

COLIN A. WOLDEN

Curriculum Vitae

EDUCATION

Massachusetts Institute of Technology
Ph. D. in Chemical Engineering, (1995)
M. S. in Chemical Engineering Practice, (1992)

University of Minnesota
B. S. in Chemical Engineering, (1990)

PROFESSIONAL EXPERIENCE

8/24 – Present **William K. Coors Distinguished Chair and Professor**
Colorado School of Mines, Department of Chemical and Biological Engineering
Research focuses on the development of new materials with application in renewable energy and sustainability. Current research interests include: (1) thin film photovoltaics; (2) membrane reforming of ammonia and methanol; (3) fusion fuel processing; (4) next generation battery materials.

8/17 – Present **Joint Appointment, National Renewable Energy Laboratory**

5/08 – 8/24 **Professor, including Interim Head (1/1/15 - 6/30/15, 1/1/17 - 8/30/17)**
Colorado School of Mines, Department of Chemical and Biological Engineering

5/02 – 5/08 **Associate Professor with Tenure**
Colorado School of Mines, Department of Chemical Engineering

9/97 – 5/02 **Assistant Professor**
Colorado School of Mines, Department of Chemical Engineering

9/95 – 9/97 **National Research Council/Army Research Office Postdoctoral Fellow**
North Carolina State University, Department of Materials Science
Advisors: Dr. John T. Prater (ARO) and Dr. Robert F. Davis (NCSU)

5/95 – 9/95 **Station Director, Natick, MA**
MIT School of Chemical Engineering Practice

9/90 – 5/95 **Graduate Research Assistant**
MIT Department of Chemical Engineering
Ph.D. Thesis entitled “Critical gas-phase and surface reactions involved in the chemical vapor deposition of diamond.” Research Advisor: Dr. Karen K. Gleason

HONORS, AWARDS, AND PATENTS

- AVS Fellow, 2014.
- CSM Dean’s Excellence Award, 2013.
- E. T. S. Walton Fellow – Science Foundation Ireland, 2010
- Outstanding Educator – Department of Chemical Engineering, 2009
- Order of Omega CSM Outstanding Faculty Award, 2007CSM “Diggers for Diversity Award”, 2005
- NSF Career Award, 2001
- 3M Corporation Untenured Faculty Award, 2000 and 2001
- NRC/ARO Postdoctoral Fellowship, 1995-1997
- Edward Vivian Prize for Excellence in Chemical Engineering Practice, 1992
- US Patent Application 18/729,083, “Generation of ammonia/hydrogen mixtures and/or hydrogen-enriched fuel mixtures”, C.A. Wolden, J. D. Way (2025).

- US Patent Application 18/741,630, “Hydrogen permeable, intermetallic diffusion barriers used in body centered cubic metal membranes”, C.A. Wolden, A. Job, J. D. Way (2024).
- US Patent 11,950,436, “All-back-contact photovoltaic devices using cracked film lithography”, L.M. Wheeler, K.J. Prince, C.A. Wolden, M.M. Mirzokarimov, C.P. Muzzillo (2024).
- US Patent 11,925,921, “Methods of making YSZ supported catalyst, and methods of using the same”, J.D. Way, C.A. Wolden, Z. Zhang, (2024).
- US Patent 11,742,440, “All-back-contact perovskite solar cells”, K.J. Prince, C.A. Wolden, L.M. Wheeler, (2023).
- US Patent 11,710,799, “Controlled thermomechanical delamination of thin films”, M.O. Reese, D.L. McGott, M.D. Kempe, T.M. Barnes, C.A. Wolden, (2023).
- U.S. Pat. App. 18/097,228, “Generation of Ammonia/Hydrogen Mixtures and /or Hydrogen Enriched Fuel Mixtures”, C.A. Wolden, R. Sitar, J. D. Way (2023).
- US Patent App. 17/180,479, “Method of making anhydrous metal sulfide nanocrystals”, W. Smith and C.A. Wolden, (2021).
- US Patent 11,090,628, “Catalytic membrane reactor, methods of making the same and methods of using the same for dehydrogenation reactions”, J. D.Way and C. A. Wolden (2021).
- US Patent 10399853, “Production of alkali sulfide cathode material and methods for processing hydrogen sulfide”, Y. Yang, C. A. Wolden, X. Li, R. Morrish, (2019).
- US Patent 10159969, "Ammonia Synthesis at Moderate Conditions Using Hydrogen Permeable Membrane Reactors," J. D. Way, S.-T. B. Lundin and C. A. Wolden, (2018).
- US Patent 20,150,325,718: “Rapid thermal processing of back contacts for CdTe solar cells”, with J. Beach, and T. R. Ohno, (2015).
- US Patent 20,150,315,035: “Electrochromic tungsten oxide for optical modulation and methods of making the same”, with C.-P. Li, C. Engrakul, and R. C. Tenent, (2015).
- U. S. Patent 8,623,121, “Stable Catalyst Layers for Hydrogen Permeable Composite Membranes”, with J. D. Way, (2014).
- US Patent App.. 61/895,919: “Plasma-assisted nanofabrication of two-dimensional metal dichalcogenide layers”, C. A. Wolden and R. M. Morrish, (2014).
- US Patent App. 62/033396: “Methods and Devices for Hydrogen Sulfide Removal with H₂ Co-Generation”, Y. Yang, C. A. Wolden, (2014).
- U.S. Patent 8,025,932, “Self-limiting thin film synthesis achieved by pulsed plasma-enhanced chemical vapor deposition”, M. T. Seman, C. A. Wolden, (2011).
- US Patent App. 11/161,347: “High Vacuum Plasma-Assisted Chemical Vapor Deposition System”, C. Wolden (2006).

PUBLICATIONS (Google h index = 45)

Journal Articles (Advisees underlined)

170. C. L. Hufnagel, V. Camacho, T. F. Fuerst, A. Rutkowski, J. D. Way, and C. A. Wolden, “The impact of argon addition on hydrogen superpermeation through palladium alloy metal foil pumps during direct internal recycling,” *Fusion Engineering and Design* **222**, 115428, (2026).
169. N. Kelley, J. D. Way, and C. A. Wolden, “Production of hydrogen and H₂/NH₃ mixtures from ammonia at elevated pressures in a catalytic membrane reformer,” *Chemical Engineering and Processing – Process Intensification* **216**, 110474, (2025).
168. S. A. Vaselabadi, B. Benham, and C. A. Wolden, “Design strategies for liquid-phase synthesis of sodium-based quaternary solid-state electrolytes,” *Materials Advances* **6**, 5523-5537 (2025).
167. A. T. Mathew, H. Lott, E. Colegrove, M. R. Young, D. Kuciauskas, C. A. Wolden, and M. O. Reese, “Arsenic activation and compensation in single crystal CdTe bilayers,” *Journal of Applied Physics* **137**, 115702 (2025).
166. C. M. Burst, C. Li, D. Way and C. A. Wolden, "Titanium Nitride as an Intermetallic Diffusion Barrier for Hydrogen Permeation in Palladium–Vanadium Composite Membranes," *Membranes* **15**, 68 (2025).

165. C. Li, J. D. Way, T. F. Fuerst, C. A. Wolden, "The Impact of Helium on Plasma-Driven Hydrogen Permeation and Implications for Direct Internal Recycling in the Fusion Fuel Cycle", *Nuclear Fusion* **65**, 016039, (2025).
164. S. A. Vaselabadi, B. Benham, and C. A. Wolden, "Facile One-pot Synthesis of High-purity Sodium Antimony Chalcogenides in Polar Solvents," *Inorganic Chemistry Frontiers* **12**, 658-671 (2025).
163. K. J. Prince, H. M. Mirlatz, X. Zheng, R.A. Kerner, E. A. Gaulding, L. T. Schelhas, L. M. Wheeler, C. A. Wolden, J. J. Berry, S. Ovaith, T. M. Barnes, J. M. Luther, "Sustainability Pathways for Perovskite Photovoltaics", *Nature Materials* **24**, 22-35, (2025)
162. C. Li, J. D. Way, T. F. Fuerst, C. A. Wolden, "High Compression in Palladium Alloy Metal Foil Pumps", *Fusion Science and Technology* **ASAP**, 1-12, (2024).
161. K. J. Prince, N. P. Irvin, M. Mirzokarimov, B. A. Rosales, D. T. Moore, H. L. Guthrey, A.F. Palmstrom, C. A. Wolden, L. M. Wheeler*, "Holistic Thermo-Optical Design of Laminate Layers for Halide Perovskite Photovoltaic Windows", *ACS Energy Letters* **9** 5836-5849 (2024).
160. C. Li, J. D. Way, T. F. Fuerst, C. A. Wolden, "Direct internal recycling fractions approaching unity", *Fusion Engineering and Design* **209** 114705 (2024).
159. R. Sitar, A. D'Aquila, J. L. Jechura, and C. A. Wolden, "Techno-economic analysis of zero-carbon ammonia-hydrogen fuel blend production through a catalytic membrane reformer and packed bed reactor", *Renewable and Sustainable Energy Reviews* **199**, 114469 (2024).
158. A. L. Job, C. Li, T. F. Fuerst, J. Douglas Way, and C. A. Wolden, "Acceleration of Pd-V intermetallic diffusion by hydrogen", *Journal of Alloys and Compounds* **972**, 172825 (2024).
157. S.-T. B. Lundin, W. J. Movick, A. Ikeda, Y. Hasegawa, C. A. Wolden, and J. D. Way, "Modeling of an ammonia decomposition membrane reactor including purity with complex geometry and non-isothermal behavior", *Journal of Membrane Science* **693**, 122345 (2024)
156. C. Li, J. D. Way, T. F. Fuerst, and C. A. Wolden, "Low temperature hydrogen superpermeation in vanadium composite metal foil pumps", *Nuclear Materials and Energy* **37**, 101529 (2023).
155. S. A. Vaselabadi, K. Palmer, W. H. Smith, and C.A. Wolden, "Scalable Synthesis of Selenide Solid-state Electrolytes for Sodium-ion Batteries", *Inorganic Chemistry* **62**, 17102-17114 (2023).
154. C. Li, A. J. Job, T. F. Fuerst, M. Shimada, J. D. Way, and C. A. Wolden, "Low temperature hydrogen plasma permeation in palladium and its alloys for fuel recycling in fusion systems", *Journal of Nuclear Materials* **582**, 154484 (2023).
153. W. H. Smith, S. A. Vaselabadi, and C. A. Wolden, "Synthesis of high-purity Li₂S nanocrystals via metathesis for solid-state electrolyte applications", *Journal of Materials Chemistry A* **11**, 7652-7661 (2023).
152. A. L. Job, C. Li, C. M. Burst, J. Douglas Way, and C. A. Wolden, "Zirconium nitride intermetallic diffusion barriers enable stable hydrogen permeation in palladium–vanadium composite membranes", *Journal of Membrane Science* **685**, 121930 (2023).
151. M. A. Scarpulla, B. McCandless, A. B. Phillips, Y. Yan, M. J. Heben, C. Wolden, G. Xiong, W. K. Metzger, D. Mao, D. Krasikov, I. Sankin, S. Grover, A. Munshi, W. Sampath, J. R. Sites, A. Bothwell, D. Albin, M. O. Reese, A. Romeo, M. Nardone, R. Klie, J. M. Walls, T. Fiducia, A. Abbas, and S. M. Hayes, "CdTe-based thin film photovoltaics: Recent advances, current challenges and future prospects", *Solar Energy Materials and Solar Cells* **255**, 112289 (2023)
150. W. H. Smith, S. A. Vaselabadi, and C. A. Wolden, "Sustainable synthesis of SiS₂ for solid-state electrolytes by cascaded metathesis", *Materials Today Communications* **35**, 105574 (2023).
149. B. A. Rosales, J. Kim, V. M. Wheeler, L. E. Crowe, K. J. Prince, M. Mirzokarimov, T. Daligault, A. Duell, C. A. Wolden, L. T. Schelhas, and L. M. Wheeler, "Thermochromic Halide Perovskite Windows with Ideal Transition Temperatures," *Advanced Energy Materials* **13**, 2203331, (2023).
148. S. Yang, F. Wan, A. Han, L. Fang, Q. Sun, Z. Zhao, D. Song, L. Zhang, L. Chen, C. A. Wolden, X. Zhang, and Y. Yang, "Environmentally friendly, non-glove box, closed-system and continuously massive production of lithium sulfide for battery applications," *Journal of Cleaner Production* **382**, 135221, (2023).

147. C. Karakaya, M. Kidder, C. Wolden, R. J. Kee, and O. Deutschmann, "Mechanistic Interpretations and Insights for the Oxidative Dehydrogenation of Propane via CO₂ over Cr₂O₃/Al₂O₃ Catalysts", *Industrial & Engineering Chemistry Research* **61**, 14482-14493 (2022).
146. R. Sitar, J. Shah, J. D. Way, and C. A. Wolden, "Efficient Generation of H₂/NH₃ Fuel Mixtures for Clean Combustion", *Energy & Fuels* **36**, 9357–9364 (2022).
145. K. J. Prince, C. P. Muzzillo, M. Mirzokarimov, C. A. Wolden, and L. M. Wheeler, "All-Back-Contact Perovskite Solar Cells Using Cracked Film Lithography", *ACS Applied Energy Materials* **5**, 9273–9279 (2022).
144. Q. Wei, J. M. Crawford, C. A. Wolden, and M. A. Carreon, "ZIF-21 Crystals: Its Morphology Control and Potential as an Adsorbent for Ammonia Capture", *Journal of Physical Chemistry C* **126**, 12951-12957 (2022)
143. W. H. Smith, S. A. Vaselabadi and C. A. Wolden, "Argyrodite superionic conductors fabricated from metathesis-derived Li₂S," *ACS Applied Energy Materials* **5**, 4029-4035 (2022).
142. R. Sitar, J. Shah, Z. Zhang, H. Wikoff, J. D. Way and C. A. Wolden, "Compact ammonia reforming at low temperature using catalytic membrane reactors", *Journal of Membrane Science* **644**, 120147 (2022).
141. D. L. McGott, B. Good, B. Fluegel, J. N. Duenow, C. A. Wolden and M. O. Reese, "Dual-wavelength time-resolved photoluminescence study of CdSe_xTe_{1-x} surface passivation via Mg_yZn_{1-y}O and Al₂O₃," *IEEE Journal of Photovoltaics* **12**, 309-315 (2022)
140. S. A. Vaselabadi, W. H. Smith and C. A. Wolden, "Solution synthesis of Sb₂S₃ and Na₃SbS₄ solid-state electrolyte", *Journal of the Electrochemical Society* **168**, 110533 (2021).
139. D. L. McGott, E. Colegrove, J. N. Duenow, C. A. Wolden and M. O. Reese, "Revealing the Importance of Front Interface Quality in Highly Doped CdSe_xTe_{1-x} Solar Cells," *ACS Energy Letters* 4203-4208 (2021).
138. F. Wan, L. Fang, X. Zhang, C. A. Wolden, Y. Yang, "Lithium sulfide nanocrystals as cathode materials for advanced batteries", *Journal of Energy Chemistry* accepted (2021).
137. D. L. McGott, B. Good, B. Fluegel, J. N. Duenow, C. A. Wolden, M. O. Reese, "Study of Mg_xZn_{1-x}O/CdSe_xTe_{1-x} films using dual-excitation time-resolved photoluminescence", *IEEE Journal of Photovoltaics*, accepted (2021)
136. G. Yeung, C. Reich, A. Onno, A. Bothwell, A. Danielson, Z. Holman, W. S. Sampath, and C. A. Wolden, "Robust passivation of CdSeTe based solar cells using reactively sputtered magnesium zinc oxide", *Solar Energy Materials and Solar Cells* 233, 111388 (2021).
135. J. M. Lucero, J. M. Crawford, C. A. Wolden, M. A. Carreon, "Tunability of ammonia adsorption over NaP zeolite", *Microporous and Mesoporous Materials* 324, 111288 (2021).
134. W. H. Smith, J. Birnbaum, and C. A. Wolden, "Production and purification of anhydrous sodium sulfide", *Journal of Sulfur Chemistry* **42**, 426-442 (2021).
133. D. L. McGott, C. P. Muzzillo, C. L. Perkins, J. J. Berry, K. Zhu, C. A. Wolden, M. O. Reese, "Is 3D/2D passivation a secret to success for polycrystalline thin-film solar cells?", *Joule* **5**, 1057-1073 (2021)
132. Z. Zhang, J. D. Way, C. A. Wolden, "Design and operational considerations of catalytic membrane reactors for ammonia synthesis", *AIChE Journal* **67**, e17259 (2021).
131. K. J. Prince, M. Nardone, S. P. Dunfield, G. Teeter, M. Mirzokarimov, E. L. Warren, D. T. Moore, J. J. Berry, C. A. Wolden and L. M. Wheeler, "Complementary interface formation toward high-efficiency all-back-contact perovskite solar cells", *Cell Reports Physical Sciences* **2**, 100363 (2021).
130. G. Yeung and C. A. Wolden, "Controlling conduction band alignment and carrier concentration in gallium-doped magnesium zinc oxide (GMZO) by reactive co-sputtering", *Journal of Vacuum Science & Technology A* **in press** (2021).
129. Q. Wei, J. M. Lucero, J. M. Crawford, J. D. Way, C. A. Wolden, and M. A. Carreon, "Ammonia separation from N₂ and H₂ over LTA zeolitic imidazolate framework membranes," *J. Membrane Science* **623**, 119078, (2021).

128. S.-T. B. Lundin, N. S. Patki, Z. Zhang, T. F. Fuerst, C. A. Wolden and J. D. Way, "PdAu/YSZ composite hydrogen separation membranes with enhanced stability in the presence of CO", *Journal of Membrane Science* **611**, 118371 (2020)
127. B. A. Rosales, L. E. Mundt, T. G. Allen, D. T. Moore, K. J. Prince, C. A. Wolden, G. Rumbles, L. T. Schelhas and L. M. Wheeler, "Reversible multicolor chromism in layered formamidinium metal halide perovskites", *Nature Communications* **11**, 5234 (2020).
126. Y. Samoilenko, G. Yeung, A. H. Munshi, A. Abbas, C. L. Reich, M. Walker, M. O. Reese, A. Zakutayev, J. M. Walls, W. S. Sampath and C. A. Wolden, "Stable magnesium zinc oxide by reactive co-sputtering for CdTe-based solar cells", *Solar Energy Materials and Solar Cells* **210**, 110521 (2020).
125. Y. Zhao, W. Smith and C. A. Wolden, "Scalable synthesis of Li₂S nanocrystals for solid-state electrolyte applications", *Journal of the Electrochemical Society* **167**, 070520 (2020).
124. C.-P. Li, R. C. Tenent and C. A. Wolden, "Optical and mechanical properties of nanocomposite films based on polymethyl methacrylate (PMMA) and fumed silica nanoparticles", *Polymer Engineering & Science* **60**, 553-557 (2020).
123. Z. Zhang, C. Karayaka, R. J. Kee, J. D. Way, and C. A. Wolden, "Barium-Promoted Ruthenium Catalysts on Yttria-Stabilized Zirconia Supports for Ammonia Synthesis", *ACS Sustainable Chemistry & Engineering* **7**, 18038 (2019).
122. Z. Zhang, S. Liguori, T. F. Fuerst, J. D. Way, and C. A. Wolden, "Efficient Ammonia Decomposition in a Catalytic Membrane Reactor To Enable Hydrogen Storage and Utilization", *ACS Sustainable Chemistry & Engineering* **7**, 5975 (2019).
121. Y. Zhao, Y. Yang, and C. A. Wolden, "Scalable Synthesis of Size-Controlled Li₂S Nanocrystals for Next-Generation Battery Technologies", *ACS Applied Energy Materials* **2**, 2246 (2019).
120. T. F. Fuerst, C. N. Taylor, M. Shimada, J. D. Way and C. A. Wolden, "High temperature deuterium enrichment using TiC coated vanadium membranes", *Journal of Vacuum Science & Technology A* **37** 021501 (2019).
119. T. F. Fuerst, E. P. Petsalis, J. D. Way and C. A. Wolden, "Application of TiC in vanadium based hydrogen membranes", *Industrial & Engineering Chemistry Research* **57** 16084-16094 (2018).
118. D. L. McGott, M.D. Kempe, S. Glynn, N. Bosco, T. M. Barnes, N.M. Haegel, C.A. Wolden, and M. O. Reese, "Controlled thermo-mechanical delamination and re-contacting of CdTe solar cells", *ACS Applied Materials & Interfaces* **10** 44854-44861 (2018).
117. K. Hietala, Y. Zhao, Y. Yang, and C. A. Wolden, "Scalable synthesis of alkali sulfide nanocrystals using a bubble column reactor", *Industrial & Engineering Chemistry Research* **57** 8436-8442 (2018).
116. Y. Samoilenko, A. Abbas, J. M. Walls and C. A. Wolden, "Copper-induced recrystallization and interdiffusion of CdTe/ZnTe thin films", *Journal of Vacuum Science & Technology A* **36**, 031201 (2018).
115. T. F. Fuerst, Z. Zhang, A. M. Hentges, S.-T. B. Lundin, C. A. Wolden and J. D. Way, "Fabrication and operational considerations of hydrogen permeable Mo₂C/V metal membranes and improvement with application of Pd", *Journal of Membrane Science* **549**, 559-566 (2018).
114. T. F. Fuerst, E. P. Petsalis, S.-T. B. Lundin, J. Wilcox, J. D. Way and C. A. Wolden, "Experimental and theoretical insights into the potential of V₂O₃ surface coatings for hydrogen permeable vanadium membranes", *The Journal of Physical Chemistry C* **122**, 3488-3496 (2018)
113. R. Aguirre, J. J. Chavez, J. Li, X. W. Zhou, S. F. Almeida, C. Wolden and D. Zubia, "Crystal Growth and Atom Diffusion in (Cu)ZnTe/CdTe via Molecular Dynamics", *IEEE Journal of Photovoltaics* **8**, 594-599

(2018).

112. A. Abbas, D. M. Meysing, M. O. Reese, T. M. Barnes, J.M. Walls, and C. A. Wolden, "Structural and chemical evolution of the CdS:O window layer during individual CdTe solar cell processing steps", *Solar Energy*, **59**, 940-946 (2018).
111. X. Li, Y. Zhao, A. Brennan, M. McCeig, C. A. Wolden and Y. Yang, "Reactive precipitation of anhydrous alkali sulfide nanocrystals with concomitant abatement of hydrogen sulfide and co-generation of hydrogen", *ChemSusChem* **10**, 2904–2913 (2017).
110. S.-T. B. Lundin, N. S. Patki, T. F. Fuerst, C. A. Wolden, J. D. Way, "Reduction of Mg from a MgO/MgAl₂O₄ support by atomic hydrogen permeation through thin-film Pd membrane", *Journal of Membrane Science* **541**, 312-320 (2017).
109. S.-T. B. Lundin, N. S. Patki, T. F. Fuerst, C. A. Wolden and J. D. Way, "Inhibition of hydrogen flux in palladium membranes by pressure–induced restructuring of the membrane surface", *Journal of Membrane Science* **535**, 70-78 (2017).
108. A. W. Welch, L. L. Baranowski, H. Hempel, H. Peng, R. Eichberger, T. Unold, S. Lany, C. Wolden, A. Zakutayev, "Trade-offs in thin film solar cells with layered chalcostibite photovoltaic absorbers", *Advanced Energy Materials*, **7**, 1601935 (2017).
107. C. Wolden and S. Kelkar, "Evaluation of vapor deposition techniques for membrane pore size modification", *Journal of Membrane Science and Research*, **3**, 64-70 (2017).
106. S. Uličná, J. Isherwood, P. Kaminski, J. Walls, J. Li and C. Wolden, "Development of ZnTe as a back contact material for thin film cadmium telluride solar cells", *Vacuum*, **139**, 159–163 (2017).
105. S.-T. B. Lundin, J. O. Law, N. S. Patki, C. A. Wolden and J. D. Way, "Glass frit sealing method for macroscopic defects in Pd-based composite membranes with application in catalytic membrane reactors", *Separation and Purification Technology* **172**, 68-75 (2017).
104. A. W. Welch, L. L. Baranowski, P. Zawadzki, C. DeHart, S. Johnston, S. Lany, C. A. Wolden and A. Zakutayev, "Accelerated development of CuSbS₂ thin film photovoltaic device prototypes", *Progress in Photovoltaics: Research and Applications* **24**, 929-939 (2016).
103. D. M. Meysing, M. O. Reese, C. W. Warren, A. Abbas, J. M. Burst, H. P. Mahabaduge, W. K. Metzger, J. M. Walls, M. C. Lonergan, T. M. Barnes and C. A. Wolden, "Evolution of oxygenated cadmium sulfide (CdS:O) during high-temperature CdTe solar cell fabrication", *Solar Energy Materials and Solar Cells* **157**, 276-285 (2016).
102. S.-T. B. Lundin, T. Yamaguchi, C. A. Wolden, S. T. Oyama, J. D. Way, "The role (or lack thereof) of nitrogen or ammonia adsorption-induced hydrogen flux inhibition on palladium membrane performance", *Journal of Membrane Science* **514**, 65-72 (2016).
101. C. A. Wolden, A. Abbas, J. Li, D. R. Diercks, D. M. Meysing, T. R. Ohno, J. D. Beach, T. M. Barnes and J. M. Walls, "The roles of ZnTe buffer layers on CdTe solar cell performance", *Solar Energy Materials and Solar Cells* **147**, 203-210 (2016).
100. T. F. Fuerst, M. O. Reese and C. A. Wolden, "PECVD synthesis of flexible optical coatings for renewable energy applications", *Plasma Processes and Polymers* **13**, 184-190 (2016).
99. X. Li, C. A. Wolden, C. Ban and Y. Yang, "Facile synthesis of lithium sulfide nanocrystals for use in advanced rechargeable batteries", *ACS Applied Materials & Interfaces* **7**, 28444-28451 (2015).
98. A. W. Welch, L. L. Baranowski, P. Zawadzki, S. Lany, C. A. Wolden and A. Zakutayev, "CuSbSe₂ photovoltaic devices with 3% efficiency", *Applied Physics Express* **8**, 082301 (2015).

97. X. M. Li, R. M. Yang, C. A. Wolden, and Y. Yang, "Thermodynamically favorable conversion of hydrogen sulfide to valuable products through reaction with sodium naphthalenide", *ChemPlusChem* **80**, 1508–1512 (2015).
96. A. Welch, L. Baranowski, P. Zawadzki, S. Lany, C.A. Wolden, A. Zakutayev, "CuSbSe₂ photovoltaic devices with 3% efficiency", *Applied Physics Express* **8**, 082301 (2015).
95. C. W. Warren, J. Li, C. A. Wolden, D. M. Meysing, T. M. Barnes, D. W. Miller, J.T. Heath, and M. C. Lonergan, "The effect of copper on the sub-bandgap density of states in CdTe solar cells", *Appl. Phys. Lett.* **106**, 203903 (2015).
94. H.P. Mahabaduge, W.L. Rance, J.M. Burst, M.O. Reese, D.M. Meysing, C.A. Wolden, J. Li, J.D. Beach, T.A. Gessert, W.K. Metzger, S. Garner, and T.M. Barnes, "High-efficiency, flexible CdTe solar cells on ultra-thin glass substrates", *Appl. Phys. Lett.* **106**, 133501 (2015).
93. D. M. Meysing, C. A. Wolden, M. M. Griffith, H. Mahabaduge, J. Pankow, M. O. Reese, J. M. Burst, W. L. Rance and T. M. Barnes, "Properties of reactively sputtered oxygenated cadmium sulfide (CdS:O) and their impact on CdTe solar cell performance", *J. Vac. Sci. Technol. A* **33**, 021203 (2015).
92. J. Li, D. R. Diercks, T. R. Ohno, C. W. Warren, M. C. Lonergan, J. D. Beach and C. A. Wolden, "Controlled activation of ZnTe:Cu contacted CdTe solar cells using rapid thermal processing", *Solar Energy Materials and Solar Cells* **133**, 208 (2015).
91. A. W. Welch, P. P. Zawadzki, S. Lany, C. A. Wolden and A. Zakutayev, "Self-regulated growth and tunable properties of CuSbS₂ solar absorbers", *Solar Energy Materials and Solar Cells* **132**, 499 (2015).
90. C.-P. Li, C. Engtrakul, R. C. Tenent, and C. A. Wolden, "Scalable synthesis of nanocrystalline, mesoporous tungsten oxide films with exceptional electrochromic performance", *Solar Energy Materials and Solar Cells* **132**, 6 (2015).
89. D. A. Cooney, J. D. Way, and C. A. Wolden, "A comparison of the performance and stability of Pd/BCC metal composite membranes for hydrogen purification", *Int. J. Hydrogen Energy* **39**, 19009 (2014).
88. M. O'Brien, K. Lee, R. Morrish, N. C. Berner, N. McEvoy, C. A. Wolden and G. S. Duesberg, "Plasma assisted synthesis of WS₂ for gas sensing applications", *Chem. Phys. Lett.* **615**, 6 (2014).
87. S. S. Kelkar and C. A. Wolden, "Feature scale modeling of pulsed plasma-enhanced chemical vapor deposition", *J. Vac. Sci. Technol. B* **32**, 052001 (2014).
86. R. Morrish, T. Haak and C. A. Wolden, "Low temperature synthesis of *n*-type WS₂ thin films via H₂S plasma sulfurization of WO₃", *Chem. Mater.* **26**, 3986 (2014).
85. W. L. Rance, J. M. Burst, D. M. Meysing, C. A. Wolden, M. O. Reese, T. A. Gessert, W. K. Metzger, S. Garner, P. Cimo and T. M. Barnes, "14%-efficient flexible CdTe solar cells on ultra-thin glass substrates", *Appl. Phys. Lett.* **104**, 143903 (2014).
84. A. E. Lewis, H. Zhao, H. Syed, C. A. Wolden and J. D. Way, "PdAu and PdAuAg composite membranes for hydrogen separation from synthetic water-gas shift streams containing hydrogen sulfide", *J. Membr. Sci.* **465**, 167 (2014).
83. C.-P. Li, F. Lin, R. M. Richards, C. Engtrakul, R. C. Tenent and C. A. Wolden, "The influence of sol-gel processing on the electrochromic properties of mesoporous WO₃ films produced by ultrasonic spray deposition", *Solar Energy Materials and Solar Cells* **121**, 163 (2014).
82. C. D. Sentman, M. O'Brien and C. A. Wolden, "Self-limiting deposition of pyrite absorbers by pulsed PECVD", *J. Vac. Sci. Technol. A* **32**, 021201 (2014).

81. S. K. Sahoo, R. P. Patel and C. A. Wolden, "Hybrid nanolaminate dielectrics engineered for frequency and bias stability", *J. Appl. Phys.* **114**, 074101 (2013).
80. D. M. Meysing, J. M. Burst, W. L. Rance, M. O. Reese, T. M. Barnes, T. A. Gessert and C. A. Wolden, "The influence of cadmium sulfide and contact annealing configuration on the properties of high-performance cadmium stannate", *Solar Energy Materials and Solar Cells* **117**, 300-305 (2013).
79. S. S. Kelkar, D. Chiavetta and C. A. Wolden, "Formation of octadecyltrichlorosilane (OTS) self-assembled monolayers on amorphous alumina", *Appl. Surf. Sci.* **282**, 291-296 (2013).
78. R. P. Patel and C. A. Wolden, "Defect analysis and mechanical performance of plasma-deposited thin films on flexible polycarbonate substrates", *Appl. Surf. Sci.* **268**, 416-424 (2013).
77. C. A. Wolden, K. Adeyemo, R. Vervuurt, M. Ostwal and J. D. Way, "Mechanistic studies of hydrogen transport through Mo₂C/V composite membranes", *J. Membr. Sci.* **427**, 150 (2013).
76. R. Morrish, R. Silverstein and C. A. Wolden, "Synthesis of stoichiometric FeS₂ through plasma-assisted sulfurization of Fe₂O₃ nanorods", *J. Am. Chem. Soc.* **134**, 17854 (2012).
75. C.-P. Li, F. Lin, R. M. Richards, C. Engtrakul, A. C. Dillon, R. C. Tenent and C. A. Wolden, "Ultrasonic spray deposition of high performance WO₃ films using template-assisted sol-gel chemistry", *Electrochem. Comm.* **25**, 62 (2012).
74. S. K. Sahoo, R. P. Patel and C. A. Wolden, "Leakage current mechanisms in high performance alumina-silicone nanolaminate dielectrics", *Appl. Phys. Lett.* **101**, 142903 (2012).
73. J. S. Fish, C.-P. Li, J. D. Fehribach, C. A. Wolden, R. O'Hayre, A. L. Bunge and C. E. Goodyer, "Poisson-Boltzmann model of space charge layer effects on conductivity in randomly distributed nanoionic composites", *Electrochim. Acta* **83**, 454 (2012).
72. C.-P. Li, R. C. Tenent, A. C. Dillon, R. M. Morrish and C. A. Wolden, "Improved durability of WO₃ nanocomposite films using atomic layer and vapor deposited coatings", *ECS Electrochem. Lett.* **1**, H24 (2012).
71. F. Lin, C.-P. Li, G. Chen, C. T. Robert, C. A. Wolden, D. T. Gillaspie, A. C. Dillon, R. M. Richards and C. Engtrakul, "Low-temperature ozone exposure technique to modulate the stoichiometry of WO_x nanorods and optimize the electrochromic performance", *Nanotechnology* **23**, 255601 (2012).
70. C.-P. Li, A. C. Dillon, C. A. Wolden and R. C. Tenent, "Electrochromic films produced by ultrasonic spray deposition of tungsten oxide nanoparticles", *Solar Energy Mater. Solar Cells* **99**, 50, (2012).
69. R. P. Patel, D. Chiavetta, and C. A. Wolden, "Dielectric performance of hybrid alumina-silicone nanolaminates synthesized by plasma enhanced chemical vapor deposition", *J. Vac. Sci. Technol. A* **29**, 06150 (2011).
68. S. K. Gade, S. J. Chmelka, S. Parks, J. D. Way, and C. A. Wolden, "Molybdenum carbide composite membranes for high temperature H₂ separation", *Adv. Mater.* **23**, 3585-3589 (2011).
67. C. A. Wolden, J. Kurtin, J. B. Baxter, I. Repins, S. E. Shaheen, J.T. Torvik, A. A. Rockett, V.M. Fthenakis, E. S. Aydil, Photovoltaic Manufacturing: Present Status and Future Prospects", *J. Vac. Sci. Technol. A* **29**, 030801-16 (2011). **Featured on the cover and was the most downloaded JVSTA article of 2011.**
66. R. Morrish, M. Rahman, J. M. D. MacElroy, C. A. Wolden, "Activation of hematite nanorod arrays for photoelectrochemical water splitting", *ChemSusChem*, **29**, 030801-16 (2011).

65. R. P. Patel and C. A. Wolden, "PECVD synthesis of silica-silicone nanolaminates using a single precursor", *J. Vac. Sci. Technol. A* **29**, 021012-7 (2011).
64. C. A. Wolden, A. Pickerell, T. Gawai, S. Parks, J. Hensley, and J. D. Way, "Synthesis of β -Mo₂C Thin Films", *ACS Appl. Mater. Inter.* **3**, 517-521 (2011).
63. N. G. Kubala and C. A. Wolden, "Self-limiting growth of anatase TiO₂: A comparison of two techniques", *Thin Solid Films* **518**, 6733 (2010).
62. F. Wang, N. G. Kubala, and C. A. Wolden, "Photoelectrochemical performance of anatase TiO₂ thin films deposited by self-limiting growth techniques", *J. Electrochem. Soc.* **157**, D432 (2010).
61. P. C. Rowlette and C. A. Wolden, "Pulsed plasma-enhanced chemical vapor deposition of Al₂O₃-TiO₂ nanolaminates", *Thin Solid Films* **518**, 3337 (2010).
60. P. C. Rowlette and C. A. Wolden, "Digital control of SiO₂-TiO₂ mixed metal oxides by pulsed PECVD", *ACS. Appl. Mater. Inter.* **1**, 2586 (2009).
59. N. G. Kubala, P. C. Rowlette, and C. A. Wolden, "Plasma-enhanced chemical vapor deposition of anatase TiO₂ using TiCl₄", *J. Phys. Chem. C.* **113**, 16307, (2009).
58. P. C. Rowlette, M. Canon, and C. A. Wolden, "Digital control of SiO₂ film deposition at room temperature", *J. Phys. Chem. C.* **113**, 6906, (2009).
57. N. G. Kubala, P. C. Rowlette, and C. A. Wolden, "Self-limiting deposition of anatase TiO₂ at low temperature", *Electrochem. Solid-State Lett.* **12**, H259, (2009).
56. P. C. Rowlette, C. G. Allen, O. B. Bromley, A. E. Dubetz, and C. A. Wolden, "Plasma-enhanced atomic layer deposition of semiconductor grade ZnO using dimethyl zinc", *Chem. Vap. Deposition* **15**, 15, (2009).
55. P. C. Rowlette, C. G. Allen, O. B. Bromley, and C. A. Wolden, "Self-limiting deposition of semi-conducting ZnO by pulsed PECVD", *J. Vac. Sci. Technol. A* **24**, 761 (2009).
54. M. T. Seman, P. Rowlette, and C. A. Wolden, "Enhancement of the deposition rate and quality of metal oxide films by pulsed PECVD at low frequency", *J. Vac. Sci. Technol. A* **26**, 1213 (2008).
53. M. T. Seman, D. N. Richards, P. Rowlette, and C. A. Wolden, "An analysis of the deposition mechanisms involved during self-limiting growth of aluminum oxide by pulsed PECVD", *Chem. Vap. Deposition* **14**, 296 (2008)
52. M. Seman, J. J. Robbins, D. Leohardt, S. Agarwal, C. A. Wolden "A comparison of the electrolyte performance of Ta₂O₅ films deposited by continuous wave and pulsed PECVD", *J. Electrochem. Soc.* **155**, J168 (2008).
51. S. Szymanski, P. Rowlette, and C. A. Wolden, "Self-limiting growth of aluminum oxide thin films by pulsed plasma-enhanced chemical vapor deposition system", *J. Vac. Sci. Technol. A* **26**, 1079 (2008).
50. S. F. Szymanski, M. T. Seman, and C. A. Wolden, "The effect of wall conditions on the self limiting deposition of metal oxides by pulsed plasma-enhanced chemical vapor deposition", *J. Vac. Sci. Technol. A* **25**, 1493, (2007).
49. S. Szymanski, M. Seman, and C. A. Wolden, "Plasma and gas-phase characterization of a pulsed plasma-enhanced chemical vapor deposition system engineered for self-limiting growth of aluminum oxide thin films", *Surf. Coat. Technol.* **201**, 8991 (2007).

48. M. Seman, J. J. Robbins, S. Agarwal, and C. A. Wolden, "Self-limiting growth of tantalum oxide thin films by pulsed plasma-enhanced chemical vapor deposition", *Appl. Phys. Lett.* **90**,131504 (2007).
47. W. Yang, J. Marino, A. Monson and C. A. Wolden, "Optimizing the dielectric performance of TiO₂ thin films through control of plasma-enhanced chemical vapor deposition process conditions", *J. Vac. Sci. Technol. A* **25**, 1298 (2007).
46. W. Yang, J. Marino, A. Monson and C. A. Wolden, "An investigation of annealing on the dielectric performance of TiO₂ thin films", *Semicond. Sci. Technol.* **21**, 1573 (2006).
45. W. Yang and C. A. Wolden, "Plasma-enhanced chemical vapor deposition of TiO₂ thin films for dielectric applications", *Thin Solid Films* **515**, 1708 (2006).
44. S. Kosaraju, J. A. Harvey, and C. A. Wolden, "Plasma-assisted co-evaporation of thin film semiconductors", *Vac. Technol. Coat.* **7**, 48 (2006). **(This paper was the featured story for the issue and it also graced the cover)**
43. S. Kosaraju, J. A. Marino, J. A. Harvey, and C. A. Wolden, "Plasma-assisted co-evaporation of β -indium sulfide thin films", *Sol. Energy Mater. Sol. Cells* **90**, 1121 (2006).
42. S. Kosaraju, J. A. Marino, J. A. Harvey, and C. A. Wolden, "The role of argon in plasma-assisted deposition of indium nitride", *J. Crystal Growth* **286**, 400 (2006).
41. M. Seman, J. Marino, W. Yang and C. A. Wolden, "An investigation of the role of plasma conditions on the deposition rate of electrochromic vanadium oxide thin films" *J. Non-Crystal. Solids* **351**, 1987 (2005.)
40. S. Kosaraju, I. Repins and C. A. Wolden, "Formation of chalcogen containing plasmas and their use in the synthesis of photovoltaic absorbers", *J. Vac. Sci. Technol. A*, **23**, 1202 (2005).
39. T. M. Barnes, C. Fry, K. Olson, and C. A. Wolden, "On the formation and stability of p-type conductivity in nitrogen doped zinc oxide", *Appl. Phys. Lett.*, **86**, 112112 (2005).
38. C. A. Wolden, T. M. Barnes, J. B. Baxter, and E. S. Aydil, "Real time measurement of hydrogen generated free carriers in polycrystalline ZnO thin films at room temperature", *J. Appl. Phys.* **97**, 043522 (2005).
37. T. M. Barnes, J. Leaf, C. Fry, and C. A. Wolden, "Room temperature chemical vapor deposition of c-axis ZnO", *J. Crystal Growth* **274**, 412 (2005).
36. C. A. Wolden, "The role of oxygen dissociation in plasma enhanced chemical vapor deposition of zinc oxide from oxygen and diethyl zinc", *Plasma Chem. Plasma Process.* **25**, 169 (2005).
35. J. J. Robbins, J. Harvey, J. Leaf, C. Fry, and C. A. Wolden, "Transport phenomena in high performance nanocrystalline ZnO:Ga films", *Thin Solid Films* **473**, 35 (2005).
34. T. M. Barnes, J. Leaf, S. Hand, C. Fry, and C. A. Wolden, "A comparison of plasma-activated N₂/O₂ and N₂O/O₂ mixtures for use in ZnO:N synthesis by chemical vapor deposition", *J. Appl. Phys.* **96**, 7036, (2004).
33. T. M. Barnes, S. Hand, J. Leaf, and C. A. Wolden, "ZnO synthesis by high vacuum plasma-assisted chemical vapor deposition using dimethylzinc and atomic oxygen", *J. Vac. Sci. Technol. A* **22**, 2118 (2004).
32. J. M. Kestner, S. McElvain, S. Kelly, L. M. Woods, T. R. Ohno, and C. A. Wolden, "An experimental and modeling analysis of vapor transport deposition of cadmium telluride", *Sol. Energy Mater. Sol. Cells* **83**, 55 (2004).
31. M. Seman and C. A. Wolden, "Characterization of ion diffusion and transient electrochromic performance in PECVD grown tungsten oxide thin films", *Sol. Energy Mater. Sol. Cells* **82**, 517 (2004).

30. J. J. Robbins, C. Fry, and C. A. Wolden, "An interrogation of the zinc oxide-gallium oxide phase space by plasma-enhanced chemical vapor deposition", *J. Cryst. Growth* **263**, 283 (2004).
29. J. J. Robbins and C. A. Wolden, "High mobility oxides: engineered structures to overcome intrinsic performance limitations", *Appl. Phys. Lett.* **83**, 3933 (2003).
28. M. Seman and C. A. Wolden, "An investigation of the role of plasma conditions on the deposition rate and electrochromic performance of tungsten oxide thin films", *J. Vac. Sci. Technol. A* **21**, 1927 (2003).
27. J. J. Robbins, J. Esteban, C. Fry, and C. A. Wolden, "An investigation of the plasma chemistry involved in the synthesis of ZnO by plasma-enhanced chemical vapor deposition", *J. Electrochem. Soc.*, **150**, C693 (2003).
26. J. Zhou and C. A. Wolden, "Modeling and measurement of film deposition in a one-dimensional hot-wire CVD system", *Thin Solid Films*, **430**, 28 (2003).
25. J. Zhou, T. R. Ohno, and C. A. Wolden, "The high temperature stability of nichrome in reactive environments", *J. Vac. Sci. Technol. A* **21**, 756 (2003).
24. J. J. Robbins, R. T. Alexander, W. Xiao, T. L. Vincent and C. A. Wolden, "An investigation of tin oxide PECVD using optical emission spectroscopy", *Thin Solid Films* **406**, 145 (2002).
23. J. J. Robbins, R. T. Alexander, M. Bai, Y.-J. Huang, T. L. Vincent, and C. A. Wolden, "Development of tin oxide synthesis by plasma-enhanced chemical vapor deposition", *J. Vac. Sci. Technol. A* **19**, 2762 (2001).
22. J. Zhou and C. A. Wolden, "A numerical and experimental investigation of the influence of mass transfer on HF/H₂O vapor-phase etching of silicon dioxide", *J. Electrochem. Soc.*, **147** 4142 (2000).
21. S. K. Han, M. T. McClure, C. A. Wolden, B. Vlahovic, A. Soldi, and Z. Sitar, "Fabrication and testing of a microstrip particle detector based on highly oriented diamond films", *Diamond Relat. Mater.* **9**, 1008-1012 (2000).
20. R. J. Kee, W.-H. Yang, L. L. Raja, and C. A. Wolden, "The influence of pressure, fluid flow, and chemistry on the combustion-based oxidation of silicon", *Twenty-Eighth Symposium (International) on Combustion* **28**, 1381 (2000).
19. C. A. Wolden, C. E. Draper, Z. Sitar, and J. T. Prater, "The influences of reactant composition and substrate material on the combustion synthesis of diamond", *J. Mater. Res.* **14**, 259 (1999).
18. W. Liu, P. C. Yang, C. A. Wolden, R. F. Davis, J. T. Prater, and Z. Sitar, "Transmission electron microscopy analysis of the oriented diamond growth on nickel substrates", *J. Appl. Phys.* **83**, 7658 (1998).
17. C. A. Wolden, C. E. Draper, Z. Sitar, and J. T. Prater, "The influence of nitrogen on the morphology, growth rate, and Raman spectra of combustion grown diamond", *Diamond Relat. Mater.* **7**, 1178 (1998).
16. C. A. Wolden, R. F. Davis, Z. Sitar, and J. T. Prater, "Flat flame diamond CVD: The effect of pressure and operating conditions for specific applications", *Diamond Relat. Mater.* **7**, 133 (1998).
15. P. C. Yang, W. Liu, R. Schlessner, C. A. Wolden, R. F. Davis, J. T. Prater, and Z. Sitar, "Surface melting in the heteroepitaxial nucleation of diamond on Ni", *J. Cryst. Growth* **187**, 81 (1998).
14. P. C. Yang, C. A. Wolden, W. Liu, R. Schlessner, R. F. Davis, J. T. Prater, and Z. Sitar, "Coalesced diamond films on nickel", *J. Mater. Res.* **13**, 1120 (1998).
13. Z. Sitar, W. Liu, P. C. Yang, C. A. Wolden, R. Schlessner, and J. T. Prater, "Heteroepitaxial nucleation of diamond on nickel", *Diamond Relat. Mater.* **7**, 276 (1998).

12. C. A. Wolden, S. K. Han, M. T. McClure, Z. Sitar, and J. T. Prater, "Highly oriented diamond deposited with a low pressure flat flame", *Mater. Lett.* **32**, 9 (1997). (**article featured on the cover**)
11. C. A. Wolden, R. F. Davis, Z. Sitar, and J. T. Prater, "In-situ mass spectrometry during diamond chemical vapor deposition using a low pressure flat flame", *J. Mater. Res.* **70**, 2733 (1997).
10. C. A. Wolden, R. F. Davis, Z. Sitar, and J. T. Prater, "Low temperature deposition of optically transparent diamond using a low pressure flat flame", *Diamond Relat. Mater.* **6**, 1862 (1997).
9. S. A. Smith, C. A. Wolden, M. D. Bremser, A. D. Hanser, R. F. Davis, and W. V. Lampert, "High rate and selective etching of GaN, AlGaIn, and AlN using an inductively coupled plasma", *Appl. Phys. Lett.* **71**, 3631 (1997).
8. P. C. Yang, R. Schlessler, C. A. Wolden, W. Liu, R. F. Davis, J. T. Prater, and Z. Sitar, "Control of diamond heteroepitaxy on nickel by optical reflectance", *Appl. Phys. Lett.* **70**, 2960 (1997).
7. "Textured diamond growth by low pressure combustion chemical vapor deposition", C. A. Wolden, Z. Sitar, R. F. Davis, and J. T. Prater, *Appl. Phys. Lett.* **69**, 2258 (1996).
6. C. A. Wolden and K. K. Gleason, "On the pressure limits of diamond chemical vapor deposition", *Diamond Relat. Mater.* **5**, 1503 (1996).
5. C. A. Wolden, K. K. Gleason, and J. B. Howard, "A reduced reaction mechanism for diamond deposition modeling", *Combust. Flame* **96**, 75 (1994).
4. C. A. Wolden and K. K. Gleason, "Heterogeneous formation of atomic hydrogen in hot-filament diamond deposition", *Appl. Phys. Lett.* **62**, 2329 (1994).
3. C. A. Wolden and K. K. Gleason, "Impact of transport phenomena on hot-filament reactor design", *Proc. Electrochem. Soc.* **93**, 236 (1993).
2. C. A. Wolden, S. Mitra, and K. K. Gleason, "Radiative heat transfer in hot-filament diamond reactors", *J. Appl. Phys.* **72**, 3750 (1992).
1. E Favre, P Peringer, C Wolden, YS Kyung, WS, Hu, "Retention of animal cells in a rotating cage bioreactor: A mechanistic study", *Trends in Animal Cell Culture Technology*, pp. 127-132. (1990).

Conference Proceedings and Book Chapters

54. B. A. Rosales, J. Kim, V. M. Wheeler, L. E. Crowe, K. Prince, M. Mirzokarimov, T. Daligault, A. Duell, C. A. Wolden, L. T. Schelhas, and L. M. Wheeler, "Thermochromic Metal Halide Perovskite Windows with Ideal Transition Temperatures," *arXiv: Applied Physics* (2022). 10.48550/arxiv.2211.03028
53. D. L. McGott, B. Good, B. Fluegel, J. N. Duenow, C. A. Wolden and M. O. Reese, "Carrier lifetime as a function of Se content for CdSe_xTe_{1-x} films grown on Al₂O₃ and MgZnO," in *2021 IEEE 48th Photovoltaic Specialists Conference (PVSC)*, 2021, pp. 1301-1303.
52. C. Reich, G. Yeung, A. Onno, A. Danielson, Z. C. Holman, C. Wolden and W. Sampath, "Photoluminescence Study of the Mg_xZn_{1-x}O/CdSe_yTe_{1-y} Interface: The Effect of Oxide Bandgap and Resulting Band Alignment," in *2021 IEEE 48th Photovoltaic Specialists Conference (PVSC)*, 2021, pp. 1468-1471
51. Y. Samoilenko, G. Yeung, A. Zakutayev, M. O. Reese and C. A. Wolden, "Combinatorial study of MZO emitters for CdTe-based solar cells," in *46th IEEE Photovoltaic Specialists Conference (PVSC)*, 2019, pp. 2498-2502.
50. Y. Samoilenko and C. A. Wolden, "Exploration of copper-free ZnTe buffer layers for CdTe-based solar cells," in *7th World Conference on Photovoltaic Energy Conversion (WCPEC)*, 2018, pp. 3040-3043.

49. D. L. McGott, C. A. Wolden and M. O. Reese, "Mitigation of Crack Formation During Thermo-Mechanical Delamination of CdTe Solar Cells," in *7th World Conference on Photovoltaic Energy Conversion (WCPEC)*, 2018, pp. 0838-0841.
48. C. Wolden and D. Way, "Saving the World through Fertiliser and Fuel". Scientia. Available: <http://www.scientia.global/professor-colin-wolden-professor-douglas-way-saving-the-world-through-fertiliser-and-fuel/>, (2018).
47. Y. Samoilenko and C. A. Wolden, "Stability of Cd_{1-x}Zn_xTe alloys under CdTe processing conditions" in *44th IEEE Photovoltaic Specialist Conference (PVSC)*, 2017, pp. 1697-1700.
46. D. Clayton-Warwick, M. D. Kempe1, M. S. Dabney, T. M. Barnes, C. A. Wolden, M. O. Reese, "Decoupling thin film CdTe growth from packaging: Toward record specific power in low cost polycrystalline PV" in *Proceedings of the 44th Photovoltaic Specialists Conference*, (2017).
45. S.-T. B. Lundin, N. S. Patki, T. F. Fuerst, S. Ricote, C. A. Wolden and J. D. Way, "Chapter 7 - Dense Inorganic Membranes for Hydrogen Separation " in *Membranes for Gas Separations*, C. Chin, Ed., ed: World Scientific, 2017, pp. 271-364.
44. A. Zakutayev, A. W. Welch, L. Baranowski, F. W. S. Lucas, E. Toberer, and C. A. Wolden, " Comparison of chalcostibite and chalcopyrite photovoltaic devices," in *Proceedings of the 43rd Photovoltaic Specialists Conference*, Portland, OR, 2016.
43. J. Li, J. R. Trevithick, T. R. Ohno, J. D. Beach and C. A. Wolden, "CdTe solar cells employing CdS_{1-y}Te_y window layers," in *Proceedings of the 43rd Photovoltaic Specialists Conference*, Portland, OR, 2016.
42. J. Trevithick, J. Li, T. R. Ohno and C. A. Wolden, "Activation of CdTe solar cells using molecular chlorine " in *Proceedings of the 43rd Photovoltaic Specialists Conference*, Portland, OR, 2016.
41. J. Li, T. R. Ohno, J. D. Beach and C. A. Wolden, "The impact of different metallization layers on CdTe Solar Cells contacted with ZnTe:Cu buffer layers," in *Proceedings of the 43rd Photovoltaic Specialists Conference*, Portland, OR, 2016.
40. B. Berland, R. Hollingsworth, N. Gomez, W. Rance, and C. Wolden, "Roll to Roll Processing of Thin Flexible Energy Devices", in *Proceedings of the 58th Technical Conference of the Society of Vacuum Coaters*, (2015).
39. A. Abbas, D. M. Meysing, J. Li, J.D. Beach, T. M. Barnes, J.M. Walls, and C. A. Wolden, "Structural and Chemical Characterization of the Back Contact Region in High Efficiency CdTe Solar Cells", in *Proceedings of the 42th IEEE Photovoltaic Specialists Conference*, pp. 1-6 (2015).
38. D.M. Meysing, M.O. Reese, J.M. Burst, H. Mahabaduge, W.K. Metzger, T.M. Barnes, C.A. Wolden, "Chemical and Mechanical Techniques Enabling Direct Characterization of CdS/CdTe Heterojunction Region in Completed Devices", in *Proceedings of the 42th IEEE Photovoltaic Specialists Conference*, pp. 1-6 (2015).
37. A. W. Welch, L. L. Baranowski, F. W. de. Souza Lucas, E. S. Toberer, C. A. Wolden and A. Zakutayev, "Copper antimony chalalcogenide thin film PV device development", in *Proceedings of the 42th IEEE Photovoltaic Specialists Conference*, pp. 1-4 (2015).
36. S. K. Sahoo, R. P. Patel, and C. A. Wolden, "Temperature Dependent Electrical and Dielectrics Properties of Metal-Insulator-Metal Capacitors with Alumina-Silicone Nanolaminate Films", *Mater. Res. Soc. Symp. Proc.* **1675**, RR3.16 (2014).
35. Z. Pan, D. Whyte, S. H. Morgan, J. Li, A. Alasward, J. D. Beach, T. R. Ohno and C. A. Wolden, "Enhanced near-infrared response of CdS/CdTe solar cell using Tm³⁺ and Yb³⁺ co-doped upconverting glass phosphors," in *Proc. SPIE 9178, Next Generation Technologies for Solar Energy Conversion V*, p. 91780Q, (2014).

34. A. Zakutayev, L. L. Baranowski, A. W. Welch, C. A. Wolden and E. S. Toberer, "Comparison of Cu-Sn-S and Cu-Sb-S as potential solar cell absorbers," in *Proceedings of the 40th IEEE Photovoltaic Specialists Conference*, pp. 2436-2438, Denver, CO, 2014.
33. D. M. Meysing, M. G. Griffith, M. O. Reese, J. M. Burst, W. L. Rance, W. K. Metzger, C. A. Wolden and T. M. Barnes, "Properties of oxygenated cadmium sulfide (CdS:O) and their impact on CdTe device performance," in *40th IEEE Photovoltaic Specialists Conference*, Denver, CO, 2014, Paper 279.
32. J. Li, J. D. Beach and C. A. Wolden, "Rapid thermal processing of ZnTe:Cu contacted CdTe solar cells," in *40th IEEE Photovoltaic Specialists Conference*, pp. 0085-0089 Denver, CO, (2014).
31. D. R. Diercks, J. Li, J. D. Beach, C. A. Wolden and B. P. Gorman, "Atom probe tomography for nanoscale characterization of CdTe device absorber layers and interfaces," in *40th IEEE Photovoltaic Specialists Conference*, Denver, CO 2014, p. Paper 48.
30. J. M. Burst, W. L. Rance, D. M. Meysing, C. A. Wolden, W. K. Metzger, S. M. Garner and P. Cimo, "Performance of transparent conductors on flexible glass and plastic substrates for thin film photovoltaics," in *40th IEEE Photovoltaic Specialists Conference*, Denver, CO, 2014, Paper 352.
29. T. M. Barnes, W. L. Rance, J. M. Burst, M. O. Reese, D. M. Meysing, C. A. Wolden, J. Li, J. D. Beach, T. A. Gessert, S. M. Garner, P. Cimo and W. K. Metzger, "High Efficiency Flexible CdTe Superstrate Devices," in *40th IEEE Photovoltaic Specialists Conference*, Denver, CO, 2014, Paper 642.
28. S. K. Sahoo, H. Bakhru, S. Kumar, D. Misra, C. A. Wolden, Y.N. Mohapatra, D. C. Agrawal , "Carrier Transport Mechanisms in Metal-Insulator–Metal Au/Ba0. 8Sr0. 2TiO3/ZrO2/Ba0. 8Sr0. 2TiO3/Pt Thin Film Heterostructures", *Mater. Res. Soc. Symp. Proc.* **1507**, mrsf12-1507-aa12-16
27. S. K. Sahoo, H. Bakhru, S. Kumar, D. Misra, C. A. Wolden, Y.N. Mohapatra, D. C. Agrawal , "Field Dependent Carrier Transport Mechanisms in Metal-Insulator–Metal Devices with Ba0. 8Sr0. 2TiO3/ZrO2 Heterostructured Thin Films as the Dielectric", *Mater. Res. Soc. Symp. Proc.* **1547**, mrss13-1547-m12-12.
26. S. K. Sahoo, R. P. Patel, and C. A. Wolden "Field dependent electrical conduction in metal-insulator-metal devices using alumina-silicone nanolaminate dielectrics", *Mater. Res. Soc. Symp. Proc.* **1547**, mrss13-1547-m07-18 (2013).
25. C. A. Wolden, "Self-limiting growth of metal oxide thin films using pulsed PECVD", *Society of Vacuum Coaters 52nd Annual Technical Conference Proceedings*, (Society of Vacuum Coaters, 2009), p. 3 – 8.
24. *Fundamental Gas-Phase and Surface Chemistry of Vapor Phase Materials Processing 3*, Eds. M. T. Swihart, D. G. Goodwin, R. Schmid, M. Sugiyama, and C. Wolden, ECStranactions, **2**, (2007).
23. J. Kestner, S. McElvain, C. A. Wolden, T. Ohno and L. Woods, "Temperature dependence of growth rate and morphology of vapor transport deposited CdTe thin films", *Mater. Res. Soc. Symp. Proc.*, **763**, B5.22.1 (2003).
22. S. Kosaraju, I. Repins and C. A. Wolden, "Development of plasma-assisted processing for selenization and sulfurization of absorber layers", *Mater. Res. Soc. Symp. Proc.*, **763**, B8.19.1 (2003).
21. C. A. Wolden, C. Fry, and J. J. Robbins, "Combinatorial synthesis of conducting oxides by plasma-enhanced chemical vapor deposition", *Proceedings of the 16th International Symposium on Plasma Chemistry*, (Taormina, Italy), (June, 2003) CD-ROM.
20. J. Robbins, W. Xiao, T. Vincent, and C. A. Wolden, "Advances in PECVD Synthesis of Transparent Conducting Oxides" *Proceedings of the 2002 NSF Design and Manufacturing Research Conference* (Society of Manufacturing Engineers, 2002) p.1988–1991, CD-ROM.

19. C. A. Wolden, "Combustion Synthesis of Diamond", Chapter 8 of the *Diamond Films Handbook* (Eds. J. Asmussen and D. Reinhard) Marcel-Dekker, New York, (2002) p. 303-323.
18. J. M. Kestner, A. Chorney, J. J. Robbins, Y.-j.Huang, T. L. Vincent, C. A. Wolden, and L. Woods, "Synthesis of electronic oxides for solar energy applications", *Mater. Res. Soc. Symp. Proc.*, **730**, V3.2.1 (2002).
17. J. Zhou, A. Overmeyer, and C. A. Wolden, "Evaluating the contributions of both catalytic and thermal chemistry in hot-wire chemical vapor deposition", *Proc. Electrochem. Soc.*, **2001-13**, 92 (2001).
16. J. J. Robbins, Y.-J.Huang, M. Bai, T. Vincent, and C. A. Wolden, "An X-ray diffraction investigation of tin oxide deposition and annealing", *Mater. Res. Soc. Symp. Proc.* **666**, F1.7.1 - F1.7.6 (2001).
15. W. Xiao, J. Robbins, C. A. Wolden, and T. Vincent, "Development of optical diagnostics for real time control of tin oxide PECVD", *Proceedings of the 2001 NSF Design and Manufacturing Research Conference* (Society of Manufacturing Engineers, 2001) CD-ROM .
14. P. Meyers, L. Woods, J. Kestner, C. Wolden, L. Raja, R. Kee, V. Kadanov, T. Ohno, E. Mateeva, R. Matson, B. Keyes, S. Johnston, and A. Fahrenbruch, "Microscopic characterization of polycrystalline APCVD CdTe thin film PV devices", *Mater. Res. Soc. Symp. Proc.*, **666**, H6.5.1 (2001).
13. P. V. Meyers, C. A. Wolden, J. Kestner, L. Raja, and R. J. Kee, "Atmospheric pressure chemical vapor deposition of CdTe Films", *2000 NCPV Photovoltaics Program Review*, (Eds. M. Al-Jassim, J. P. Thorthon and J. M. Gee), American Institute of Physics, Woodbury, NY, pp. 269-270 (2000).
12. J. M. Kestner, C. A. Wolden, P. V. Meyers, L. Raja, and R. J. Kee, "Atmospheric pressure chemical vapor deposition of CdTe films – First PV devices", in *Proceedings of the 28th IEEE Photovoltaic Specialists Conference*, p. 595-598. (2000).
11. J. J. Robbins, T. Vincent, and C. A. Wolden, "Plasma-enhanced chemical vapor deposition of tin oxide thin films", *Proceedings of the 2000 NSF Design and Manufacturing Research Conference* (Society of Manufacturing Engineers, 2000) CD-ROM.
10. A. Al-Kaoud, T. Wen, A. Gilmore, V. Kaydanov, T. R. Ohno, C. A. Wolden, L. Feng, J. Xi, "Atmospheric pressure chemical vapor deposition of SnO₂: Processing and properties", *NCPV Photovoltaics Program Review*, (Eds. M. Al-Jassim, J. P. Thorthon and J. M. Gee), American Institute of Physics, Woodbury, NY (1999) p. 212-217.
9. Y. Mahathongdy, D. S. Albin, C. A. Wolden, and R. B. Baldwin, "Vapor CdCl₂–optimization and screening experiments for an all dry chloride treatment of CdS/CdTe Solar Cells", in *NCPV Photovoltaics Program Review*, (Eds. M. Al-Jassim, J. P. Thorthon and J. M. Gee), American Institute of Physics CP462, Woodbury, NY (1999) p. 236-241.
8. P. V. Meyers, R. J. Kee, L. Raja, M. Aire and C. A. Wolden, "Atmospheric pressure chemical vapor deposition of CdTe – Reactor design considerations", in *NCPV Photovoltaics Program Review*, (Eds. M. Al-Jassim, J. P. Thorthon and J. M. Gee), American Institute of Physics CP462, Woodbury, NY (1999) p. 218-223.
7. C. A. Wolden, Z. Sitar, and R. F. Davis, "Combustion Flame Deposition of Diamond", Chapter 3 of *Low Pressure Synthetic Diamond: Manufacturing and Applications* (Eds. B. Dischler and C. Wild) Springer-Verlag, Heidelberg, (1998) p. 41-57.
6. A. D. Hanser, C. A. Wolden, W. G. Perry, T. Zheleva, E. P. Carlson, P. Hartlieb, and R. F. Davis "Diluent gas effects on properties of AlN and GaN thin films grown by metalorganic vapor phase epitaxy on a(6H)-SiC substrates", *Mater. Res. Soc. Symp. Proc.* **482**, 149 (1998).

5. S. A. Smith, C. A. Wolden, M. D. Bremser, A. D. Hanser, R. F. Davis, and W. V. Lampert, "Selective and non-selective etching of GaN, (Al,Ga)N, and AlN using an inductively coupled plasma", *Inst. Phys. Conf. Ser.* **156**, 349 (1998).
4. Z. Sitar, P. C. Yang, W. Liu, R. Schlessner, C. A. Wolden, and J. T. Prater, "Novel approaches to heteroepitaxial nucleation of diamond on nickel", *Proceedings of the 4th NIRIM International Symposium on Advanced Materials*, (1997) p. 7.
3. "TEM analysis of the phases observed during the growth of oriented diamond on nickel", W. Liu, P. C. Yang, C. A. Wolden, Z. Sitar, R. F. Davis, and J. T. Prater, *Mater. Res. Soc. Symp. Proc.* **423**, 457 (1996).
2. P. Yang, W. Liu, C. A. Wolden, Z. Sitar, R. F. Davis, and J. T. Prater, "Nucleation and growth of oriented diamond on nickel substrates", *Mater. Res. Soc. Symp. Proc.* **423**, 281 (1996).
1. C. A. Wolden, G. Zau, W. T. Conner, H. H. Sawin and K. K. Gleason, "A novel molecular beam reactor for the study of diamond surface chemistry", *Mater. Res. Soc. Symp. Proc.* **334**, 123 (1994).

SELECTED INVITED & AWARD-WINNING PRESENTATIONS

- 2025 **Invited Presentation** – DOE Tritium Focus Group, Devens, MA "Direct Internal Recycling Using Palladium Alloy Metal Foil Pumps", C.A. Wolden, 5/14/25.
- 2024 **Invited Presentation** – Renewable Hydrogen Storage and Transport Conference, Los Angeles, CA, "Ammonia as a vector for distributed delivery of UHP hydrogen and clean combustion mixtures", C. A. Wolden, 3/12/24.
- 2023 **Invited Presentation** – Albemarle Lithium, Kings Mountain, NC, "Scalable Synthesis of Metal Sulfide Nanocrystals for Electrochemical Storage Applications", C. A. Wolden, 5/25/23.
- 2023 **Invited Presentation** – Hydrogen Powered Future, University of Oklahoma, "The ongoing saga of Haber & Bosch: Scientists who saved the world, accelerated global warming, and may contribute to climate restoration", C. A. Wolden, 4/28/04.
- 2021 European MRS Meeting, Virtual, D. McGott, "Is 3D/2D passivation a secret to success for polycrystalline thin-film solar cells?", 6/2/21. **Deborah McGott won the Young Researcher Award with this presentation**
- 2021 **Invited Presentation** –Texas Tech University, "The Role of Ammonia in Enabling H₂@Scale", C. A. Wolden, 10/15/21.
- 2019 **Invited Presentation** – Future Leaders in Chemical Engineering, North Carolina State University, "Combinatorial Synthesis of Mg_xZn_{1-x}O (MZO) Thin Films for CdTe Solar Cells", G. Yeung, Y. Samoilenko, and C.A. Wolden, 10/21/19. **Gavin Yeung selected to attend this prestigious conference for undergraduate researchers.**
- 2019 **Invited Presentation** – ARPA-E Fusion Workshop, San Francisco "Advanced Membrane Technologies to Enable an Efficient Tritium Fuel Cycle", C. A. Wolden, 8/13/19.
- 2019 **Invited Presentation** – Posters on the Hill, Washington, D.C., K. Hietala, Y. Zhao, W. Smith, and C. A. Wolden, "Scalable Synthesis of Alkali Sulfide Nanocrystals Using a Bubble Column Reactor", 5/1/19. **Kristen Hietala one of 60 undergraduates from around the country who were chosen for this prestigious opportunity. Among these she was one of two students selected to receive the Excellence in Engineering award and \$500 from IEEE.**
- 2018 **Invited Presentation** – IOP Advances in Photovoltaics, Loughborough, UK "Advances in Thin Film CdTe-based Solar Cells", C. A. Wolden, 9/18/18.

- 2017 **Invited Presentation** – South Dakota School of Mines, Department of Chemical and Biological Engineering, Rapid City, SD “*Green Manufacturing of Alkali Sulfide Nanocrystals for Next Generation Batteries*”, C. A. Wolden, 11/7/17
- 2017 **Invited Presentation** – 2017 AIChE Meeting, Minneapolis, MN “*Reactive precipitation of anhydrous alkali sulfide nanocrystals with concomitant abatement of hydrogen sulfide and co-generation of hydrogen*”, C. A. Wolden, 11/1/17.
- 2017 **Invited Presentation** - 44th International Conference on Metallurgical Coatings and Thin Films (ICMCTF), San Diego, CA “*Accelerated development of CuSb(S, Se)₂ thin film photovoltaics*”, C. A. Wolden, 4/24/17.
- 2016 **Invited Presentation** - University of Utah, Department of Materials Science and Engineering, Salt Lake City, UT “*The Evolution of Advanced Front Contacts during CdTe Solar Cell Fabrication*”, C. A. Wolden, 4/6/16.
- 2016 **Invited Presentation** - University of New Mexico, Department of Chemical and Biological Engineering, Albuquerque, NM “*The Role of Oxygenated Cadmium Sulfide Window Layers on High Efficiency CdTe Solar Cells*”, C. A. Wolden, 1/27/16.
- 2015 **Invited Presentation** - 8th Sino-US Joint Conference of Chemical Engineering, Shanghai, China, “*Development of Earth Abundant Membrane Reactors for Energy Efficient Chemical Processing*”, C. A. Wolden, 10/13/15
- 2014 **Invited Presentation** - 47th Meeting of the Korean Vacuum Society, Goseong-gun, South Korea, “*Interface Engineering of Advanced Contacts for High Efficiency CdTe Solar Cells*” C. A. Wolden, 8/18/14.
- 2013 **Invited Presentation** - 2013 Spring MRS Meeting, San Francisco, CA, “*Solution-phase Routes to Cost Reduction for Smart Windows*”, C.-P. Li, F. Lin, D. Alie, C. Engtrakul, C. A. Wolden, R. M. Richards, S. Shaheen, R. C. Tenent, 4/3/13.
- 2013 **Invited Presentation** - 9th World Congress of Chemical Engineering, Seoul, Korea, “*Nanoscale control of film thickness, composition, and conformality using plasma-enhanced chemical vapor deposition*”, C. A. Wolden, 8/21/13.
- 2012 Rocky Mountain AVS Symposium, Westminster, CO, “*Fabrication and surface functionalization of asymmetric nanopore arrays*”, S. Kelkar, R. Patel, D. Chiavetta, S. Retterer, and C. A. Wolden, 9/20/12. **Sanket Kelkar won first place in the Graduate Student Poster competition, \$500 Prize.**
- 2012 **Invited Keynote** - “*Nanocomposite smart windows for energy efficient buildings*”, C. A. Wolden, Smart Surfaces 2012, Dublin, Ireland, 3/9/12.
- 2012 **Invited Presentation** - “*Non-equilibrium Processing of CdTe Absorbers*”, C. A. Wolden, Bay Area PV Consortium Annual Meeting, Berkeley, CA, 10/2/12.
- 2011 **Invited Plenary Address** – XVI International Workshop on the Physics of Semiconductor Devices, IIT-Kanpur, India, “*Photovoltaic Manufacturing, Present Status, Future Prospects & Research Needs*”, C. A. Wolden, 12/22/11.
- 2011 **Invited Presentation** - Kansas State University, Manhattan, KS, “*Carbide Composite Membranes for Hydrogen Purification*”, C. A. Wolden, 11/8/11.
- 2011 **Invited Presentation** - 58th AVS Symposium, Nashville, TN, “*Plasma Deposition of Carbide-Based Composite Membranes for Hydrogen Purification*”, C. A. Wolden, 11/3/11.
- 2011 **Invited Presentation** - CU Materials & Nanoscience Seminar, “*Activation of Hematite Nanorod Arrays for Photoelectrochemical Water Splitting*”, C. A. Wolden, 2/12/11.

- 2010 Student Poster Session, Rocky Mountain AVS, “Carburization of Molybdenum (VI) Oxide for Synthesis of Mixed Alcohols from Syngas”, A. Pickerell, J. Hensley, J. D. Way, and C. A. Wolden, 9/10. **Anna was awarded best Poster and \$500 prize.**
- 2009 56th AVS International Symposium, San Jose, CA, “Room Temperature Synthesis of Silica and SiO₂-TiO₂ Composites for use as Barrier and Anti-Reflection Coatings”, P. C. Rowlette and C. A. Wolden, 11/09. **Pieter Rowlette won the Thin Film Division Graduate Student Award with this presentation.**
- 2009 RM-AVS Graduate Poster Competition, Westminster, CO: “Self-Limiting Deposition of Anatase TiO₂ for Photocatalytic Applications”, N. G. Kubala, F. Wang,, and C. A. Wolden, 9/09. **Nick Kubala won first place and a \$500 cash award.**
- 2009 RM-AVS Graduate Poster Competition, Westminster, CO: “Nanoscale Engineering of Mixed Metal Oxide Thin Films for Electronic and Solar Applications”, P. C. Rowlette, M. Canon, and C. A. Wolden, 4/09. **Pieter Rowlette won second place and a \$250 cash award.**
- 2009 **Invited Presentation** - Society of Vacuum Coaters TechCon, Santa Clara, CA “Fundamental Understanding of Pulsed PECVD Through Diagnostics and Modeling”, Colin A. Wolden, 5/09.
- 2009 **Invited Presentation** - Department of Chemical and Biological Engineering, University of Connecticut, “Nanoscale Engineering of Mesoscopic Structures”, Colin A. Wolden, 2/09.
- 2008 **Invited Presentation** - Department of Chemical and Biological Engineering, Drexel University, “Nanoscale Engineering of Mesoscopic Structures”, Colin A. Wolden, 10/08.
- 2008 **Invited Presentation** - 2008 AIChE Annual Meeting, Philadelphia, PA, “Applying Lessons Learned from an Etching Lab: The Roll of O Atoms in PECVD”, C. A. Wolden, 11/08. Special symposium honoring the distinguished career of Professor Herb Sawin.
- 2008 **Invited Participant** – Scientific Challenges in Solar Energy Conversion and Storage Workshop, Sponsored by the Institute for Mathematics and Its Applications, Minneapolis, MN. 11/1/08.
- 2008 **Invited Presentation** - Department of Chemical and Biological Engineering, Drexel University, “Nanoscale Engineering of Mesoscopic Structures”, C. A. Wolden, 10/08.
- 2008 **Invited Presentation** - Eindhoven Technical University, Dept. of Applied Physics, “Self-Limiting Synthesis of Metal Oxide Thin Films by Pulsed PECVD,” C. A. Wolden, 1/08.
- 2007 54th AVS International Symposium, Seattle, WA, “Engineering Plasma-Enhanced Chemical Vapor Deposition to Deliver Self-Limiting Deposition of Metal Oxide Thin Films”, M. T. Seman, S. Agarwal, J. J. Robbins and C. A. Wolden, 10/07. **(Michael T. Seman received the AVS Graduate Research Award with this presentation.)**
- 2006 **Invited Presentation** - Applied Materials, Santa Clara, CA, “Formation of Chalcogen Containing Plasmas and Their Use in the Synthesis of Thin Film Photovoltaic Absorbers”, C. A. Wolden, 9/06.
- 2006 **Invited Presentation** - Applied Materials, Santa Clara, CA, “PECVD Synthesis of Metal Oxides: Precursors, Plasma Chemistry, and Achieving ALD Control with Continuous Processing”, C. A. Wolden, 9/06.
- 2006 **Invited Presentation** - Applied Materials, Santa Clara, CA, “Electrochromic Films and Devices Produced by Plasma-enhanced Chemical Vapor Deposition”, C. A. Wolden, 9/06.
- 2005 **Invited Presentation -)** Intel Corporation, Portland, OR, “Development of Plasma Assisted Co-Evaporation (PACE) for thin film semiconductors”, S. Kosaraju and C. A. Wolden, 5/05.

- 2005 **Invited Presentation** - National Renewable Energy Laboratory, Golden, CO, “Development of Plasma Assisted Co-Evaporation (PACE) for thin film photovoltaics”, S. Kosaraju and C. A. Wolden, 5/05.
- 2005 Society of Vacuum Coaters, Denver, CO, “Development of Plasma Assisted Co-Evaporation (PACE) for thin film deposition”, S. Kosaraju, I. Repins, and C. A. Wolden, 4/05. **(Invited to present in the Heureka! session, describing breakthrough technology)**
- 2004 **Invited Presentation** - National Institute of Standards and Technology, Boulder, CO, “Molecular Engineering of Oxide Chemical Vapor Deposition”, C. A. Wolden, 12/04.
- 2004 Materials Research Society Fall Meeting, Boston, MA, “Controlled Nitrogen Incorporation in ZnO Films Grown by Plasma Assisted Chemical Vapor Deposition”, T. M. Barnes, J. Leaf, K. Olson and C. A. Wolden, 12/04. **(Teresa Barnes received the MRS Graduate Student Gold Award with this presentation.)**
- 2004 51st International AVS Symposium, Anaheim, CA, “HVP-CVD: A Novel Chemical Vapor Deposition Approach for Zinc Oxide Synthesis”, T. M. Barnes, C. Fry, J. Leaf, and C. A. Wolden, **(Teresa Barnes received the AVS Semiconductor Division Graduate Research Award with this presentation.)**
- 2004 **Invited Presentation** -University of California Santa Barbara, Inorganic Chemistry Seminar Series, “Transparent Electronic Oxides: Theoretical Design & Experimental Synthesis”, C. A. Wolden, 4/04.
- 2003 **Invited Presentation** - National Renewable Energy Laboratory, “Plasma Synthesis of Metal Oxide Films for Solar Energy Applications”, C. A. Wolden 7/03.
- 2001 American Vacuum Society Regional Conference, Arvada, CO, “Plasma Enhanced Chemical Vapor Deposition of Electrochromic Tungsten Oxide”, A. Chorney and C. A. Wolden, 8/01. **(as an undergraduate Anna Chorney received 3rd place in the Student Poster Competition competing primarily against graduate students).**
- 2001 Materials Research Society Spring Meeting, San Francisco, CA, “Characterization of Chalcocites produced by Thermal and Plasma-assisted Sulfurization”. C. C. Fischer and C. A. Wolden, 4/01. **(Chris Fischer was awarded the Outstanding Poster in the nationwide Undergraduate Materials Research Initiative competition).**
- 2000 **Invited Presentation** - 3M Corporate Research Center, St. Paul, MN, “Synthesis of Electronic Oxides”, C.A. Wolden, 11/00.
- 1998 **Invited Presentation** - Gordon Research Conference on Diamond, Oxford, England, “Diamond Growth at the Center of the C-H-O Phase Diagram: Nucleation, Growth, Texture Development” C. A. Wolden, 8/98.

STUDENTS SUPERVISED

- Postdoctoral Scholars (12 to date)
 - Dr. Mingyuan Cao, 2024 - 2025
 - Dr. Rok Sitar, 2023, CEO, Blaze Energy Technologies
 - Dr. Jolie Lucero, 2020 – 2021, Los Alamos National Laboratory
 - Dr. Javishk Shah, 2019 – 2022, HyET NoCarbon
 - Dr. Tommy Fuerst, 2019, Idaho National Laboratory
 - Dr. Simona Ligouri, 2017, Faculty - Clarkson University
 - Dr. Santosh Sahoo, 2013, ASML
 - Dr. Rachel Morrish, 2010-2015, Faculty - Colorado School of Mines
 - Dr. Joe Beach, 2012-2015, Founder - Starfire Energy
 - Dr. William Rance, 2014, Lohnstar Optics
 - Dr. Pieter Rowlette, 2010, Intel
 - Dr. Fengli Wang, 2008 – 2009, Shenzhen Smoore Technology Limited
- Graduate Students: Supervised 28 PhD and 22 MS students advised to date.
 - Michael Aire (ME Chemical Engineering, 5/99) - Non-thesis Masters: Project included initial design and construction of APCVD reactor for CdTe. – Newmont Mining
 - Yoxa Mahathongdy (MS Materials Science, 7/99) - “Statistical optimization & analysis of vapor CdCl₂ Processing for CdS/CdTe solar cells” – Corning
 - Joshua Robbins (MS Chemical Engineering, 9/00) - “Plasma enhanced chemical vapor deposition and physical characterization of tin oxide thin films”. – PhD Candidate, CSM
 - Jie Zhou (PhD Chemical Engineering, 10/01) – “The kinetics of hot-wire chemical vapor deposition of Teflon-like films”. – Advanced Solar Power
 - Weican Xiao (MS Engineering, 7/02, co-advised with Tyrone Vincent) – “*In-situ* optical diagnostics of tin oxide thin film synthesis during plasma enhanced chemical vapor deposition”: – Unknown
 - James Kestner (PhD - Materials Science, 7/03) – “Development and analysis of vapor transport deposition of Cadmium Telluride Thin Films”: – Boeing
 - Joshua Robbins (PhD Chemical Engineering, 7/03) – “Development and analysis of plasma-enhanced chemical vapor deposition of transparent conducting oxides”; – Founder, New Terrain Brewing
 - Michael Seman (MS Chemical Engineering, 5/04) – “Electrochemical and optical characterization of electrochromic tungsten oxide synthesized by PECVD”; – PhD Candidate, CSM
 - Teresa Barnes (PhD Chemical Engineering, 12/04) – “Development of high vacuum plasma-assisted chemical vapor deposition and its application to semiconducting zinc oxide”; – NREL
 - Sreenivas Kosaraju, (PhD Chemical Engineering, 8/05) – “Plasma-assisted co-evaporation synthesis of wide band gap semiconductors” ; – Intel
 - Wenli Yang, (PhD Chemical Engineering, 12/06) – “Plasma-enhanced chemical vapor deposition of titanium oxide thin films for dielectric applications”; – Stion
 - Scott Szymanski, (MS Chemical Engineering, 7/07) – “Self-limiting growth of aluminum oxide thin films by pulsed plasma-enhanced chemical vapor deposition”; – Whiting Petroleum
 - Mike Seman, (PhD Chemical Engineering, 12/07) – “Pulsed plasma-enhanced chemical vapor deposition of metal oxide thin films: Application to electrochromics”; – Co-founder, Resource X
 - Pieter Rowlette, (PhD Chemical Engineering, 12/09) – “Pulsed plasma-enhanced chemical vapor deposition of mixed metal oxides and nanolaminates” ; – Intel
 - Anna Pickerel, (Non Thesis MS Chemical Engineering, 12/10) Project based on synthesis of carbide catalysts for alcohol synthesis from biofuels. – Teacher
 - Nick Kubala, (MS Chemical Engineering, 12/09) – “Self-limiting growth of titanium oxide thin films by pulsed plasma-enhanced chemical vapor deposition”; – Align Midstream
 - Chris Lange, (MS Electrical Engineering, 5/11) “Design and construction of a diagnostic suite for fundamental studies of pulsed PECVD”; – Tacuna Systems LLC
 - Trupti Gawai, (Non Thesis MS Chemical Engineering, 5/11) Project based on pulsed PECVD of oxide films. – Micron
 - Rakhi Patel, (PhD Chemical Engineering, 8/12) – “Pulsed plasma-enhanced chemical vapor deposition of hybrid organic-inorganic nanolaminates”; – Intel
 - Zhaowang Zong, (MS Chemical Engineering, 9/13) – “Electrochromic transistors”; – CSM PhD candidate.

- Chi-ping Li, (PhD Materials Science, 1/14) – “Scalable synthesis of mesoporous electrochromic tungsten oxide”; –Taiwan OLED manufacturer.
- Jon Kintner: (Non Thesis MS Engineering, 5/14) Project based on CdTe solar cells. – Starfire Energy.
- Christopher Sentman (MS Chemical Engineering, 8/14) – “Pulsed PECVD Synthesis of metal dichalcogenide thin films for sustainable energy applications”; –Poet Biofuels
- Dan Cooney, (MS Chemical Engineering, 9/14) – “Development of BCC metal membranes for H₂ separation”; – ADA Technology
- Sanket Kelkar, (PhD Chemical Engineering, 8/15) – “Design and Fabrication of Asymmetric Nanopores using Pulsed PECVD”; – Micron
- Daniel Meysing, PhD Chemical Engineering, 8/15) – “Development of Ternary Oxides for Use in Advanced Front Contacts in Cadmium Telluride Solar Cells by Magnetron Sputtering”; – First Solar.
- Adam Welch, (PhD Materials Science, 12/15) – “CuSb(S,Se)₂ Based Thin Film Heterojunction Photovoltaic Devices”; – Starfire Energy
- Jason Trevithick, (MS Chemical Engineering, 6/16) – “Activation of CdTe solar cells using molecular chlorine”; – Micron
- Jiaojiao Li, (PhD Materials Science, 8/16) – “Development of ZnTe Cu Contacted CdTe Solar Cells”; – Reel Solar Inc.
- Sean T. B. Lundin, (PhD Chemical Engineering 9/17, co-advised with J. D. Way) – “Material and Operational considerations for effective use of palladium composite hydrogen separation membranes. – University of Tokyo
- Tommy Fuerst, (PhD Chemical Engineering, 12/18, co-advised with J. D. Way) – “Catalytic Coatings for Vanadium-Based Hydrogen Membranes”, Idaho National Laboratory
- Yangzhi Zhao, (PhD Materials Science, 9/19, co-advised with Y. Yang), – “Scalable synthesis of lithium sulfide nanocrystals for next generation battery technologies”, - IonBlox, Rath Award Finalist
- Yegor Samoileko, (PhD Chemical Engineering, 1/20), “Development of II-VI ternary alloys for CdTe based solar cells”, Advanced Energy
- Courtney Clark (MS Materials Science, 5/20) Non-thesis Masters: Techno-Economic Analysis and Scale-Up of Lithium Sulfide Production for Use in Next Generation Batteries– Los Alamos National Laboratory
- Zhenyu Zhang, (PhD Chemical Engineering, 12/20, co-advised with J. D. Way), “Design and optimization of catalytic membrane reactors for efficient ammonia synthesis and decomposition”, Cronwell
- Gavin Yeung, (MS Chemical Engineering, 8/21) , “Development of emitter layers for cadmium selenide telluride-based solar cells”, Rocket Lab
- Deborah Clayton-Warwick, (PhD Materials Science, 12/21, co-advised with M. O. Reese), “Development and application of novel thermomechanical liftoff technique for CdTe solar cells”. First Solar – Rath Award Winner
- Will Smith, (PhD Chemical Engineering, 12/22), “Synthesis of Metal Sulfide Compounds for Solid State Electrolytes using Metathesis Reactions”, A123 Systems
- Adam Job, (MS Chemical Engineering, 6/23), “Interfacial Engineering of Dense Metal Membranes for Stable and Cost-Effective Hydrogen Purification in Fusion Relevant Environments”, Ash Grove Cement
- Kevin Prince, (PhD Chemical Engineering, 8/23), “Interfacial engineering and Alternative device architectures for perovskite photovoltaics”,Helmholtz-Zentrum Berlin
- Rok Sitar, (PhD Chemical Engineering, 8/23), “Development of catalytic membrane reformer technology as a compact, energy efficient solution for on-site generation of hydrogen and ammonia/hydrogen fuel blends”, CEO Blaze Energy Technologies
- Liz Golonski, (MS, Chemical Engineering, 5/24), “Analysis of nitrogen oxide emissions produced during combustion of cracked-ammonia fuels”, West Point
- Chao Li, (PhD, Chemical Engineering, 8/24), “Palladium-based metal foil pumps for direct internal recycling of hydrogen isotopes in the fusion fuel cycle”, Marathon Fusion
- Saeed Ahmadi Vasselabadi, (PhD, Chemical Engineering, 12/24), “Solution synthesis of sodium-based multinary chalcogenides for next-generation battery applications”, Virginia Tech University
- Cameron Burst, (MS, Materials Science, 8/25), “Composite titanium-vanadium membranes for high temperature hydrogen purification”, Mines
- Sean Mathews, (MS, Chemical Engineering 8/25), “Evaluation of nickel-based perovskite catalyst for low temperature ammonia decomposition”
- Andrea Mathew, PhD Candidate, Materials Science
- Nolan Kelley, PhD Candidate, Chemical Engineering

- Ben Ivie, PhD Candidate, Advanced Energy Systems
- Garrett Strain, MS Candidate, Chemical Engineering
- Vitor Camacho, PhD Candidate, Chemical Engineering
- Created and supervised undergraduate research opportunities for 78 students (with graduate school attended)
 - Class of 1999: Andrew Barleben
 - Class of 2000: Robert Alexander, Logan Hagaman (California Institute of Technology)
 - Class of 2001: Darren Odom, Devin Dyar, Jim Huang
 - Class of 2002: Dustin Rice, Amanda Overmeyer (CSM), Chris Fischer (MIT), Mailasu Bai (CSM), Brent Lutz (University of Florida), Michael Eaton (CSM), Stephen Kelley (Stanford), Anna Chorney (Penn State)
 - Class of 2003: James Esteban, Jason Litzinger, Nathan Torres
 - Class of 2004: Jackie Leaf, Steve Hand, Cassandra Fry (CSM)
 - Class of 2005: Kyle Olson, John Harvey
 - Class of 2006: Joey Marino, Alex Monson, Hideto Hagiya, Scott Szymanski (CSM)
 - Class of 2007: Audrey Nelson, James Condon
 - Class of 2008: David Richards (Purdue), Nick Kubala (CSM)
 - Class of 2009: Olivia Bromley, Amy Dubetz (Tulane)
 - Class of 2010: Marilou Canon, Rambert Nahm (Cornell), Cody Willingham (CSM)
 - Class of 2011: Bas van de Loo (TU/e), Rene Vervuurt (TU/e), Alex Sale, Donal Finegan (University College London)
 - Class of 2012: Sterling Parks, Sara Chmelka, Karl Brennan (Cornell), Amanda Fankel
 - Class of 2013: Becky Silverstein, David Chiavetta, Maria O'Brien (Trinity College Dublin), Aisling Brazel
 - Class of 2014: Amy Goldstein, Trevor Haak, Eoin McMullan, Sirichat Rojnirun
 - Class of 2015: Colm O'Riada (University of Cambridge)
 - Class of 2016: Alice Brennan, Miranda McCeig
 - Class of 2017: Emily White
 - Class of 2018: Elias Petsalis (CSM), Lucy Fitzgerald
 - Class of 2019: Kristen Hietala, Gavin Yeung (CSM)
 - Class of 2020: Daisy Fuchs (CU), Sarah Livingston
 - Class of 2021: Hope Wikoff, Arthur Harris, Jerry Birnbaum, Isaiah Thurman
 - Class of 2022: Jane Turek, Ben Reinecke
 - Class of 2023: Alexandria D'Aquila, Katie Palmer (CSM), Gordon Huang, Sean Mathews (CSM)
 - Class of 2024: Izzy Roszell, Cameron Burst (CSM), Emma Neuroth (CSM)
 - Class of 2025: Kagan Killough (Bordeaux), Brynn Benham
 - Current Students: Ben Bauerle, Caroline Hufnagel, John Braford, Vivian Aldinger, Gwenyth Lemon, Ceiwen Wick

RESEARCH CONTRACTS

I have been the PI or co-PI on initiatives on awards valued at ~\$21.6M to CSM (my portion ~\$15.5M). The sources include an array of sources including NSF, DOE, ARPA-E, and private industry. The Table below summarizes research contracts secured in the past decade.

Project Title	Amount / Dates	Source	Collaborators
Direct Internal Recycling for High Field and Spherical Tokamaks	\$2,592,472 7/15/25 – 7/14/30	DOE	Scott Walton (NRL) Sub: \$597K
High Throughput Testing of Metal Foil Pumps	\$360,000 6/1/25 – 5/31/28	INL	
Synthesis and Characterization for CdTe	\$210,000 12/18/24 - 12/17/27	NREL	Matt Reese (NREL)
Low-cost III-V solar cells through mechanical spalling and substrate reuse	\$270,000 10/1/24 -9/30/27	NREL	PI C. Packard
INFUSE: Testing of Engineered Membranes in Fusion-Relevant Metal Foil Pumps	\$100,000 9/1/24 - 8/31/25	DOE	
Scalable, Low-Cost Hydrogen Delivery Systems	\$987,954 1/1/24 -12/31/26	EERE	
Green Hydrogen Laboratory	\$3,000,000	DOE	PI R. J. Kee

	1/1/24 -12/31/26		
Fabrication and Characterization of Tandem Photovoltaics Architectures	\$70,000 1/1/23 – 6/30/24	NREL	Lance Wheeler (NREL)
Distributed Production of Green Hydrogen	\$200,000 1/1/23 – 12/31/24	COEDIT	
Ammonia/Hydrogen Fuel for Clean Combustion	\$35,000 5/1/22 - 8/31/23	COEDIT	
Manufacturing of Metal Sulfides for Next Generation Batteries	\$379,765 9/1/22 -8/31/25	NSF	
CdTe Core	\$209,720 9/28/21 – 8/27/24	NREL	Matt Reese (NREL)
Interfacial-engineered Membranes for Efficient Tritium Extraction	\$1,397,972 1/1/21- 6/30/24/	ARPA-E	Sub: INL (\$260K)
Nanomaterials for Next Generation Solid State Batteries	\$141,293 11/21/19 - 12/31/21	COEDIT / SolidPower	
Intensification and Integration of Hydrogen and Ammonia Production	\$2,247,676 1/1/19 – 7/11/24	ARPA-E	Co-PI J.D. Way
Interdigitated Back Contact Solar Cells for Switchable Photovoltaic Windows	\$206,454 1/1/19 - 9/30/21	DOE/NREL	Lance Wheeler (NREL)
Development of advanced materials and characterization techniques for hydrogen carriers	\$527,119 1/1/19 – 9/30/23	NREL	PI B. Trewyn
High Specific Power Solar Cells	\$227,000 1/1/18 – 12/31/21	ONR/NREL	Matt Reese (NREL)
Continuous Manufacturing of Anhydrous Metal Sulfide Nanocrystals	\$387,192 9/15/18 -8/30/21	NSF	
Methane Aromatization in a Membrane Reactor	\$34,679 5/1/18 -10/9/18	TDA Research	
Addressing Unresolved Scientific Challenges for CdTe-based Solar Cells	\$336,051 7/15/17 - 6/30/20	NSF	
Membrane Reactor Synthesis of Ammonia at Moderate Conditions	\$500,000 10/1/16 – 7/31/18	ARPA-E	PI J.D. Way
Earth Abundant Membrane Reactors for Efficient Chemical Processing	\$329,615 5/1/15 - 4/30/19	NSF	Co-PI J.D. Way
Scalable Manufacturing of Nanostructured Lithium Sulfide	\$39,000 4/1/16 – 4/30/18	COEDIT	Co-PI Y. Yang
Accelerating Development of CdTe Solar Cells	\$125,000 12/1/16 – 6/30/17	BAPVC	Co-PIs T. Ohno, J. Beach
Advanced Membranes for Tritium Purification	\$155,000 9/1/15 - 8/31/18	DOE NEUP	Co-PI J.D. Way
MRI: Acquisition of a coupled optical and scanning probe microscopy facility for advanced materials research	\$328,114 5/1/15 -12/31/18	NSF	Co-PI K. Neeves
Flexible Multi-Functional Coatings to Enable Advanced Optoelectronics	\$150,000 1/1/14 – 12/31/15	COEDIT	
Low-cost highly transparent flexible low-e coating film	\$50,000 10/1/13 – 9/30/14	ITN Energy	
Non-Equilibrium Processing of CdTe Absorbers to Enable 20% Efficiency	\$599,724 1/1/13 – 12/31/15	BAPVC	Co-PIs T. Ohno, J. Beach
Rapid Development of Earth-Abundant Thin Film Solar Cells	\$179,456 1/22/13 -1/21/16	NREL	Andriy Zakutayev (NREL)
Fabrication of Pd Ternary Alloy Membranes	\$200,000 8/8/12 – 12/31/15	Pall Corporation	PI J.D. Way
Synthesis of Stoichiometric Pyrite Photovoltaic Absorbers	\$196,000 6/1/12 -5/31/2015	NSF	
High Temperature, Roll-to-Roll CdTe Superstrate	\$219,843	NREL	Teresa Barnes

Devices Using Flexible Glass	1/1/12 – 8/31/15		(NREL)
Catalyzing Innovation and Collaboration for Photovoltaics Research and Development: An NSF Workshop	\$58,925 3/19/10 -1/31/12	NSF	
Asymmetric Nanopores for Fundamental Studies of Hindered Transport	\$304,912 9/1/10– 8/31/14	NSF	
Integration of Electro-Catalysts With Nanostructured Absorbers for Photoelectrochemical Production of Hydrogen	\$45,454 9/1/10– 8/31/14	CRSP	
Metal Carbide Catalysts for Synthesis of Alcohols from Synthesis Gas	\$85,098 1/1/14– 1/14/11	NREL	PI J.D. Way
Nanoporous, Metal Carbide, Surface Diffusion Membranes for High Temperature Hydrogen Separation	\$998,543 10/1/09 - 9/30/13	DOE	PI J.D. Way