Curriculum Vitae

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Date of Birth:	17.05.1987 (Chickasha, OK, USA)
Citizenship:	USA
Marital Status:	Married

Education

Ph.D. Columbia University, Research Director Jack Norton (2014)
M.Phil., Columbia University, Research Director Jack Norton (2013)
M.A., Columbia University, Research Director Jack Norton (2011)
B.S., University of Oklahoma, Research Director Kenneth M. Nicholas (2009)
High School, Cement High School, Cement, OK (2005)

Employment History

Junior Professor (TT - W3), Institute for Technical Chemistry, University of Stuttgart (2019-pres)
Postdoctoral Fellow, MPI for Chemical Energy Conversion, Research Director Walter Leitner (2018-19)
Postdoctoral Fellow, RWTH Aachen, Research Director Walter Leitner (2017-18)
Postdoctoral Fellow, ETH Zürich, Research Director Christophe Copéret (2014-17)

Research Interests

Surface Organometallic Chemistry, Molecular Heterogeneous Catalysis, Mechanistic Chemistry, Reactive Intermediates, Kinetics and Thermodynamics of Catalytic Processes, Technical Chemistry

Fellowships and Awards

Catalysis Science and Technology Emerging Investigator (2021)
Marie Curie ETH Zürich Postdoctoral Fellowship (2015)
Pegram Award for Excellent Doctoral Work, Columbia University (2014)
Miller Teaching Award, Columbia University (2011)
US Department of Energy Office of Science National Graduate Fellowship (2010)
Dick Van der Helm Undergraduate Research Fellowship (2008)

Languages

English (Native)
German (Fluent)

Presentations

Deven P. Estes, Understanding Metal-Support Interactions Using Well-Defined Surface Metal Hydrides Synthesized by Surface Organometallic Chemistry and Molecular Heterogeneous Catalysis, International Symposium on the Relations between Homogeneous and Heterogeneous Catalysis (ISHHC 19), Online (Oslo, Norway), June 29th, 2022.

Deven P. Estes, Transition-Metal Hydrides Immobilized on Metal Oxide Surfaces: Understanding Metal Support Interactions in Heterogeneous CO_2 Hydrogenation Catalysts, Green Chemistry and C1 Value Symposium, Chembio Finland 2022, Helsinki, Finland, June, 8th, 2022.

Deven P. Estes, Interactions between Metal Hydride Complexes and Metal Oxide Surfaces: Effect of Confinement on CO_2 Hydrogenation, CataLysis Symposium, Kassel, DE, May 3rd, 2022.

Deven P. Estes, Andreas Rosen, Walter Leitner, Jürgen Klankermayer, Tailored Catalyst System for the Synthesis of Dimethoxymethane from CO_2 and Molecular Hydrogen, 18th International Symposium on Relations between Homogeneous and Heterogeneous Catalysis, July 23rd, 2018, Sydney, AU

Deven P. Estes, The Effect of Electron-Withdrawing Ligands on Alkyne Metathesis Catalysts: Insights from Solid State NMR, International Symposium on Olefin Metathesis and related reactions (ISOM) XXII, July 11th, 2017, Zürich, CH

Deven P. Estes, G. Siddiqui, F. Allouche, K. V. Kovtunov, O. V. Safonova, A. Trigub, I. V. Koptyug, C. Copéret, C-H Activations Catalyzed by Transition-Metal Ions Isolated on Metal Oxide Surfaces, Swiss Chemical Society Fall Meeting 2016, September 15th, 2016, Zürich, CH

Deven P. Estes, David C. Grills, Gang Li, Jack R. Norton; Investigation of the Co-H Bond in Solvated Cobaloximes, In *Abstracts of Papers*, Proceedings of the 246th ACS National Meeting and Exposition, Indianapolis, IN, September 8-12th, 2013; American Chemical Society: Washington, DC, 2013

Jack R. Norton, Deven P. Estes, Aaron K. Vannucci, Ariel Hall, Dennis L. Lichtenberger; Acidities and metal-hydrogen bond dissociation energies of $(\eta^5\text{-}C_5R_5)M(CO)_2H$ (M= Fe, Ru, Os) (R = H, Me), In *Abstracts of Papers*, Proceedings of the 241st ACS National Meeting and Exposition, Anaheim, CA, March 27-31st, 2011; American Chemical Society: Washington, DC, 2011

Publications

27. Yuji Ikeda, Deven P. Estes, Blazej Grabowski, Comprehensive Understanding of H Adsorption on MoO_3 from Systematic Ab Initio Simulations, *J. Phys. Chem. C,* **2022**, 126, 7728. DOI: 10.1021/acs.jpcc.2c01085

26. Abdulhamid H. Almidani, Michael Benz, Mario Winkler, Yuji Ikeda, Blazej Grabowski, Joris van Slageren, Deven P. Estes, The reaction of $HV(CO)_4$dppe with MoO_3: a well-defined model of hydrogen spillover, *Catal. Sci. Technol. Emerging Investigator Series***, 2021**, 11, 7540. DOI: 10.1039/D1CY01374B

25. Carolin Rieg, Daniel Dittmann, Zheng Li, Dr. Robert Lawitzki, Katrin Gugeler, Sarah Maier, Prof. Guido Schmitz, Prof. Johannes Kästner, Prof. Deven P. Estes, Dr. Michael Dyballa, Quantitative Distinction between Noble Metals Located in Mesopores from Those on the External Surface, *Chem. Eur. J.*, **2021**, 27, 17012. DOI: https://doi.org/10.1002/chem.202102076.

24. Hoang-Huy Nguyen, Zheng Li, Toni Enenkel, Joachim Hildebrand, Matthias Bauer, Michael Dyballa, and Deven P. Estes**,** Probing the Interactions of Immobilized Ruthenium Dihydride Complexes with Metal Oxide Surfaces by MAS NMR: Effects on CO_2 Hydrogenation, *J. Phys. Chem. C*, **2021**, 125, 14627. DOI: 10.1021/acs.jpcc.1c02074 .

23. Sarah Maier, Steve P. Cronin, Manh-Anh Vu Dinh, Zheng Li, Michael Dyballa, Michal Nowakowski, Matthias Bauer, Deven P. Estes, Immobilized Platinum Hydride Species as Catalysts for Olefin Isomerizations and Enyne Cycloisomerizations, *Organometallics*, **2021**, 40, 1751. DOI: 10.1021/acs.organomet.1c00216 .

22. Carolin Rieg, Daniel Dittmann, Zheng Li, Alan Kurtz, Isabelle Lorenz, Deven P.Estes, Michael Buchmeiser, Michael Dyballa, Michael Hunger, Noble metal location in porous supports

determined by reaction with phosphines, *Micropor. Mesopor. Mat.*, **2021,** 310, 110594. DOI: 10.1002/chem.202102076.

21. Sven Lang, Michael Dyballa, Yvonne Traa, Deven P. Estes, Elias Klemm, Michael Hunger, Direct Proof of Volatile and Adsorbed Hydrocarbons on Solid Catalysts by Complementary NMR Methods, *Chem. Ing. Tech.* **2021**, 93, 1020. DOI: 10.1002/cite.202000128.

20. Manuel Kirchhof, Katrin Gugeler, Felix Richard Fischer, Michal Nowakowski, Alina Bauer, Sonia Alvarez-Barcia, Karina Abitaev, Marc Schnierle, Yaseen Qawasmi, Wolfgang Frey, Angelika Baro, Deven P. Estes, Thomas Sottmann, Mark R. Ringenberg, Bernd Plietker, Matthias Bauer, Johannes Kästner, and Sabine Laschat, Experimental and Theoretical Study on the Role of Monomeric vs Dimeric Rhodium Oxazolidinone Norbornadiene Complexes in Catalytic Asymmetric 1,2- and 1,4-Additions, *Organometallics*, **2020**, 39, 3131.DOI: 10.1021/acs.organomet.0c00310

19. Deven P. Estes, Markus Leutzsch, Lukas Schubert, Alexis Bordet, Walter Leitner, The Effect of Ligand Electronics on the Reversible Catalytic Hydrogenation of CO_2 to Formic Acid using Ruthenium Polyhydride Complexes: A Thermodynamic and Kinetic Study, *ACS Catal.*, **2020**, 10, 2990. DOI: https://pubs.acs.org/doi/abs/10.1021/acscatal.0c00404

18. Scott R. Docherty, Deven P. Estes, Christophe Copéret, Facile Synthesis of Unsymmetrical Trialkoxysilanols: $(RO)_2(R'O)SiOH$, *Helv. Chim. Acta*, **2018**, e1700298. DOI: https://onlinelibrary.wiley.com/doi/full/10.1002/hlca.201700298

17. Deven P. Estes, Christopher P. Gordon, Alexey Fedorov, Wei-Chih Liao, Henrike Ehrhorn, Celine Bittner, Manuel Luca Zier, Dirk Bockfeld, Ka Wing Chan, Odile Eisenstein, Christophe Raynaud, Matthias Tamm, Christophe Copéret, Molecular and Silica-Supported Molybdenum Alkyne Metathesis Catalysts: Influence of Electronics and Dynamics on Activity Revealed by Kinetics, Solid-State NMR, and Chemical Shift Analysis, *J. Am. Chem. Soc.*, **2017**, 139, 17597. DOI: https://pubs.acs.org/doi/abs/10.1021/jacs.7b09934

16. Deven P. Estes, Amanda K. Cook, Erwin Lam, Louise Wong, Christophe Copéret, Understanding the Lewis Acidity of Co(II) Sites on a Silica Surface, *Inorg. Chem.* **2017**, 56, 7731. DOI: https://pubs.acs.org/doi/abs/10.1021/acs.inorgchem.7b00443

15. Deven P. Estes, Mechanistic Investigations of C–H Activations on Silica-Supported Co (ii) Sites in Catalytic Propane Dehydrogenation, *Chimia*, **2017**, 71, 177. DOI: https://www.ingentaconnect.com/contentone/scs/chimia/2017/00000071/00000004/art00005

14. Murielle Delley, Marius Silaghi, Francisco Nuñez-Zarur, Kirill Kovtunov, Oleg Salnikov, Deven P. Estes, Igor Koptyug, Aleix Comas-Vives, Christophe Copéret, X-H Bond Activation on Cr(III),O Sites (X = R or H) : Key Steps in Dehydrogenation and Hydrogenation Processes, *Organometallics*, **2017**, 36, 234. DOI: https://pubs.acs.org/doi/abs/10.1021/acs.organomet.6b00744

13. Deven P. Estes, Georges Siddiqi, Florian Allouche, Kirill V. Kovtunov, Olga V. Safonova, Alexander L. Trigub, Igor V. Koptyug, Christophe Copéret, C-H activation on Co,O Sites: Isolated Surface Sites versus Molecular Analogues, *J. Am. Chem. Soc.*, **2016**, 138, 14987. DOI: https://pubs.acs.org/doi/abs/10.1021/jacs.6b08705

12. Deven P. Estes, Celine Bittner, Òscar Àrias, Martin Casey, Alexey Fedorov, Matthias Tamm, and Christophe Copéret, Alkyne Metathesis at ppm Catalyst Loading, *Angew. Chem. Int. Ed.*, **2016**, 55, 14166. DOI: https://onlinelibrary.wiley.com/doi/full/10.1002/anie.201605129

11. Christophe Copéret, Deven P. Estes, Kim Larmier, Keith Searles, Isolated Surface Hydrides: Formation, Structure and Reactivity, Thematic Issue on Metal Hydrides, *Chem. Rev.* **2016**, 116, 8463. DOI: https://pubs.acs.org/doi/abs/10.1021/acs.chemrev.6b00082

10. Yue Hu, Anthony P. Shaw, Deven P. Estes, Jack R. Norton; Transition-Metal Hydride Cation Radicals, Thematic Issue on Metal Hydrides, *Chem. Rev.* **2016**, 116, 8427. DOI: https://pubs.acs.org/doi/abs/10.1021/acs.chemrev.5b00532

9. Christophe Copéret, Aleix Comas-Vives, Matthew P. Conley, Deven P. Estes, Alexey Fedorov, Victor Mougel, Haruki Nagae, Francisco Núñez-Zarur, Pavel A. Zhizhko; Surface Organometallic and Coordination Chemistry toward Single-Site Heterogeneous Catalysts: Strategies, Methods, Structures, and Activities, *Chem. Rev.* **2016**, 116, 323. DOI: https://pubs.acs.org/doi/abs/10.1021/acs.chemrev.5b00373

8. Deven P. Estes, Christophe Copéret; The Role of Proton Transfer in Heterogeneous Transformations of Hydrocarbons, *Chimia*, **2015**, 69, 321. DOI: https://www.ingentaconnect.com/content/scs/chimia/2015/00000069/00000006/art00003

7. Deven P. Estes, David C. Grills, Jack R. Norton; The Reaction of Cobaloximes with Hydrogen: Products and Thermodynamics, *J. Am. Chem. Soc.* **2014**, 136, 17362. DOI: https://pubs.acs.org/doi/abs/10.1021/ja508200g

6. Gang Li, Deven P. Estes, Jack R. Norton, Serge Ruccollo, Aaron Sattler; Dihydrogen Activation by Cobaloximes with Various Axial Ligands, *Inorg. Chem.* **2014**, 53, 10743. DOI: https://pubs.acs.org/doi/abs/10.1021/ic501975r

5. Jay C. Poret, Anthony P. Shaw, Christopher M. Csernica, Karl D. Oyler, Deven P. Estes, Development and Performance of the W/Sb_2O_3/KIO_4/ Lubricant Pyrotechnic Delay in the US Army Hand-Held Signal, *Prop., Expl., Pyrotech.* **2013**, 38, 35. DOI: https://onlinelibrary.wiley.com/doi/full/10.1002/prep.201200109

4. Deven P. Estes, Jack R. Norton, Steffen Jockusch, Wesley Sattler; Mechanisms by which Alkynes React with $CpCr(CO)_3H$. Application to Radical Cyclization, *J. Am. Chem. Soc.* **2012**, 134, 15512. DOI: https://pubs.acs.org/doi/abs/10.1021/ja306120n

3. Gang Li, Arthur Han, Mary E. Pulling, Deven P. Estes, Jack R. Norton; Evidence for Formation of a Co-H bond in $(H_2O)_2Co(dmgBF_2)_2$ under H_2: Application to Radical Cyclization, *J. Am. Chem. Soc.* **2012**, 134, 14662. DOI: https://pubs.acs.org/doi/abs/10.1021/ja306037w

2. Deven P. Estes, Aaron K. Vannucci, Ariel R. Hall, Dennis L. Lichtenberger, Jack R. Norton; Thermodynamics of the Metal – Hydrogen Bond in $(\eta^5\text{-}C_5H_5)M(CO)_2H$ (M = Fe, Ru, Os), *Organometallics* **2011**, 30, 3444. DOI: https://pubs.acs.org/doi/abs/10.1021/om2001519

1. Masaomi Matsumoto, Deven Estes, Kenneth M. Nicholas; Evolution of Metal Complex-Catalysts by Dynamic Templating with Transition State Analogs; *Eur. J. Inorg. Chem.* **2010**, 12, 1847. DOI: https://onlinelibrary.wiley.com/doi/full/10.1002/ejic.201000129