

## CV of applicant and examples of output

### Professor Stan Kolaczowski



#### Brief Biography

After completing his PhD in 1977, he worked for 7 years for Esso Petroleum Co Ltd, in a range of technical and managerial positions on environmentally related themes. In 1984, he joined the University of Bath as a Lecturer, where he has developed research interests in the field of Chemical Reaction Engineering, and in particular, in applications that relate to the solution of environmental problems. In 1997, he was awarded a Personal Chair and became a full Professor in Chemical Engineering. From 1997 to 2003, he was Head of the Department of Chemical Engineering, and led the Department through a challenging period culminating in the construction of a new building. This is one of the most modern facilities for chemical engineering in the UK (opened in 2002 by HRH Duke of Edinburgh), and provides world-class facilities for research and teaching.

Since 2003 he is the Director of the Catalysis and Reaction Engineering Group which consists of four academic members of staff and their postgraduate students, research officers, and visitors. This is now probably one of the largest research groups in Chemical Reaction Engineering in the UK.

**Place of work:** Department of Chemical Engineering  
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**Date of birth:** *03/11/1951*                      **Place of birth:** *London, UK.*

**Nationality:** *British*

**Education:**

*1963 to 1970: Bishop Thomas Grant School, London, UK.*

*1970 to 1977: University of Bath, Bath, UK.  
BSc (Hons) Chemical Engineering (1974)  
PhD (1977) in Chemical Engineering*

## **PROFESSIONAL EXPERIENCE**

### **1. Working in industry**

*1972 - 1973 1 year industrial training with National Coal Board (working in the technical department with projects on 3 different coke works in Wales, UK)*

*1977 - 1984 7 years with Esso Petroleum Co Ltd in the following posts:*

- Scientist (Esso Research Centre)*
- Manager of Marketing Operations (Butterworths Systems UK Ltd, an affiliate of Exxon)*
- Product Line Manager (Butterworths Systems UK Ltd, an affiliate of Exxon)*
- Senior Engineer (Esso, Victoria St, London)*

### **2. Working at the University of Bath**

*1984 - 1990 Lecturer in Chemical Engineering*

*1990 - 1993 Senior Lecturer in Chemical Engineering*

*1993 - 1996 Reader in Chemical Engineering*

*1996 – to-date Full Professor in Chemical Engineering*

*1997 – 2003 Head of Department of Chemical Engineering*

*2003 – to-date Director of the Catalysis & Reaction Engineering Group.*

### **3. Professional qualifications**

*Chartered Engineer (1983)*

*Fellow of the Institution of Chemical Engineers (1988)*

*European Engineer (1991)*

*Fellow of the Higher Education Academy (2007), previously ILTHE (2001).*

### **4. Awards**

*Highly Commended ‘ABB Engineering Services Environment Award’, to: S Kolaczowski, and I Bonnett (from GE Healthcare), at the Institution of Chemical Engineers, 2007 Gala Awards Dinner. This award recognized the importance that was placed on my contribution to the design of the heart of a process to recover radioactive isotopes in the form of tritium, which are used to find new pharmaceuticals and to investigate the molecular basis of disease. This involved high temperature oxidations. This led to a patent application.*

## **5. Conferences**

The number of invited lectures and contributions at international conferences: *approximately 35*.

The number of invited lectures at Universities: *approximately 20 (countries and numbers): England (including Cambridge & Oxford), Scotland, Northern Ireland, Holland, Sweden, Poland, Spain, Italy, France, Canada, US, Korea.*

## **6. Bibliographic data:**

Total number of publications in peer reviewed journals: *approximately 65*

Total number of monographs, book chapters:

*1 book (with Hayes) on: 'Introduction to Catalytic Combustion' with 681 pp.*

*1 book (with Crittenden) on: 'Waste Minimisation Guide' with 81 pp.*

*1 book as editor (with Crittenden) on: Management of Hazardous and Toxic Waste in the Process Industries.*

*1 booklet (with Crittenden) on: 'Stopping waste within the production process' 27 pp.*

*1 Chapter in 2<sup>nd</sup> edition of book on 'Structured Catalysts and Reactors': on the Treatment of volatile organic carbon (VOC) emissions from stationary sources: catalytic oxidation of the gaseous phase.*

## **7. EXAMPLES OF PUBLICATIONS**

*I have selected some papers published in refereed journals, one important monograph, and one patent.*

### **7.1 Examples of refereed journals:**

[1] Hayes R E and **Kolaczowski S T**, (1994) Mass and heat transfer effects in catalytic monolith reactors, *Chem Eng Sci*, 49 (21), 3587 - 3599.

[2] Rivas F J, **Kolaczowski S T**, Beltran F J, McLurgh D B (1999). Degradation of maleic acid in a wet air oxidation environment in the presence and absence of a platinum catalyst, *Applied Catalysis B: Environmental* 22, 279-291.

[3] Hayes R E, **Kolaczowski S T**, Li P K C, Awdry S, (2001), The palladium catalysed oxidation of methane: reaction kinetics and the effect of diffusion barriers, *Chem. Eng. Sci.*, 56: 4815 - 4835.

[4] Zhang F, Hayes R E and **Kolaczowski S T**, (2004) A new technique to measure the effective diffusivity in a catalytic monolith washcoat, *Trans IChemE, Part A, Chemical Engineering Research and Design*, 82 (A4), 481-489.

[5] Plucinski P K, Bavykin V, **Kolaczowski S T** and Lapkin A A, (2005) Application of a structured multifunctional reactor for the oxidation of a liquid organic feedstock, *Catalysis Today*, 105, 479 - 483.

[6] Nguyen L H, Vazhnova T, **Kolaczowski S T** and Lukyanov D B (2006) Combined experimental and kinetic modelling studies of propane and n-butane aromatisation over H-ZSM-5 catalyst, *Chem. Eng. Sci.*, (61) 5881 – 5894.

[7] **Kolaczowski S T** and Kim S S, Novel alumina ‘KK leaf structures’ as catalyst supports, *Catalysis Today* 117 (2006) 554 - 558.

[8] **Kolaczowski S T**, Chao R, Awdry S and Smith A (2007) Application of a CFD code (FLUENT) to formulate models of catalytic gas phase reactions in porous catalyst pellets, *Trans IChemE, Part A, Chemical Engineering Research and Design*, 85 (A11): 1539 – 1552.

[9] Crittenden B D, **Kolaczowski S T**, Takemoto T and Phillips D Z, (2009) Crude oil fouling in a pilot-scale parallel tube apparatus, *Heat Transfer Engineering*, 30 (10-11): 777-785.

[10] **Kolaczowski S T**, Asli U A and Davidson M G, (2009) A new heterogeneous ZnL<sub>2</sub> catalyst on a structured support for biodiesel production, *Catalysis Today*, 147S, S220 - S224

[11] Lamb G W, Al Badran F A H, Jonathan M. J. Williams J M J and **Kolaczowski S T**, (2010) Production of pharmaceuticals - amines from alcohols in a continuous flow fixed bed catalytic reactor, *Chemical Engineering Research & Design*, 88, 1533 – 1540.

## **7.2 Examples of patent publications:**

[1] **Kolaczowski S T**, Awdry S and Scott-Scott J L, (1999), Catalytic combustion chamber with pilot stage and a method of operation thereof, US Patent, Patent Number 6,000,212. Date of Patent: Dec 14. Assignee: Rolls-Royce Plc. *[This patent was granted]*

[2] **Kolaczowski S T** (2008) ‘Apparatus and process for use in three-phase catalytic reactions’. International Publication Date 10 April 2008, WO 2008/040999 A2. *[This patent application has been filed]*

## **7.3 Example of monograph**

[1] Hayes R E and **Kolaczowski S T** (1997) Introduction to Catalytic Combustion, Gordon and Breach Science Publishers, 681 pgs. *[This is a text book that is used by many individuals in universities and companies that develop models of catalytic gas phase reactors especially catalytic converters].*

# **8. EXAMPLES OF VERY RECENTLY SUBMITTED PUBLICATIONS**

## **8.1 Publications accepted and in press:**

- 1) **Kolaczowski S T**, Lee C D and Jodlowski P, Gasification of wood pellets in an experimental quartz tube gasifier – how visual 1D experiments can aid 3D design considerations. Bioten Conference proceedings, CPL press.
- 2) **Kolaczowski S T**, Lee C D and Awdry S, Equilibrium reaction(s) involving H<sub>2</sub>S and COS species – consideration of thermodynamics and implications on the biomass gasification process. Bioten Conference proceedings, CPL press.
- 3) S.Ye, Y. H. Yap, **S.T. Kolaczowski**, K Robinson and D. Lukyanov, Catalyst ‘light-off’ experiments on a Diesel Oxidation Catalyst connected to a diesel engine – methodology and techniques, in press in *Chemical Engineering Research and Design*.

## **8.2 Papers submitted:**

- 4) **Kolaczowski S T**, Ye S, Yap Y Robinson K, Lukyanov D, Transient experiments on a full-scale DOC – methodology & techniques to support modelling, submitted to a Special Issue of *Catalysis Today*.
- 5) Nuckols M L, **Kolaczowski S T**, Awdry S, Smith T and Thomas D. An initial assessment for the use of seawater as a method to remove metabolically-produced carbon dioxide from a submersible atmosphere, Oceans 2011 Conference in US (will be refereed).

## **9. RESEARCH GRANTS**

*As the list is **very long (in excess of 80 grants)**, just a few **examples** are provided of grants that were active over that last 6 years.*

*I have also provided an indication of where I play a role as the **Principal Investigator**.*

1. [2002–05] Co-investigator on a European (CEC - Competitive and Sustainability) funded project (**£208k**), on: Compact reactor and carbon supported catalyst system for multiphase air oxidation.
2. [2007–10] Principal Investigator on an EPSRC funded project (**£502k**), on catalytic converters for the control of vehicle emissions (with Dept. of Mechanical Engineering).
3. [2008-11] Co-investigator on an EPSRC funded project (**£298k**) on: Tertiary amines from alcohols without oxidants, reductants or alkyl halides (with Dept. Chemistry ).
4. [2008] Principal Investigator on two strategic initiatives funded through the Office of Science & Innovation’s UK-US Science Bridges programme [**£20k**]. The first is in conjunction with the University of California and Refgas Ltd, focussing on integrated reaction systems for gas to liquid biofuels and electrical power. The second project is on compact biodiesel reactors with the University of California and Heatric (Division of Meggitt) UK Ltd.
5. [2008–09] Principal Investigator on a Knowledge West funded project (**£13k**) on: Biomass to fuel: Conversion of tars to useful products.
6. [2008–11] Principal Investigator on a Great Western Research funded project with financial support from industry (**£84k**) on: Compact catalytic reactors for novel sustainable chemical pathways.
7. [2009–18] Co-investigator (one of eight) on a prestigious award to establish a Doctoral Training Centre in Sustainable Chemical Technologies (award of **£7.5M** from EPSRC + **£8M** from industry and other sources). This project involves joint collaboration between the Department of Chemistry and the Department of Chemical Engineering at the University of Bath.
8. [2009-12] Principal Investigator: funding from the Office of Naval Research, US, via Duke University in US (**554k, US dollars**).
9. [2011-12] Principal Investigator: EPSRC KTA awards (**£60k + £58k**) on: Continuous flow solutions for pharmaceutical manufacture (with Prof J Williams in Chemistry).
10. [2011] Principal Investigator: Alantum Europe, Germany (**£74k**) on: Radial Heat Transfer in Catalytic Supports.

## **10. MAIN FIELDS OF SCIENTIFIC ACTIVITY**

My main interest is in Chemical Reaction Engineering - in particular applications that have environmental benefits. This work involves the formation of mathematical models of chemical reactors, combined with associated experimental work.

### **10.1 Current research topics:**

1. Chemical reactions in catalytic monolith reactors, and novel catalyst supports.
2. Experimental and CFD modelling studies, of the catalytic combustion of:

- hydrogen (for a heater in a deep sea diving suit), and
- carbon monoxide and hydrocarbons to control emissions from vehicles in catalytic converters.
- 3. Turning batch to continuous processes in the pharmaceutical industry using compact multi-functional catalytic reactors for the: partial oxidation of alcohols; the production of tertiary amines from alcohols (without oxidants, reductants or alkyl halides); and the performance of catalytic hydrogenation reactions.
- 4. New heterogeneous catalysts for biodiesel production: turning batch to continuous processes and supporting catalysts on monolith supports.
- 5. Gasification of biomass to produce a syngas, then electricity: system integration, catalytic enhancement of syngas quality, and catalytic clean-up of emissions (reduction of CO, HCs, and NOx).
- 6. Recovery of carbon dioxide from submersible habitats, using sea water in novel designs of compact multi-chamber scrubbers.

## **10.2 Topics taught on undergraduate courses in chemical engineering**

- Tutorials (First, Second and Final years)
- Second year laboratory classes
- Final year experimental projects
- Chemical reaction engineering (Second and Final years)
- Applied thermodynamics - prediction of properties and non-ideal vapour liquid equilibria (Second year)
- Environmental legislation and methods of pollution control (Final year)
- Communication and team work (First and Second years)
- Environmental control in the process industry (MSc in Environmental Science, Policy and Planning)
- Design projects (Second and Final years)
- Project development techniques (Final year)
- Material balances (First year)
- Management & Economics (Second and Third year students)
- Transport Phenomena (Third year students)

## **11. Interactions with industry**

I often collaborate with industry. In the past, this has included companies such as BP, Degussa, Gaz de France, Gastec, Rolls Royce, Johnson Matthey.

Over the last 10 years, examples include the following:

- Heatric (division of Meggitt Ltd): on the development of a compact catalytic reactor for the production of methanol from low calorific gases.
- S&C Thermofluids Ltd: on the application of CFD codes to catalytic reactors.
- Mast Carbons Ltd: on the use of novel carbons as catalyst supports.
- GE Healthcare: on the development of a new high temperature oxidation process, this led to the securing of a patent.
- GSK: on trials on turning batch pharmaceutical reactions into continuous catalytic processes.
- Refgas Ltd: on the design of a biomass to syngas gasification plant.
- Alantum Europe Ltd: on the heat transfer characteristics of novel metal foams that could be used as catalyst supports.

## **12. PhD STUDENTS SUPERVISED**

**I have indicated where I have taken the 'lead role' in supervising the PhD student.**

- (1) Dr P Crumpton (1988) Modelling of non-adiabatic honeycomb reactors.  
PhD Supervisors: Kolaczkowski (lead role) and Spence.
- (2) Dr C Bennett (1990) Monolith reactors for automobile catalysts.  
PhD Supervisors: Thomas and Kolaczkowski (lead role).
- (2) Dr I Downey (1993) Fouling of crude oil refinery preheat exchangers.  
PhD Supervisors: Kolaczkowski (lead role) and Crittenden.
- (4) Dr S Serbetcioglu (1993) Mass transfer and catalytic reactions in a three-phase monolith reactor.  
Supervisor: Kolaczkowski (lead role).
- (5) Dr A Shalhi (1993) Use of HiTRAN inserts to enhance heat transfer and control fouling from hydrocarbons.  
Supervisors: Crittenden (lead role) and Kolaczkowski.
- (6) Dr T Takemoto (1993) Use of HiTRAN inserts to reduce fouling from crude oils.  
Supervisors: Crittenden (lead role) and Kolaczkowski.
- (7) Dr D Worth (1994) Mathematical modelling of a multichannel catalytic monolith combustor.  
Supervisors: Kolaczkowski (lead role) and Spence.
- (8) Dr B Robbins (1996) Concentration and recovery of nitric acid via electro-membrane processes.  
Supervisors: Kolaczkowski (lead role), Field and Lockett.
- (9) Dr D McLurgh (1997) Study of a porous tube reactor for the wet air oxidation of aqueous wastes.  
Supervisor: Kolaczkowski (lead role).
- (10) Dr P Li (1997) Catalytic combustion of methane in monoliths and the influence of diffusion barriers.  
Supervisor: Kolaczkowski (lead role).
- (11) Dr D Phillips (1999) Mitigation of crude oil fouling by the use of HiTRAN inserts.  
Supervisors: Crittenden (lead role) and Kolaczkowski.
- (12) Dr S Buche (1999) Polymer electrolyte fuel cell diagnostics.  
Supervisors: Peters, Kolaczkowski and Sowerby (lead role).
- (13) Dr S Kim (2001) Measurement of the effective diffusivity of gasoline compounds in coated monoliths and associated factors.  
Supervisor: Kolaczkowski (lead role).
- (14) Dr C Flatley (2001) Catalytic combustion of liquid fuels.  
Supervisor: Kolaczkowski (lead role).
- (15) Dr G R Williams (2002) Liquid phase catalytic partial oxidation of methane.  
Supervisors: Kolaczkowski (lead role) and Plucinski.
- (16) Dr A Shirley (2005) A transient steam reforming process to produce hydrogen from methane for use in fuel cells.  
Supervisor: Kolaczkowski (lead role).
- (17) Dr L H Nguyen (2005) Development of a kinetic model for light alkane aromatisation over zeolite catalysts.  
Supervisors: Kolaczkowski and Lukyanov (lead role).
- (18) Dr F Zhang (2005) Measurement of the effective diffusivity in carbon monoxide in commercial catalytic converters.  
Supervisor: Kolaczkowski (lead role).

- (19) Dr R Chao (2007) Modelling of gas phase reactions in fixed bed catalytic reactors.  
Supervisor: Kolaczkowski (lead role).
- (20) Dr Y Yap (2010) Characterisation of a diesel oxidation catalyst.  
Supervisors: Kolaczkowski (lead role), Lukyanov, Robinson and Awdry.
- (21) Dr S Ye (2010) Oxidation catalyst studies on a diesel engine  
Supervisor: Kolaczkowski, Robinson (lead role) and Awdry.
- (22) Dr U Asli (2011) Catalytic monoliths for biodiesel production.  
Supervisors: Kolaczkowski (lead role) and Davidson.