

## **Curriculum Vitae, Prof. Unni Olsbye**

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Current position (since 2007): Professor, Managing Director of inGAP (Innovative Natural Gas Processes and Products), Dept. of Chemistry, University of Oslo (UiO)

### **Work experience**

2002- Full Professor, Department of Chemistry, UiO  
2001-02 Associate Professor, Department of Chemistry, UiO  
2000-01 R&D Manager, NORDOX Industrier AS  
1993-2000 Senior Scientist and Leader of Petrochemistry Group, Dept. of Hydrocarbon Process Chemistry, SINTEF. From July 1996 Deputy Department Manager.  
1991-92 Research Scientist, Senter for Industriforskning (SI) (later SINTEF) Dept. of Hydrocarbon Process Chemistry  
1988-90 Ph.D. stipendiate, Elf Aquitaine, Lacq, France

### **Education**

1991 PhD, Department of Chemistry, University of Oslo (UiO)  
1987 MSc, Industrial chemistry, Norwegian University of Science and Technology (NTNU).

### **Memberships**

1. Elected member of Norwegian Academy of Technical Sciences
2. Member of Scientific Board, ABC conference series
3. Member of Editorial Board, Catalysis Letters and Topics of Catalysis
4. Member of Editorial Board, Applied Catalysis A: General
5. Member of Editorial Board, Catalysis Today
6. Member of program board, GASSMAKS program, RCN

### **Student supervision**

Supervised 4 PhD students and 3 postdocs  
Currently supervise 5 PhD students and 2 postdoctoral fellows.  
Host exchanged 2 PhD students (2008-2010)

### **Publications and presentations**

Published more than 70 scientific papers in peer-reviewed journals.

### **Research interests**

- 1) **Kinetic and mechanistic studies** of heterogeneously catalysed reactions, comprising both redox (metal/support) and acid-base (zeolitic) catalysts.
- 2) **Elucidation of site specificity and selectivity** of heterogeneous catalysts, by combining surface sensitive techniques with intrinsic kinetic measurements
- 3) **Conversion of alkanes and CO<sub>2</sub>, H<sub>2</sub>O** into bulk molecules (steam and dry reforming and catalytic partial oxidation of methane to synthesis gas; light alkane dehydrogenation, alkane/alkene (oxy)chlorination, methanol to olefins and gasoline, methyl halides to olefins and gasoline)

## Publication list (2006-)

### Books:

1. S. Kvisle, T. Fuglerud, S. Kolboe, U. Olsbye, K.P. Lillerud, B.P. Vora **Methanol-to-hydrocarbons** in H. Ertl, F. Knözinger, F. Schüth and J. Weitkamp (Ed.s), Handbook of Heterogeneous Catalysis (2nd Edition) Wiley-VCH 6 (2008) 2950-2965.
2. U. Olsbye **Hydrocarbon processing: Catalytic Combustion and Partial Oxidation to Syngas** in D. Duprez, F. Cavani (Ed.s), Advanced Processes in Catalytic Oxidation. From Laboratory Studies to Industrial Applications Imperial College Press (2011), *In press*.

### Patents:

1. B. Arstad, U. Olsbye, H. Fjellvåg **Method for partial oxidation of natural gas using oxide catalyst with lattice oxygen.** PCT Int. Appl. (2009), WO 2009045112.
2. K.P. Lillerud, M. Tilset, U. Olsbye, K.C. Szeto, M. Bjørgen, K.O. Kongshaug, S. Bordiga, J. Hafizovic, A. Krivokapic, S. Jakobsen **Porous heterogeneous catalyst containing three-dimensional inorganic framework and complexed active metal.** PCT Int. Appl. (2007) WO 2007007113

### Publications (with referee)

#### 1. Peer-review journals:

39. L. Sommer, A. Krivokapic, S. Svelle, K.P. Lillerud, M. Stöcker, U. Olsbye **Enhanced Catalyst Performance of Zeolite SSZ-13 in the Methanol to Olefin Reaction after Neutron Irradiation** J. Phys. Chem. C 115 (14) (2011) 6521–6530
38. R. Skorpa, S. Bordiga, F. Bleken, U. Olsbye, B. Arstad, J. Tolchard, K. Mathisen, S. Svelle, M. Bjørgen, **Assessing the surface sites of the large pore 3-dimensional microporous material H-ITQ-7 using FT-IR spectroscopy and molecular probes** Microporous Mesoporous Mater. 141(1-3), (2011) 146-156.
37. F. Mudu, B. Arstad, H. Fjellvåg, U. Olsbye **Thermodynamic Control of Product Formation During the Reaction Between CH<sub>4</sub> and Pt Promoted Ceria-zirconia Solid Solutions** Catal Lett 141 (2011) 8–14.
36. F. Bleken, W. Skistad, K. Barbera, M. Kustova, S. Bordiga, P. Beato, K.P. Lillerud, S. Svelle, U. Olsbye **Conversion of methanol over 10-ring zeolites with differing volumes at channel intersections: comparison of TNU-9, IM-5, ZSM-11 and ZSM-5** Phys. Chem. Chem. Phys. 13 (2011) 2539-2549.
35. D. Mores, J. Kornatowski, U. Olsbye, B.M. Weckhuysen **Coke Formation during the Methanol-to-Olefin Conversion: In Situ Microspectroscopy on Individual H-ZSM-5 Crystals with Different Brønsted Acidity** Chemistry - A European Journal 17 (2011) 2874 – 2884.
34. M. Kandiah, M.H. Nilsen, S. Usseglio, S. Jakobsen, U. Olsbye, M. Tilset, C. Larabi, E.A. Quadrelli, F. Bonino, K.P. Lillerud **Synthesis and Stability of Tagged UiO-66 Zr-MOFs** Chem. Mater. 22 (2010) 6632-6640
33. L. Sommer, S. Svelle, K.P. Lillerud, M. Stöcker, B.M. Weckhuysen, U. Olsbye **Optical Investigation of the Intergrowth Structure and Accessibility of Brønsted Acid Sites in Etched SSZ-13 Zeolite Crystals by Confocal Fluorescence Microscopy** Langmuir 26(21) (2010) 16510-16516.
32. M. Bjørgen, S. Akyalcin, U. Olsbye, S. Benard, S. Kolboe, S. Svelle **Methanol to hydrocarbons over large cavity zeolites: Toward a unified description of catalyst deactivation and the reaction mechanism** J. Catal. 275 (2010) 170–180.

31. F. Mudu, B. Arstad, E. Bakken, H. Fjellvåg, U. Olsbye **Perovskite-type oxide catalysts for low temperature, anaerobic catalytic partial oxidation of methane to syngas** *J. Catal.* 275 (2010) 25–33.
30. S. Teketel, U. Olsbye, K.P. Lillerud, P. Beato, S. Svelle **Selectivity control through fundamental mechanistic insight in the conversion of methanol to hydrocarbons over zeolites** *Micropor. Mesopor. Mat.* 136 (2010) 33–41
29. N.B. Muddada, U. Olsbye, L. Caccialupi, F. Cavani, G. Leofanti, D. Gianolio, S. Bordiga, C. Lamberti **Influence of additives in defining the active phase of the ethylene oxychlorination catalyst** *Phys Chem Chem Phys* 12(21) (2010) 5605-5618.
28. M. Kandiah, S. Usseglio, S. Svelle, U. Olsbye, K.P. Lillerud, M. Tilset **Post-synthetic modification of the metal–organic framework compound UiO-66** *J. Mater. Chem.* 20 (2010) 9848–9851.
27. F. Bleken, S. Svelle, K.P. Lillerud, U. Olsbye, B. Arstad and O. Swang **Thermochemistry of Organic Reactions in Microporous Oxides by Atomistic Simulations: Benchmarking against Periodic B3LYP** *J. Phys. Chem. A* 114(27) (2010) 7391-7397.
26. K.P. Lillerud, U. Olsbye, M. Tilset **Designing Heterogeneous Catalysts by Incorporating Enzyme-Like Functionalities into MOFs** *Top. Catal.* 53(13-14) (2010) 859-868.
25. L. Sommer, D. Mores, S. Svelle, M. Stoecker, B. Weckhuysen, U. Olsbye **Mesopore formation in zeolite H-SSZ-13 by desilication with NaOH** *Micropor Mesopor mat.* 132(3) (2010) 384-394.
24. M.H. Nilsen, S. Svelle, S. Aravinthan, U. Olsbye **The conversion of chloromethane to light olefins over SAPO-34: The influence of dichloromethane addition** *Applied Catalysis A: General* 367(1-2) (2009) 23-31.
23. S. Teketel, S. Svelle, K.P. Lillerud, U. Olsbye **Shape-selective conversion of methanol to hydrocarbons over 10-ring unidirectional-channel acidic H-ZSM-22** *ChemCatChem* 1(1) (2009) 78-81.
22. B.P.C. Hereijgers, F. Bleken, M.H. Nilsen, S. Svelle, K.P. Lillerud, M. Bjørgen, B.M. Weckhuysen, U. Olsbye **Product shape selectivity dominates the Methanol-to-Olefins (MTO) reaction over H-SAPO-34 catalysts** *J. Catal.* 264(1) (2009) 77-87.
21. F. Bleken, M. Bjørgen, L. Palumbo, S. Bordiga, S. Svelle, K.P. Lillerud, U. Olsbye **The effect of acid strength on the conversion of methanol to olefins over acidic microporous catalysts with the CHA topology** *Topics in Catalysis* 52(3) (2009) 218-228.
20. D. Mores, E. Stavitski, M.H.F. Kox, J. Kornatowski, U. Olsbye, B.M. Weckhuysen, **Space- and time-resolved in-situ spectroscopy on the coke formation in molecular sieves: methanol-to-olefin conversion over H-ZSM-5 and H-SAPO-34** *Chemistry-A European Journal* 14(36) (2008) 11320-11327.
19. J. Hafizovic Cavka, S. Jakobsen, U. Olsbye, N. Guillou, C. Lamberti, S. Bordiga, K.P. Lillerud **A New Zirconium Inorganic Building Brick Forming Metal Organic Frameworks with Exceptional Stability** *J. Am. Chem. Soc.* 130(42) (2008) 13850-13851.
18. A. Virnovskaia, E. Rytter, U. Olsbye **Kinetic and isotopic study of ethane dehydrogenation over a semicommercial Pt,Sn/Mg(Al)O catalyst**, *Ind. Eng. Chem. Res.* 47(19) (2008) 7167-7177.

17. M. Rivallan, G. Berlier, G. Ricchiardi, A. Zecchina, M-T. Nechita, U. Olsbye **Characterisation and catalytic activity in de-NO<sub>x</sub> reactions of Fe-ZSM-5 zeolites prepared via ferric oxalate precursor**, Appl. Catal. B: Environmental 84 (1-2) (2008) 204-213.
16. M. Bjørgen, F. Joensen, M. Spangsborg Holm, U. Olsbye, K.P. Lillerud, S. Svelle **Methanol to gasoline over zeolite H-ZSM-5: Improved catalyst performance by treatment with NaOH** Appl. Catal. A: General 345(1) (2008) 43-50.
15. M. Bjørgen, K.P. Lillerud, U. Olsbye, S. Svelle **Conversion of methanol to hydrocarbons: hints to rational catalyst design from fundamental mechanistic studies on H-ZSM-5** Stud. Surf. Sci. Catal. 167(Natural Gas Conversion VIII) (2007) 463-468.
14. S. Svelle, U. Olsbye, F. Joensen, M. Bjørgen **Conversion of Methanol to Alkenes over Medium- and Large-Pore Acidic Zeolites: Steric Manipulation of the Reaction Intermediates Governs the Ethene/Propene Product Selectivity** J. Phys. Chem. C 111(49) (2007) 17981-17984.
13. J. Hafizovic, A. Krivokapic, K.C. Szeto S. Jakobsen, K.P. Lillerud, U. Olsbye, M. Tilset **Tailoring the dimensionality of metal-organic frameworks incorporating Pt and Pd. From molecular complexes to three-dimensional networks.** Crystal Growth & Design (2007), 7(11), 2302-2304.
12. A. Virnovskaia, S. Morandi, E. Rytter, G. Ghiotti, U. Olsbye **Characterization of Pt,Sn/Mg(Al)O Catalysts for Light Alkane Dehydrogenation by FT-IR Spectroscopy and Catalytic Measurements** J. Phys. Chem. C 111(40) (2007) 14732-14742.
11. L. B. Råberg, M. B. Jensen, U. Olsbye, C. Daniel, S. Haag, C. Mirodatos, A. Olafsen Sjøstad **Propane dry reforming to synthesis gas over Ni based catalysts. Influence of support and operating parameters on catalyst activity and stability** J. Catal. 249 (2007) 250–260.
10. M. Bjørgen, S. Svelle, F. Joensen, J. Nerlov, S. Kolboe, F. Bonino, L. Palumbo, S. Bordiga, U. Olsbye **Conversion of methanol to hydrocarbons over zeolite H-ZSM-5: On the origin of the olefinic species** J. Catal. 249 (2007) 195–207.
9. J. Hafizovic, U. Olsbye, K.P. Lillerud **Poly[aqua(□ -5'-carboxy-2,2'-bipyridine-5-carboxylato)dichloridorubidium(I)platinum(II)]** Acta Cryst E: Structure Reports Online (2007), E63(4), m962-m964.
8. J. Hafizovic, M. Bjørgen, U. Olsbye, P.D. Dietzel, S. Bordiga, C. Prestipino, C. Lamberti, K.P. Lillerud **The Inconsistency in Adsorption Properties and Powder XRD Data of MOF-5 Is Rationalized by Framework Interpenetration and the Presence of Organic and Inorganic Species in the Nanocavities.** J. Am. Chem. Soc. (2007), 129(12), 3612-3620.
7. A. Virnovskaia, S. Jørgensen, J. Hafizovic, Ø. Prytz, E. Kleimenov, M. Haevecker, H. Bluhm, A. Knop-Gericke, R. Schloegl, U. Olsbye **In situ XPS investigation of Pt(Sn)/Mg(Al)O catalysts during ethane dehydrogenation experiments**, Surf. Sci. (2007) 601(1) 30-43.
6. S. Svelle, F. Joensen, J. Nerlov, U. Olsbye, K.P.Lillerud, S.Kolboe, M. Bjørgen **Conversion of Methanol into Hydrocarbons over Zeolite H-ZSM-5: Ethene Formation Is Mechanistically Separated from the Formation of Higher Alkenes**, J. Am. Chem. Soc. (2006) 128(46) 14770-14771.
5. M.B. Jensen, U. Olsbye, O. Swang **Oxygen Influence on the Dissociative Chemisorption of Methane on Nickel: A Quantum Chemical Cluster Model Study**, Chem. Phys. Lett. (2006) 432(1-3), 94-99.

4. S. Svelle, S. Aravinthan, M. Bjørgen, K.P. Lillerud, S. Kolboe, I.M. Dahl, U. Olsbye **The methyl halide-to-hydrocarbons reaction over H-SAPO-34**, J. Catal. (2006) 241(2) 243-254.

3. S. Svelle, M. Bjørgen, S. Kolboe, D. Kuck, M. Letzel, U. Olsbye, O. Sekiguchi  
E. Uggerud **Intermediates in the Methanol-to-hydrocarbons (MTH) Reaction: A Gas Phase Study of the Unimolecular Reactivity of Multiply Methylated Benzenium Cations**, Catal. Lett. (2006) 109(1-2) 25 - 35.

2. S. Svelle, U. Olsbye, K.P. Lillerud, S. Kolboe, M. Bjørgen **Diphenylmethane-Mediated Transmethylation of Methylbenzenes over H-Zeolites.** J. Am. Chem. Soc. (2006) 128(17) 5618-5619.

1. J. Hafizovic, U. Olsbye, K.P. Lillerud **(2,2'-Bipyridine-5,5'-dicarboxylic acid)tetrachloroplatinum(IV) monohydrate**, Acta Cryst. E, 62(3), (2006), m414-m416.

## 2. Conference proceedings with referee

5. M.B. Jensen, L. B. Råberg, A. Olafsen Sjøstad, U. Olsbye **Mechanistic study of the dry reforming of propane to synthesis gas over a Ni/Mg(Al)O catalyst**, Cat. Today 145(1-2) (2009) 114-120.

4. M. Bjørgen, F. Joensen, K.P. Lillerud, U. Olsbye, S. Svelle **The mechanisms of ethene and propene formation from methanol over high silica H-ZSM-5 and H-beta** Cat. Today 142(1-2) (2009) 90-97.

3. E.A. Eilertsen, M.H. Nilsen, R. Wendelbo, U. Olsbye, K.P.; Lillerud **Synthesis of high silica CHA zeolites with controlled Si/Al ratio** Stud. Surf. Sci. Catal. 174A(Zeolites and Related Materials) (2008) 265-268.

2. M. Bjørgen, K.P. Lillerud, U. Olsbye, S. Svelle **Conversion of methanol to hydrocarbons: hints to rational catalyst design from fundamental mechanistic studies on H-ZSM-5**, Stud. Surf. Sci. Catal. (2007), 167(Natural Gas Conversion VIII), 463-468.

1. A. Olafsen, C. Daniel, Y. Schuurman, L. B. Råberg, U. Olsbye, C. Mirodatos **Light alkanes CO<sub>2</sub> reforming to synthesis gas over Ni based catalysts**, Catalysis Today (2006), 115(1-4), 179-185.