

PRACTICAL PROCESS INTENSIFICATION FROM CHEMISTRY TO ENGINEERING

*Process Intensification –
A step change in product, process and business
performance through in-depth understanding of
the fluid dynamics and process chemistry.*

**Cranfield, Bedfordshire, UK
8th–9th December 2009**

Ideal for:

Experienced engineers, chemists and scientists as well as graduates

- from the chemical and related industries (biochemical, pharmaceutical, personal care)
- who are involved in process development, design operation or research
- who will benefit from understanding the principles and learning more about the subject

Why should one attend?

- To understand how to apply process intensification in industrial processes, and know when (and when not) to apply it.
- To learn more about the laboratory testing and equipment involved from an independent perspective
- To learn about implementation methodologies for process intensification
- To learn how to maximise knowledge of a process, prior to scale up
- To be able to identify and solve process challenges using intensified technologies

INTRODUCTION

Introduction to Process Intensification

Process Intensification (PI) is increasingly being adopted as an effective way to expand productive capacity and update ageing batch processes without the need for large civil engineering investment. The technology is well-established and as it often achieves yield improvements and waste reductions, the present economic climate is driving the number of applications at a rapid rate of growth. Process Intensification offers

- Higher yields and better product consistency and repeatability
- Energy savings and reduced operating costs
- Plant capital cost reductions

However achieving success with an intensified process is more than just selecting the right reactor. It may require the redesign of other operations, improvements to the chemistry through changes to operating conditions and/or catalysis. PI can provide new opportunities for control, instrumentation and on-line analytics. These are some of the factors important to industrialists seeking a move towards PI, all of which require a good understanding of the underlying mechanisms and principles. Furthermore, the understanding of these key mechanisms and principles can also be applied to process scale up more generally, helping to achieve more successful development to full scale.

BHR Group has been active in the field of Process Intensification and process optimisation for over 20 years and provides a range of services and products to help industry implement PI solutions. This course has been developed from specialist in-house courses given to industrial clients in Europe and the USA and incorporates practical teaching on a range of PI technologies, case histories and worked examples and participative exercises.

Course description

The course aims to communicate the principles of process intensification, provide recommendations for process design and implementation, enable participants to apply these principles and recommendations to their PI processes/problems, enable participants to discuss specifications for the selection and operation of PI equipment from an independent standpoint.

Day One outlines the basic principles, emphasises the importance of the chemistry, heat and mass transfer to these processes and puts forward the business perspective for PI implementation. A case history illustrates how the PI has been applied and what was gained from the process.

Day Two introduces the PI methodology and the 'tool kits' of laboratory and process plant knowledge specific for PI implementation. Delegates will see how problems can be solved with a range of different equipment types from the traditional to those which push the boundaries of mixing and heat transfer capabilities. Once again the day's work is interspersed with case histories, worked examples and practical exercises.

The **Course Director** is **Jeanette King**, MA, M Eng, AMICHEM, BHR Group Limited. Jeanette is the Business Manager, Process Consultancy. Her client base includes many of the leading international petrochemical, pharmaceutical and fine chemical companies. Prior to joining the Group as a Senior Engineer, Jeanette was a Senior R&D Engineer in a Global FMCG company, and has operated projects in UK, Europe, India, China & the USA.

Course Lecturers include: **Richard Jackson**, PhD, BSc, MRSC.CHEM. Richard is BHR Group's Chief Chemist, PI champion and a founder director of BHR Biofuels, (a company implementing PI technologies on green fuel projects). Before joining BHR, Richard worked for 10 years on a wide range of laboratory, plant and scale up development projects in the UK and in the USA, including complete plant implementations. Richard's expertise spans across a number of chemical areas having operated at senior technical levels in international pharmaceutical and fine chemical companies.

Firoz Khan, PhD, M Sc, B Eng, Dip, AMICHEM, BHR Group. Firoz is a Senior Project Engineer in the Process Group and Course Director of BHR Group's Process Mixing Course. Firoz' mixing expertise has provided technical solutions to BHR Group's international clients and his specialist area of reactive mixing has made him a key member of many BHR Group's projects within the chemical and process industry.

COURSE PROGRAMME

DAY ONE

Introduction and Basic Technology Day

Tuesday, 8th December 2009

Course Introduction

Course objectives and layout including an introduction to the course presenters.

Introduction to Process Intensification

What is Process Intensification (PI) and what are the key drivers for it? What are the potential benefits of PI compared with the drawbacks? The session introduces the importance of good chemistry and mixing knowledge and how this can help realise the benefits of PI.

Chemistry Fundamentals

A recap of chemistry basics and the importance of understanding these in a reaction engineering environment. The fundamentals of chemical kinetics, reaction schemes and orders will be linked to the principles of PI and the key indicators for intensifiable reactions will be introduced.

Mixing and Heat Transfer Fundamentals

The heat and mass transfer principles used in chemical engineering will be built upon to explore a range of environments with differing intensities. Examples of equipment types that can create these environments will be introduced along with useful outline design equations.

Business Drivers?

A key part of PI is the linkage of process objectives with those of the business. This short session will highlight the key business drivers and warnings for the application of PI, and highlight how the two need to work together in order for either to benefit.

Case History

Illustration of some of the subjects raised during day 1 of the Course through an example from BHR Group's consultancy work.

Tour of laboratories and PI facilities at BHR Group

Course Dinner

DAY TWO

Practical Applications Day

Wednesday, 9th December 2009

Process Intensification Methodologies

Day 2 starts by delegates being taken through a robust methodology for applying PI to a chemical process. Delegates will see how the fundamentals of kinetics, heat and mass transfer are called upon at each of the stages to build the intensified process and maximise the potential of 'right first time' scale up. Delegates will also see how the methodology can be useful for non intensified processes to minimise scale up times.

Worked Example

A worked example enabling participants to apply the learning from Day 1 in working through a PI problem – with guidance from the Course lecturers.

Process Intensification Tool Kit: Part 1

An explanation of how to get the most out of the process from the initial chemical bench-top development. The types of equipment to use and the types of tests to explore to maximise the useful information gained from the process.

Process Intensification Tool Kit: Part 2

Exploration of the range of equipment available at larger scales for PI and their characteristics for heat and mass transfer. A range of different reactor types will be explained and a simplified selection method for them will be demonstrated.

Case History

A further example of how a chemical process has been intensified and demonstration of how the 'Process Intensification Tool Kits' were used to do this in a plant environment.

Process Intensification Exercise

A final session in which participants have the opportunity to apply all the information learnt to determine whether a process will lend itself to a PI solution.

Close of Course

Fee

The total cost for two days tuition, course notes, lunch, refreshments and course dinner is £925 plus VAT (£1,063.75).

Please quote **PIC 09** and **name of delegate and company** on all transactions.

Discounted rates

A discount is offered for **multiple bookings** from the same Company, information on request.

A discount is offered for **FMP Members**, see reservation form.

Cancellations

Before 1 November 2009	<i>Full refund</i>
1 – 15 November 2009	<i>£50 administration charge</i>
After 15 November 2009	<i>No refund</i>

Substitutions may be made at any time.

Venue and Accommodation

The course will be held at Cranfield, Bedfordshire, UK. Cranfield is situated some 50 miles north of London between Bedford and Milton Keynes, close to Junctions 13 & 14 of the M1.

Accommodation is not included in the fee but the BHR Conference staff can provide details of local hotels on and off campus.

Directions to the Conference venue, a timetable and joining instructions will be forwarded to delegates upon registration.

About BHR Group

Founded over 60 years ago, BHR Group is an independent contract research, development and consultancy company. Dealing in all aspects of engineering with fluids, BHR Group is recognised, in particular, as the world leading authority on mixing processes. The Group runs a number of client in-house courses on fluid engineering topics.

For more details, contact Sue Randall, Course Administrator on +44 (0) 1234 756512.

Reservations

FULL PAYMENT MUST ACCOMPANY THE RESERVATION FORM

An invoice will be issued on receipt of payment.

Please submit one form for each delegate. Photocopies of a blank form may be used.

- Cheques should be made payable to BHR Group Limited.
- Bank transfers should be paid to our account at:
National Westminster Bank plc
Cranfield University Branch, Wharley End,
Cranfield, Bedford, MK43 0SR, UK
Account number: 36565466
Bank sort code: 60-06-56
IBAN: GB40 NWBK 6006 5636 5654 66
SWIFT BIC: NWBK GB 2L

Credit card payment details should be entered on the Reservation Form by completing the appropriate boxes and signing the form.

Enquiries

Enquiries should be addressed to:

Sue Randall, Course Administrator
BHR Group Limited
The Fluid Engineering Centre
Cranfield, Bedfordshire MK43 0AJ, UK

Tel: +44 (0)1234 756512
Fax: +44 (0)1234 750074
E-mail: srandall@bhrgroup.com

INVOICE AND REGISTRATION FORM

PRACTICAL PROCESS INTENSIFICATION – FROM CHEMISTRY TO ENGINEERING

Cranfield, Bedfordshire, UK
8th–9th December 2009

Your details

Please complete in block letters ticking appropriate boxes

Prof Dr Mr Mrs Miss Ms

Last name First name

Position

Company

Company VAT Number

Address

Post/Zip Code Country

Telephone Fax

Email

Dietary requirements or special requests

Signature Date

Return to:

BHR Group Limited
The Fluid Engineering Centre
Cranfield
Bedfordshire MK43 0AJ
United Kingdom
FAO Mrs Marian Rolfe

Tel : +44 (0)1234 756538
Fax : +44 (0)1234 750074
Email: mrolfe@bhrgroup.com
Web: <http://www.bhrgroup.com/conferences.aspx>
Registered in England No. 2420351
VAT Reg No. 536 4271 46



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Registration

CONFERENCE CODE: PIC09 VAT is charged at 15%	Amount Due	For Office Use Only
2 Day Course: 8th–9th December 2009 Delegate Fee £925 + VAT (£1,063.75) FMP Members £875 +VAT (£1,006.25) <i>Includes tuition, lecture notes, course dinner, lunches and refreshments</i>		
TOTAL (full payment must accompany this form)		

PAYMENT

(Please tick relevant box and complete as appropriate)

- Please find enclosed my cheque for £_____ or
- The fees will be settled by Bank Transfer direct to the BHR Group account (see details – back page). **A Purchase Order or number should accompany this form.**

Purchase Order Number:

Please debit my credit card:

MasterCard Visa Eurocard Expiry date /

Card holder's name and address

Signature Date

Delegate No:

Tax Point:

On receipt of payment, a letter of acknowledgement and confirmation will be sent.

