneconomic reserve.

Since hydrates have a very high specificity for certain gas molecules, they represent a potential for gas separation (for example the separation of nitrogen and methane). They have also been used to separate water from biochemical systems.

Recently, there has been an interest in hydrates as a source of carbon dioxide storage.

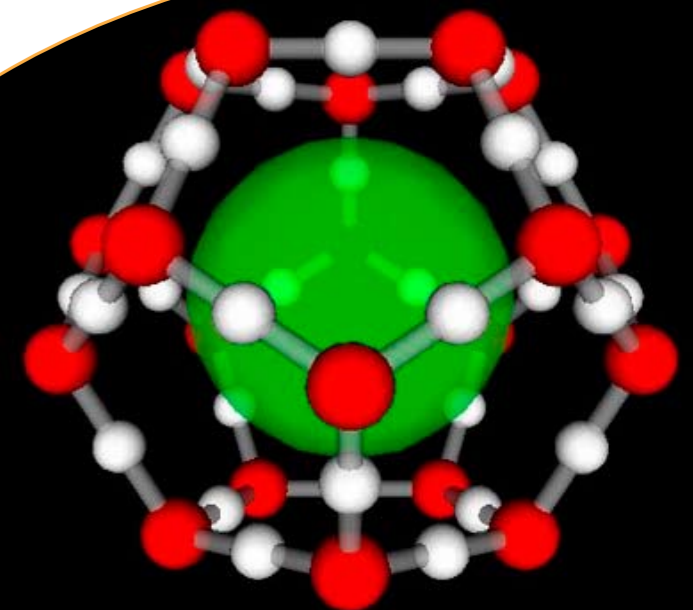
The ability of natural gas to form hydrates has actually been exploited for some years now as a means of storage and transportation.



The so-called "burning snowball" – methane gas and water in the form of a hydrate is combustible

The phasing out of traditional refrigerants (Denmark will discontinue the use of hydrofluorocarbons (HFC's) from 2007 – the first country to do so) means that the search is on for environmentally friendly replacements. Since hydrates dissociate above the freezing temperature of water, but have about the same heat of melting as water, the use of hydrate slurries as secondary refrigerants is being actively studied.

There are a lot of good reasons to study the behavior of gas hydrates and why they are an active field of interdisciplinary research.



A single gas hydrate cage – the green methane molecule stabilizes the surrounding water molecules – giving a solid hydrate at temperatures above the freezing point of water.

Down Hole Precision Robotics

Precision Robotics
The value-creating solutions provided by down hole precision robotics enable operators to minimize production losses and quickly get wells back on production.

Returns on Investment
A major North Sea operator has estimated that they save 50% on their interventions when they apply Welltec's innovative services instead of conventional methods. More to the point, they recognized billions of dollars in value-creation as illustrated by the graphics to the right.

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\$30 Billion

Based on estimated revenue for major North Sea operator

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September 18	MAIN SPEAKER	AFTER DINNER
TOPIC	Intervention Strategies for Production Enhancement	
SPEAKER	John Haukvik	
LOCATION	Welltec, Gydevang 25, 3450 Allerød	
SPONSOR	Welltec	
October 23	MAIN SPEAKER	AFTER DINNER
TOPIC	The Growing Demand for Oil and Natural Gas and the Related Global Warming Issues	
SPEAKER	SPE-DL George J Stosur	
LOCATION	Hotel Adina, Amerika Plads 7, 2100 København Ø	
SPONSOR	Chevron	
December 4	MAIN SPEAKER	DINNER SPEAKER
TOPIC	Hydrocarbon potential in East Greenland	
SPEAKER	Jørgen Bojesen-Koefoed, Flemming Getreuer Christiansen	
LOCATION	GEUS, Øster Voldgade 10, 1350 København K	
SPONSOR	GEUS	
January 13	MAIN SPEAKER	DINNER SPEAKER
TOPIC	Hejre development – Uncertainty analysis using experimental design techniques	Wind energy in DONG Energy
SPEAKER	Jesper Werner Christensen	
LOCATION	DONG Energy, Nesa Allé 1, 2820 Gentofte	
SPONSOR	DONG Energy	
February 11	MAIN SPEAKER	DINNER SPEAKER
TOPIC	LNG – Roaring Ahead – Where Will it End?	Maersk Drilling: Maersk High Efficiency Rigs
SPEAKER	SPE-DL John Morgan, John M. Campbell & Company	
LOCATION	Moltkes Palæ, Dronningens Tværgade 2, 1302 København K	
SPONSOR	Shell E & P	
March 10	MAIN SPEAKER	DINNER SPEAKER
TOPIC	Mature Fields: Keep Revisiting the Fundamentals New Technology	TecWel: The ultrasound Well Scanner
SPEAKER	SPE-DL Dr. Neil Williams, Oil Search Limited - Tecwel, Chris Nussbaum	
LOCATION	Moltkes Palæ, Dronningens Tværgade 2, 1302 København K	
SPONSOR	HESS	
April 16	MAIN SPEAKER	DINNER SPEAKER
TOPIC	Gas hydrates in flow assurance: Controlling hydrates at arctic conditions and evaluation of new green inhibitors	“Opal not only for fun” by Ida L. Fabricius
SPEAKER	Nicolas von Solms & Lars Jensen	
LOCATION	Technical University of Denmark, Anker Engelundsvej 1, Building 101, Auditorium 1, 2800 Kgs. Lyngby	
SPONSOR	DTU	
May 19	MAIN SPEAKER	ANNUAL MEETING
TOPIC	Halfdan Northeast: Development of tight gas with dual lateral wells	
SPEAKER		
LOCATION	Mærsk Olie og Gas AS, Esplanaden 50, 1263 København K	
SPONSOR	Mærsk Olie og Gas AS	
June 19	MAIN SPEAKER	DINNER SPEAKER
TOPIC	Summer party	
SPEAKER		
LOCATION		
SPONSOR	Schlumberger	

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A FEW SEATS STILL AVAILABLE

Short Course in Core Analysis

23 April 2009

There are still a few seats left on the SCAL short course 23 April 2009.

Read more about the contents of the course in the previous newsletter, which can be found on our website www.spe-cph.dk. Go to 'ARCHIVES' and to 'Newsletter February 2009'.

Who should attend ?

The short course is directed towards the young professional that would like to know about the fundamentals of core analysis, but even the more experienced petrophysicist will benefit from participating

Date: 23 April 2009

Venue: GeoCenter Denmark
Øster Voldgade 10
1350 København K

Start / End: 08:45 – 16:30

Price: Free

Registration: Susanne.Poulsen@maerskoil.com

Coffee and lunch is included

Abstract

ABSTRACT

INHIBITION OF GAS HYDRATE FORMATION BY LOW-DOSAGE, ENVIRONMENTALLY BENIGN INHIBITORS

By Lars Jensen¹, Hans Ramløv², Kaj Thomsen¹ and Nicolas von Solms¹

¹ Technical University of Denmark, Department of Chemical and Biochemical Engineering, Søtoftsplads, 2800 Kgs. Lyngby, Denmark.

² Roskilde University, Department of Science - Systems and Models, Universitetsvej 1, 4000 Roskilde, Denmark.

Gas hydrates are crystalline compounds formed when water and suitably sized gas molecules are combined at high pressure and low temperature. They consist of polyhedral cavities formed from networks of hydrogen-bonded water molecules which small gas molecules can enter. Depending on the type of gas molecules present, gas hydrates form different structures, known as structure I (sI), structure II (sII) and in special cases structure H (sH) – see figure.

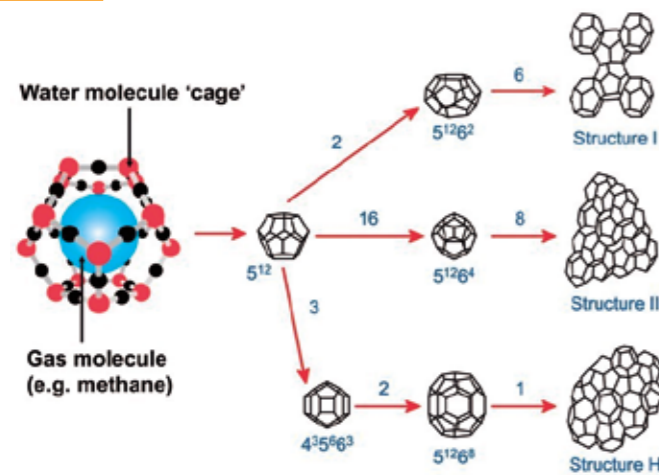


FIGURE. GAS HYDRATE STRUCTURES I, II AND H.

The gases that form hydrates are normally small molecules, many of which are encountered in natural gas. Examples are methane, ethane, propane, iso-butane, butane, car-

bon dioxide, nitrogen and hydrogen sulphide. Gas hydrate formation is a problem that the oil and gas industry is very concerned about, since oil and gas transmission lines, tie-backs and off-shore process equipment are prone to being blocked by hydrates, causing potential hazards or economic loss.

Traditionally the formation of hydrates has been prevented by adding thermodynamic hydrate inhibitors such as methanol and glycol. However, the amounts needed to avoid hydrate formation may reach 50wt% in the water-rich phase. Since water production from fields can be quite severe, especially in cases where water injection has been used to enhance the oil recovery, very large amounts of hydrate inhibitor are required. For these reasons, a particular interest in finding low dosage hydrate inhibitors (LDHIs) has arisen. These are most often water soluble polymers however instead of shifting the hydrate equilibrium conditions to lower temperatures or higher pressures they affect the kinetics of hydrate formation. Polymeric compounds like polyvinyl caprolactam or polyvinylpyrrolidone have been shown to be quite effective in retarding both nucleation and growth of gas hydrate at concentrations 10-100 times lower than thermodynamic inhibitors. However, these polymers are potentially harmful to the environment and are banned in several locations.

Consequently, ice-structuring proteins (ISPs) have been considered as an environmentally-friendly alternative. ISPs obtained from certain species of pout (a cold-water fish) have been tested in the literature and in our laboratories and the results are promising. However, insect-based ISPs have been shown to be much more active than fish-based ISPs for freezing point depression. We have done initial testing with insect ISPs in our labs for activity in hydrate inhibition and results are good. In our current work we are planning to increase the potency of these insect ISPs by genetic manipulation as well as bring down the production cost by producing them in bacterial fermentations.

Speaker BIOGRAPHY

NICOLAS VON SOLMS
B.Sc. (Chem. Eng.), M.Sc., M.S., Ph.D



Nicolas von Solms, B.Sc. (Chem. Eng.), M.Sc., M.S., Ph.D. is associate professor in the Department of Chemical and Biochemical Engineering, Technical University of Denmark. His research interests are in the area of thermodynamics and phase equilibria for practical applications and he has published around 30 papers in this general area.

In petroleum fluids he is currently leading a three-year project in the area of gas hydrates, sponsored by the Danish Research Council for Technology and Production Sciences and the Technical University of Denmark. He is also involved in a project looking at chemical flooding for enhanced oil recovery.

AFTER DINNER PRESENTATION: Ida L. Fabricius: "Opal not only for fun".



Ida is Associate Professor at the Technical University of Denmark. She holds a Ph.D. in Technical Geology (1989). Her research interests include linking technical geology, rock mechanics and rock physics. She is a member of SEG and SPE.

Gem quality opal diffracts the light because it is composed of a regular array of lepispheres. Similar lepispheres arise when biogenic opal is transformed during diagenesis. Sedimentary rocks composed of biogenic opal or diagenetic opal form source rocks, reservoirs or seals for petroleum. Petrophysical properties of sedimentary rocks composed of biogenic opal differ from properties of sedimentary rocks composed of diagenetic opal.



COPENHAGEN
APRIL
MEETING
THURSDAY 16 APRIL 2009

PROGRAMME

17:00 – 18:00
DRINKS

18:00 – 19:00
PRESENTATION AND SPE NEWS

19:00
DINNER

LOCATION

Technical University of Denmark
Anker Engeldundsvej 1
Building 101, Auditorium 1
2800 Kgs. Lyngby

SPEAKER

Nicolas von Solms
Technical University of Denmark
Department of Chemical and
Biochemical Engineering

TOPIC

Inhibition of gas hydrate formation
by low-dosage, environmentally benign
inhibitors

AFTER DINNER TOPIC:

Ida L. Fabricius
Opal not only for fun

ENTRANCE FEE

None

REGISTRATION

Please indicate your attendance
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on the internet: www.spe-cph.dk

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