

Prof. MD Heydenrych *C.Eng.*

Professional Portfolio



Personal Particulars

Michael David Heydenrych

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Study record

Primary education: Bedfordview Primary School and Fields Primary School, Rustenburg.
Tertiary education: BSc (Chem Eng) 1977-1981 (University of the Witwatersrand)
MSc (Eng) 1989 (University of the Witwatersrand)
MDP (Project Management) 1992, (UNISA)
PhD 2001 (University of Twente, Netherlands)

Employment history

Jan 1982 – Jul 1982 Matthey Rustenburg Refiners, Wadeville (Platinum group metals production facility)

Jul 1982 – Jul 1984 Compulsory National service. Engineers Corps, promoted to Commissioned Officer in July 1983, then worked as Project Officer at Army HQ.

Jul 1984 – Jan 1987 CSIR - Worked as a team member on determining the hydrodynamics of Fischer-Tropsch slurry reactors. The information was used by SASOL to scale up their slurry reactors, and these are now used industrially. Developed as the group's expert on the financial feasibility of processes, and process modelling using SimSci's Process software.

Jan 1987 – Jul 1990 CSIR - Project leader for the determination of the intrinsic kinetics of the oligomerisation of ethene on a supported nickel catalyst. The slurry reactor used for determining the intrinsic kinetics was novel, but not yet published. Sasol has since started using such laboratory slurry reactors for characterisation of catalysts. Published MSc thesis on this work, and registered a South African patent on an oligomerisation process.

Jul 1990 – Jul 1992 Consulting engineer for Megkon, a company specialising in systems engineering. Did a complete Reliability and Availability Analysis for the Soda Ash Botswana project, and consulted with many other firms on smaller projects.

Jul 1992 – Apr 1995 Returned to CSIR to work on fluidised bed combustors: full-scale design, supplying units to industry. Specialised in fluidised bed minerals reduction processes, including gasification. Responsible for process modelling within the group.

- Apr 1995 – Apr 1997 Headed a large development project on the nitridation and chlorination of titanium and related metals at CSIR (turnover approx. R2 mill/yr).
- Apr 1997 - present Associate Professor, University of Pretoria, researching the modelling of rotary kilns and pyrolysis of forestry bio-mass.

Achievements in teaching

Attended the workshop “Effective teaching” by Felder and Brent, University of the Witwatersrand, in 1999, and subsequently applied co-operative learning methods in his teaching. This substantially improved his teaching effectiveness, reflected in the very good student evaluations in recent years. He has transformed his courses to reflect an outcomes-based approach, and depending on the course, has selectively applied student-centred learning in his teaching approach.

Research achievements

Peer-reviewed publications

1. Dimitrov, K. and Heydenrych, M., “Relationship between the edgewise compression strength of corrugated board and the compression strength of liner and fluting medium papers”, *Southern Forests* 2009, 71(3): 227–233
2. Arie Jan van Houwelingen, Werner van der Merwe, Nadine Wales, Mike Heydenrych, Willie Nicol, ‘The effect of hydrodynamic multiplicity on liquid phase trickle flow axial dispersion’, *Chemical Engineering Research and Design*, 87 (2009) 677–683
3. Heydenrych, M.D., Greeff, P., Heesink, A.B.M., Versteeg, G.F., (2001), ‘Mass transfer in rolling rotary kilns: A novel approach’, *Chem. Eng. Sci.*, 57 (18) 3851-3859.
4. Heydenrych, M.D., Schieke, J., Heesink, A.B.M., Kuipers, J.A.M. (2001), ‘Diffusion effects in rotating rotary kilns’, *SAJ Chem. Eng.* 13, 1 (2001)
5. Heydenrych, M.D., Nicolaidis, C.P. and Scurrel, M.S., (2001), ‘Oligomerization of ethene in a slurry reactor using a nickel(II)-exchanged silica-alumina catalyst’, *Journal of Catalysis*, 197, 1 January 2001, p49-57
6. Moolman, F.S. and Heydenrych, M.D. (2000), ‘Fluorination of zircon in a fluidized bed’, *Can. J. Chem. Eng.*, 78, December 2000, 1120 – 1126.
7. Heydenrych, M.D., Reid, C. and Manzini, D. (2000), ‘Pressure drop over fluidised bed distributor caps’, *S.A.J. Chem. Eng.*, 12 Issue 2, (2000) 1-9
8. Van Vuuren, D.S., Hunter, J.R. and Heydenrych, M.D., (1988), ‘The solubility of various gases in Fischer-Tropsch reactor wax’, *Chem. Eng. Sci.*, 43(6) 1291-1296.
9. Faber, E.F., Heydenrych, M.D. and Hicks, R.E. (1988) ‘Techno-economic comparison of air and steam drying’, *ChemSA*, 14, September 1988

Other publicly available publications

1. Heydenrych, M.D. (2002) 'Modelling of gas-solid reactions in rotary kilns', Chemical Technology, January 2002, p14-16
2. Heydenrych, M.D. (2001) 'Modelling of Rotary Kilns', PhD thesis, University of Twente.
3. Heydenrych, M.D. (1991) 'Methanol synthesis using liquid absorbents – experimental', CSIR report ENER-I 91025, 49 pp.
4. Heydenrych, M.D. (1989) 'Intrinsic kinetics of olefin oligomerisation on a supported nickel catalyst', M.Eng. Thesis, University of the Witwatersrand.
5. Van Vuuren, D.S. and Heydenrych, M.D., (1985), 'Multicomponent modeling of Fischer-Tropsch slurry reactors', CSIR rep. CENG-581, 46 pp.

Contract reports

1. "Flow sheet development for the chlorination section of Titanic", Sept. 1999
2. "Ultrasonic assistance for the fluidisation of powders", April 1999
3. "A mass balance for the incineration of chlorinated hydrocarbons" – Joint Innovation fund proposal, April 1999
4. "Development of Literock as a lightweight building material" – Joint Innovation fund proposal, April 1999
5. "Strategy for the development of the cost modelling of fluidised beds", November 1998
6. "A model for the mixing of gases in the DRH rotary nitriding kiln", July 1998
7. "Changing electrical conductivity and sintering properties of Highveld Slag by pyrolysis using coal volatiles", Oct 1997
8. "Titanic road map – plotting the history of the Titanic Project", August 1997
9. "The importance of pyrolysis of volatiles in the operation of the DRH furnace for the nitridation of Highveld slag", April 1997
10. "Nitriding efficiencies of the continuous 10 kg/h DRH furnace", January 1997
11. "Experimental results of the 1kg/h chlorination reactor", July 1996
12. "Chlorination kinetics of nitrided Highveld slag using a laboratory-scale fluidized bed recycle reactor", February 1996
13. "Risk and economic aspects for the choice of scale of DRH prototype furnaces", June 1995
14. "Incineration tests on Sasol High-sulphur pitch", by North, Heydenrych and Eleftheriades, March 1995.

15. "Reactor choice for the low-temperature chlorination of nitrated slag", December 1994
16. "A mass and energy balance of the Titanic process", September 1994
17. "A literature survey on the chlorination of titaniferous materials", August 1994
18. "Initial explosion safety audit of proposals for the Powder Mill upgrade", by T Koetze and MD Heydenrych, CSIR report BX 402-001, July 1994
19. "Techno-economic survey on chrome pre-reduction using natural gas as reductant", June 1994
20. "Preliminary process design and costing for a closed loop incinerator for high-sulphur pitch", June 1994
21. "Technical and commercial feasibility of the novel closed loop incineration system in South Africa", May 1994
22. "A simulation model of the closed loop incinerator", May 1994
23. "Stack-gas estimate on Sanachem incinerator", CSIR ENER-C 94073, March 1994
24. "Evaluation of Nitric acid spill near Wonderfontein", CSIR ENER-C 93059, December 1993
25. "Operator reliability report of Thor chemicals site for good operating procedures", April 1993
26. "Budget estimate for n-butanol effluent incineration", February 1993
27. "Laboratory feasibility study for the production of soda lime", November 1992
28. "A dynamic model of a fluidized bed combustor followed by a fluidized bed dryer", July 1992
29. "Arcton-12 supply at BMW (Rosslyn)", CSIR ENER-C 92059, April 1992
30. "A mass and energy balance for the proposed continuous production of Litterock", March 1992
31. "An energy balance for the production of magnesia from dolomite", February 1992
32. "A thermodynamic study of a Zircon smoker", CSIR report ENER-C 91124, November 1991
33. "Availability and reliability study of the Soda Ash Botswana plant", December 1990

Patents

1. Heydenrych, M.D. and Van Vuuren, D.S. (1989) 'Catalytic process for the oligomerisation of olefins', South African patent ZA 89 02,236.
2. Heydenrych, M.D., Morgan, D and Stone, AK(2000) 'Fluidisation', South African Patent ZA 2000/2465

Conference papers

1. Heydenrych, Mike “Energy Integration in the pyrolysis of forestry bio-wastes”, Symposium on Thermal and Catalytic Sciences for Biofuels and Biobased products, Iowa State University, Ames Iowa USA, 21-23 September 2010.
2. J Swanepoel, DS van Vuuren, M.D. Heydenrych; “Leachability of nitride ilmenite in hydrochloric acid”. Advanced Metals Initiative Light Metals Conference 2010
3. DS van Vuuren, SJ Oosthuizen and MD Heydenrych. “Titanium production via metallothermic reduction of $TiCl_4$ in molten salt: Problems and Products”. Advanced Metals Initiative Light Metals Conference 2010.
4. Heydenrych, M.D., Mouton, M., “ TiO_2 nanoparticle phase transformation by means of heat treatment”, Gauteng Branch SAChE Symposium, Johannesburg, 11 May 2006.
5. Heydenrych, M D., “Mass transfer in rotary kilns: A fundamental approach”, 6th World Congress of Chemical Engineering, Melbourne, September 2001.
6. Heydenrych, M.D., “Mass Transfer in Rotary Kilns” 9th National Meeting of SAChE, 9 – 12 October 2000, Secunda, p99.
7. Heydenrych, M.D., “Process modelling tools in design – an experiential viewpoint”, Process Engineering in the Fast Lane, University of Pretoria, 26 June 2000.
8. Heydenrych, M.D., “Incorporation of feedback in the final year design course”, AECI-Wits Chem. Eng. Lecturer’s Conference – Open-ended problems in Chem. Eng. teaching, 5-6 July 1999.
9. Heydenrych, M.D., “Reactor simulation using Java”, AECI-Wits Chem. Eng. Lecturer’s Conference – Computer-aided Chem. Eng. teaching, 30-31 January 1998.
10. Mostert, G., Heydenrych, M.D., Stone, A., ‘The importance of cost models in the evaluation of process options – a case study’, Hidden Wealth Symposium 1-3 October 1996, SAIMM symposium series S16
11. Heydenrych, M.D., ‘The effect of buffers on plant availability’, SAChE 7th National Conference, Durban, 1994.
12. Mandersloot, W.G.B. and Heydenrych, M.D., ‘Practicalities of the preparation of graphics’, Proc. of SAChE 7th National Meeting, Johannesburg, 1994.
13. Heydenrych, M.D., Mandersloot, W.G.B., ‘Practicalities of curve fitting’, Proc. of SAChE 7th National Meeting, Johannesburg, 1994.
14. Mandersloot, W.G.B. and Heydenrych, M.D., ‘The PC in science and engineering’, Proceedings of the SAChE symposium on the PC, Pretoria, 1991
15. Faber, E.F., Heydenrych, M.D. and Hicks, R.E. (1986) ‘Techno-economic comparison of air and steam drying’, Cost and energy saving in drying’, One-day symposium, CSIR conference centre, 3 October 1986.

Community service

Active member of the South African Institution of Chemical Engineers (SAIChE):

- Past President of SAIChE (and currently Council member)
- Fellow of IChemE and SAIChE.