

Timothy A. Strobel –*Curriculum Vitae*

CONTACT INFORMATION

Carnegie Institution for Science
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PERSONAL

Citizenship: USA

EDUCATION

Colorado School of Mines, Golden, CO USA

Ph.D., Chemical Engineering, August 2008

- Dissertation: “On Some Clathrates of Hydrogen”
- Advisors: Professor E. Dendy Sloan, Professor Carolyn A. Koh
- Minor subject: Chemistry

B.S., Chemical Engineering, May 2004

PROFESSIONAL EXPERIENCE

Carnegie Institution for Science

Geophysical Laboratory, Washington, DC, USA

Staff Scientist

September 2011 to Present

Associate Director - EFree, DOE EFRC

August 2014 to Present

Research Scientist

October 2010 to August 2012

Carnegie Fellowship

September 2008 to September 2010

Yanshan University

State Key Laboratory for Metastable Materials, Qinhaungdao, China

Visiting Professor

June 2015 to Present

Colorado School of Mines

Chemical Engineering Department, Golden, CO, USA

Research Assistant

October 2003 to August 2008

PROFESSIONAL ACTIVITIES

***Invited Lectures* [>40]**

- 2017 Invited Speaker, AIRAPT Conference, Beijing, China (upcoming)
- 2017 Invited Speaker, Intl. Conf. on Chemical Bonding, Kauai, Hawaii (upcoming)
- 2016 Invited Speaker, Aarhus University, Aarhus, Denmark
- 2016 Invited Speaker, International Union of Crystallography, Pohang, S. Korea
- 2016 Invited Speaker, POSTECH University, Pohang, S. Korea
- 2016 Invited Speaker, George Washington University, Washington, DC

2016 **Plenary Speaker**, iPolymorphs Conference, Donostia, Spain
 2016 Invited Speaker, Canadian Chemistry Conference, Halifax, NS
 2016 Invited Speaker, University of Nevada, Las Vegas, NV
 2016 Invited Speaker, MRS Spring Meeting, Phoenix, AZ
 2015 Invited Speaker, George Mason University, Fairfax, VA
 2015 Invited Speaker, University of Southern Florida, Tampa, FL
 2015 Invited Speaker, International Conference on Exotic Silicon, Golden, CO
 2015 Invited Speaker, Yanshan University, Chem. Dept., Qinhaungdao, China
 2015 Invited Speaker, Yanshan University, Materials Dept., Qinhaungdao, China
 2015 Invited Speaker, HPSTAR, Shanghai, China
 2015 Invited Speaker, University of Utah, Salt Lake City, UT
 2015 Invited Speaker, ACHPR7, Bangkok, Thailand
 2014 Invited Speaker, Gordon Research Conference, Holderness, NH
 2014 **Keynote Speaker**, COMPRES Annual Meeting, Skamania Lodge, WA
 2013 Invited Speaker, Naval Research Laboratory, Washington, DC
 2013 Invited Speaker, Colorado School of Mines, Golden, CO
 2012 Neighborhood Lecture, Carnegie Institution of Washington, Washington, DC
 2012 Invited Speaker, International Union of Crystallography, Mito, Japan
 2012 Invited Speaker, Gordon Research Conference, Easton, MA
 2011 Invited Speaker, AIRAPT Conference, Mumbai, India
 2011 Invited Speaker, American Chemical Society Meeting, Denver, CO
 2011 Invited Speaker, Washington State University, Pullman, WA
 2011 Invited Speaker, Tennessee Tech. University, Cookeville, TN
 2011 Invited Speaker, Carnegie Institution of Washington, Washington, DC
 2010 Invited Speaker, International Union of Crystallography, Gatlinburg, TN
 2010 Invited Speaker, Gordon Research Conference, Holderness, NH
 2010 Invited Speaker, Carnegie Institution of Washington, Washington, DC
 2010 Invited Speaker, Cornell University, Ithaca, NY
 2010 Invited Speaker, Clarkson University, Potsdam, NY
 2010 Invited Speaker, University of New Hampshire, Durham, NH
 2009 Invited Speaker, American Chemical Society Meeting, Washington, DC
 2009 Invited Speaker, American Chemical Society Meeting, Salt Lake City, UT
 2008 Invited Speaker, National Renewable Energy Laboratory, Golden, CO
 2008 Invited Speaker, Telluride Science Research Center, Telluride, CO
 2008 Invited Speaker, Carnegie Institution of Washington, Washington, DC
 2007 Invited Speaker, Advanced Photon Source, Argonne Natl. Lab, Argonne, IL

Professional Societies

- American Chemical Society
- American Physical Society
- Materials Research Society

Other Awards and Honors

- Visiting Professor, Yanshan University (2015-present)
- Young Investigator Lecture, Gordon Conference on High Pressure (2014)
- CIW Science Holiday Card Contest (2012)
- Jamieson Award for young scientist in high pressure (2011)
- CIW Science Holiday Card Contest (2010)
- Young Investigator Lecture, Gordon Conference on High Pressure (2010)
- Carnegie Fellowship (2008)
- Second place, Colorado School of Mines Research Fair (2008)
- Honorable mention, Colorado School of Mines Research Fair (2007)

1. [0] Stefanoski, S.; Finkelstein, G.J.; Ward, M.D.; Zeng, T.; Wei, K.; Bullock, E.S.; Nolas, G.S.; Liu, H.; Strobel, T.A. "Zintl Ions Within Framework Channels: The Complex Structure and Transport Properties of $\text{Na}_8\text{Ge}_{26}$." Submitted (2017).
2. [0] Hu, M.; Dong, X.; Wu, Y.; Liu, L.; Zhao, Z.; Gao, G.; Zhou, X.F.; Strobel, T.A.; Xu, B.; Yu, D.; Liu, Z.; Tian, Y.; He, J. "Multifunctional Polymerized Graphene Nanoribbon Architectures: 3D Phases Composed Entirely of sp^2 Carbons" Submitted (2017).
3. [0] Bhadram, V.S.; Krishna, R.; Toberer, E.; Hrubciak, R.; Greenberg, E.; Prakapenka, V.; Strobel, T.A. "Pressure-Induced Structural Transition in Chalcopyrite ZnSiP_2 ." Under Revision for *Applied Physics Letters* (2017).
4. [0] Hu, M.; Zhao, Z.; Hu, W.; Strobel, T.A.; Sun, H.; He, J.; Yu, D.; Kono, Y.; Shu, J.; Mao, H.K.; Fei, Y.; Wang, Y.; Shen, G.; Juhl, S.J.; Liu, Z. Xu, B.; Tian, Y. "Compressed Glassy Carbon: An Interpenetrating Graphene Network with Extraordinary Specific Compressive Strength and Elastic Recovery" Under Revision for *Science Advances* (2017).
5. [0] Tong, X.; Xu, X.; Fultz, B.; Zhang, H.; D.Y. Kim; Strobel, T.A. "Phonons in Si_{24} at Simultaneously Elevated Temperature and Pressure." In Press *Physical Review B* (2017).
6. [0] Zhang, H.; Liu, H.; Wei, K.; Kurakevych, K.; Le Godec, Y.; Liu, Z.; J. Martin; Nolas, G.S.; Strobel, T.A. "BC8 Silicon (Si-III) is a Narrow-Gap Semiconductor" In Press *Physical Review Letters* (2017).
7. [0] Lin, Y.; Zhao, Z.; Cohen, R.E.; Strobel, T.A. "Interpenetrating Graphene Networks: Three-Dimensional Node-Line Semimetals with Massive Negative Linear Compressibilities" *Physical Review B*, 94, 245422 (2016).
8. [0] Zhao, Z.; Zhang, H.; Kim, D.Y.; Strobel, T.A. "Properties of Exotic Metastable Ge: The Case of ST12" *Nature Communications*, 8, 13909 (2017).
9. [0] Keefer, D.W.; Gou, H.; Purdy, A.P.; Epshteyn, A.; Kim, D.Y.; Badding, J.V.; Strobel, T.A. "Pressure-Induced Polymerization of $\text{LiN}(\text{CN})_2$ " *Journal of Physical Chemistry A*, 120, 9370 (2016).
10. [2] Haberl, B.; Strobel, T.A.; Bradby, J.E. "Pathways to Exotic Metastable Silicon Allotropes" *Applied Physics Reviews*, 3, 040808 (2016). **Special focus topic, highlighted in Physics Today.**
11. [2] Strobel, T.A., Somayazulu, M.; Sinogeikin, S.; Dera, P.; Hemley, R.J. "Hydrogen-Stuffed, Quartz-Like Water Ice" *Journal of the American Chemical Society*, 138, 13786 (2016). **Highlighted by Advanced Photon Source**
12. [0] Kurakevych, O.O.; Le Godec, Y.; Crichton, W.; Strobel, T.A. "Silicon Allotropy and Chemistry at Extreme Conditions" *Energy Procedia*, 92, 839 (2016).
13. [1] Kurakevych, O.O.; Le Godec, Y.; Crichton, W.A.; Guignard, J.; Strobel, T.A.; Zhang, H.; Liu, H.; Coelho Diogo, C.; Polian, A.; Menguy, N.; Juhl, S.J.; Alem, N.; Gervais, C. "Synthesis of Bulk BC8 Silicon Allotrope by Direct Transformation and Reduced-Pressure Chemical Pathways" *Inorganic Chemistry*, 55, 8943 (2016).

14. [2] Bhadram, V.S.; Kim, D.Y.; Strobel, T.A. "High-Pressure Synthesis and Characterization of Incompressible Titanium Pernitride" *Chemistry of Materials*, 28, 1616 (2016).
15. [4] Lin, Y.; Strobel, T.A.; Cohen, R.E. "Structural Diversity in Lithium Carbides" *Physical Review B*, 92, 214106 (2015).
16. [1] Stefanoski, S.; Liu, H.; Yao, Y.; Strobel, T.A. "Ambient-Pressure Polymerization of Carbon Anions in the High-Pressure Phase Mg₂C." *Inorganic Chemistry*, 54, 10765 (2015).
17. [55] Zhou, J.; Lian, J.; Hou, L.; Zhang, J.; Gou, H.; Xia, M.; Zhao, Y.; Strobel, T.A.; Tao, L.; Gao, F. "Ultrahigh Volumetric Capacitance and Cyclic Stability of Fluorine and Nitrogen Co-Doped Carbon Microspheres." *Nature Communications*, 6, 8503 (2015).
18. [9] Zeng, T.; Hoffmann, R.; Nesper, R.; Ashcroft, N.W.; Strobel, T.A., Proserpio, D.M. "Li-Filled B-Substituted Carbon Clathrates." *Journal of The American Chemical Society*, 137, 12639 (2015).
19. [6] Muramatsu, T.; Wanene, W.K.; Somayazulu, M.S.; Vinitzky, E.; Chandra, D.; Strobel, T.A.; Struzhkin, V.V.; Hemley, R.J. "Metallization and Superconductivity in the Hydrogen-Rich Ionic Salt BaReH₉." *Journal of Physical Chemistry C*, 119, 18007 (2015).
20. [4] Gou, H.; Yonke, B.L.; Epshteyn, A.; Kim, D.Y.; Smith, J.S.; Strobel, T.A. "Pressure-Induced Polymerization of P(CN)₃." *Journal of Chemical Physics*, 142, 194503 (2015).
21. [17] Li, Y.L.; Wang, S.N.; Oganov, A.R.; Gou, H.; Smith, J.S.; Strobel, T.A. "Exotic Stable Calcium Carbides." *Nature Communications*, 6, 6974 (2015).
22. [46] Kim, D.Y.; Stefanoski, S.S.; Kurakevych, O.O.; Strobel, T.A. "Synthesis of an Open-Framework Allotrope of Silicon." *Nature Materials*, 14, 169 (2015). Selected for **Chemistry World Highlight**. Featured in **New Scientist and Physics Today**.
23. [18] Strobel, T.A.; Kurakevych, O.O.; Kim, D.Y.; Le Godec, Y.; Chrichton, W.A.; Guignard, J.; Guignot, N.; Cody, G.D.; Oganov, A.R. "Synthesis of β -Mg₂C₃: A Monoclinic High-Pressure Polymorph of Magnesium Sesquicarbide." *Inorganic Chemistry*, 53, 7020 (2014). Selected for **2014 ESRF Highlight**
24. [8] Rozsa, V.F.; Strobel, T.A. "Triple Guest Occupancy and Negative Compressibility in Hydrogen-Loaded β -Hydroquinone Clathrate" *Journal of Physical Chemistry Letters*, 5, 1880 (2014).
25. [18] Kurakevych, O.O.; Le Godec, Y.; Strobel, T.A.; Kim, D.Y.; Chrichton, W.A.; Guignard, J. "High-Pressure and High-Temperature Stability of Antifluorite Mg₂C by *In Situ* X-ray Diffraction and *Ab Initio* Calculations." *Journal of Physical Chemistry C*, 118, 8128 (2014).
26. [28] Kurakevych, O.O.; Strobel, T.A.; Kim, D.Y.; Cody, G.D. "Synthesis of Mg₂C: A Magnesium Methanide" *Angewandte Chemie International Edition*, 52, 8930 (2013). Selected for **inside back cover**.
27. [32] Kurakevych, O.O.; Strobel, T.A.; Kim, D.Y.; Muramatsu, T.; Struzhkin, V.V. "Na-Si Clathrates Are High-Pressure Phases: A Melt-Based Route to Control Stoichiometry and Properties" *Crystal Growth & Design*, 13, 303 (2013).

28. [14] Zaleski-Ejgierd, P.; Labet, V.; Strobel, T.A.; Hoffmann, R.; Ashcroft, N.M.W. “WH_n Under Pressure” *Journal of Physics: Condensed Matter*, 24, 155701 (2012). Selected for **IOPScience Web Highlight**.
29. [11] Ferrell, J.R.; Sachdeva, S.; Strobel, T.A.; Gopalakrishnan, G.; Koh, C.A.; Pez, G.; Cooper, A.C.; Herring, A.M. “Exploring the Fuel Limits of Direct Oxidation Proton Exchange Membrane Fuel Cells with Platinum Based Electrocatalysts.” *Journal of the Electrochemical Society*, 159, B371 (2012).
30. [28] Strobel, T.A.; Ganesh, P.; Somayazulu, M.; Hemley, R.J. “Novel Cooperative Interactions and Structural Ordering in H₂S-H₂.” *Physical Review Letters*, 107, 255503 (2011).
31. [4] Chidester, B.A.; Strobel, T.A. “The Ammonia-Hydrogen System Under Pressure.” *Journal of Physical Chemistry C*, 115, 10433 (2011).
32. [28] Strobel, T.A.; Somayazulu, M.; Hemley, R.J. “Phase Behavior of H₂+H₂O at High Pressures and Low Temperatures.” *Journal of Physical Chemistry C*, 115, 4898 (2011).
33. [31] Strobel, T.A.; Goncharov, A.F.; Seagle, C.T.; Liu, Z.; Somayazulu, M.; Struzhkin, V.V.; Hemley, R.J. “High-Pressure Study of Silane to 150 GPa.” *Physical Review B*, 83, 144102 (2011).
34. [24] Strobel, T.A.; Chen, X.J.; Somayazulu, M.; Hemley, R.J. “Vibrational Dynamics, Intermolecular Interactions, and Compound Formation in GeH₄-H₂ Under Pressure.” *Journal of Chemical Physics*, 133, 164512 (2010).
35. [100] Strobel, T.A.; Hester, K.C.; Koh, C.A.; Sum, A.K.; Sloan, E.D. “Properties of the Clathrates of Hydrogen and Developments in Their Applicability for Hydrogen Storage.” *Chemical Physics Letters*, 478, 97-109 (2009) (**Invited**). **Featured on cover**.
36. [79] Strobel, T.A.; Somayazulu, M.; Hemley, R.J. “Novel Pressure-Induced Interactions in Silane-Hydrogen.” *Physical Review Letters*, 103, 065701 (2009). Selected as **Editor’s Suggestion**. Highlighted in **Physics Viewpoints** by N.W. Ashcroft, *Physics*, 2, 65 (2009).
37. [65] Strobel, T.A.; Koh, C.A., Sloan, E.D. “Thermodynamic Predictions of Various Tetrahydrofuran and Hydrogen Clathrate Hydrates.” *Fluid Phase Equilibria*, 280, 61-67, (2009).
38. [47] Shin, K.; Kim, Y.; Strobel, T.A.; Prasad, P.S.R.; Sugahara, T.; Lee, H.; Sloan, E.D.; Sum, A.K.; Koh, C.A. “Tetra-n-butylammonium Borohydride Semiclathrate: A Hybrid Material for Hydrogen Storage.” *Journal of Physical Chemistry A*, 113, 6415-6418 (2009).
39. [53] Ohno, H.; Strobel, T.A.; Dec, S.F.; Sloan, E.D.; Koh, C.A. “Raman Studies of Methane-Ethane Hydrate Metastability.” *Journal of Physical Chemistry A*, 113, 1711-1716 (2009).
40. [58] Strobel, T.A.; Sloan, E.D.; Koh, C.A. “Raman Spectroscopic Studies of Hydrogen Clathrate Hydrates.” *Journal of Chemical Physics*, 130, 014506 (2009).
41. [47] Strobel, T.A.; Kim, Y.; Andrews, G.; Ferrell, J.R.; Koh, C.A.; Herring, A.M.; Sloan, E.D. “Chemical-Clathrate Hybrid Hydrogen Storage: Storage in Both Guest and Host.” *Journal of the American Chemical Society*, 130, 14975-14977 (2008).

42. [64] Strobel, T.A.; Koh, C.A.; Sloan, E.D. "Water Cavities of sH Clathrate Hydrate Stabilized by Molecular Hydrogen." *Journal of Physical Chemistry B*, 112, 1885-1887 (2008).
43. [137] Strobel, T.A.; Koh, C.A.; Sloan, E.D. "Hydrogen Storage Properties of Clathrate Hydrate Materials." *Fluid Phase Equilibria*, 261, 382-389 (2007).
44. [35] Strobel, T.A.; Hester, K.C.; Sloan, E.D.; Koh, C.A. "A Hydrogen Clathrate Hydrate with Cyclohexanone: Structure and Stability." *Journal of the American Chemical Society*, 129, 9544-9545 (2007).
45. [30] Rovetto, L.J.; Strobel, T.A.; Koh, C.A.; Sloan, E.D. "Is Gas Hydrate Formation Thermodynamically Promoted by Hydrotrope Molecules?" *Fluid Phase Equilibria*, 247, 84-89 (2006).
46. [111] Hester, K.C.; Strobel, T.A.; Sloan, E.D.; Koh, C.A. "Molecular Hydrogen Occupancy in Binary THF-H₂ Clathrate Hydrates by High Resolution Neutron Diffraction." *Journal of Physical Chemistry B*, 110, 14024-14027 (2006).
47. [198] Strobel, T.A.; Taylor, C.J.; Hester, K.C.; Dec, S.F.; Koh, C.A.; Miller, K.T.; Sloan, E.D. "Molecular Hydrogen Storage in Binary THF-H₂ Clathrate Hydrates." *Journal of Physical Chemistry B*, 110, 17121-17125 (2006).

PATENTS

1. Strobel, T.A.; Kurakevych, O.O; Kim, D.Y. "New Form of Silicon and Method of Making the Same" Patent application PCT/US2014/045745. (Claims accepted in Jan. 2017)
2. Epshteyn, A.; Yonke, B.; Strobel, T.A.; Gou, H. "Preparation of Graphitic C₃N₃P Material" US Patent 9,409,936.