KEVIN D. DOBSON

Institute of Energy Conversion
University of Delaware
Newark, Delaware 19716-3820
TEL: 302-831-6260
FAX: 302-831-6226
E-MAIL: kdobson@udel.edu

EDUCATION

Ph.D.	Chemistry, University of Otago, Dunedin, New Zealand, 1997
B.Sc.	(Hons., 1st Class), Chemistry, University of Otago, 1993

EXPERIENCE

2001-Present

Research Associate II
Institute of Energy Conversion, University of Delaware, Newark, Delaware
Research interests at IEC have included; Investigation aspects of CdTe/CdS solar cells, includes effects of back contact processing on cell behavior, an the identification of cell degradation mechanisms, with particular emphasis on isolating the possible involvement of Cu in these processes; Investigating suitability of electrodeposition for processing of $Cu(In,Ga)Se_2$ and $Cu_2ZnZnSe_4$ thin-films for solar cell application, including understanding, controlling and simplifying the chemistry of the bath and film growth; Investigation of chemical-based deposition of photovoltaic device components, including transparent conducting oxides and semiconductor window layers; Chemical etch treatments for photovoltaic device processing.

1999-2001

Post-doctoral Fellow
Department of Materials and Interfaces, Weizmann Institute of Science, Rehovot, Israel
Project involved the investigation of the role of Cu in the degradation of CdTe/CdS solar cells. Techniques used to investigate cells included light- and electron-beam induced current (LBIC, EBIC), current-voltage measurements (IV), secondary ion mass spectrometry (SIMS), photoluminescence (PL), and X-ray photoelectron spectroscopy (XPS). Cu was found to have diffused throughout the cell structure following back contact processing, and significant Cu-doping was found to make the CdS layer photoconducting. Effects of atmospheric components during stress testing were also monitored, and results suggested cell encapsulation to be critical to enhance cell/module lifetimes. A second aspect of this project involved the preparation, based on electroless deposition methods, of a new $NiTe_2$ (Cu-free) back contact to CdTe/CdS cells.

1997-1998 Research Fellow
Department of Chemistry, University of Otago, Dunedin, New Zealand
Project title: “In Situ FTIR Spectroscopic Investigations of the Surface Reaction of Sulfide at Activated and Natural Carbons.”

PUBLICATIONS

1. "New Sol-Gel Attenuated total Reflection Infrared Spectroscopic Method for Analysis of Adsorption at Metal Oxide Surfaces in Aqueous Solutions. Chelation of TiO_2, ZrO_2, and Al_2O_3 Surfaces by Catechol, 8-Quinolinol, and Acetylacetone," P.A. Connor, K.D. Dobson and A.J. McQuillan, Langmuir **11**, 4193 (1995). http://dx.doi.org/10.1021/la00011a003

2. "In Situ Infrared Spectroscopic Analysis of the Adsorption of Ruthenium (II) Bipyridyl Dicarboxylic Acid Photosensitisers to TiO_2 in Aqueous Solutions," N.W. Duffy, K.D. Dobson, K.C. Gordon, B.H. Robinson and A.J. McQuillan, Chem. Phys. Lett. **266**, 451 (1997). http://dx.doi.org/10.1016/S0009-2614(97)00035-3

3. "Surface Titration Internal Reflection Spectroscopy (STIRS) Monitors Hydrous Metal Oxide Surface Charge and Adsorption," K.D. Dobson, P.A. Connor and A.J. McQuillan, Langmuir **13**, 2314 (1997). http://dx.doi.org/10.1021/la961053q

4. "An Infrared Spectroscopic Study of Carbonate Adsorption to Zirconium Dioxide Sol-Gel Films from Aqueous Solutions," K.D. Dobson and A.J. McQuillan, Langmuir **13**, 3392 (1997). http://pubs.acs.org/doi/abs/10.1021/la962024i

5. "In Situ Infrared Spectroscopic Studies of Lactic Acid Adsorption to TiO_2 and CdS Semiconductor Surfaces," T. Awatani, K.D. Dobson, A.J. McQuillan, B. Ohtani and K. Uosaki, Chem. Lett., 849 (1998). http://www.jstage.jst.go.jp/article/cl/27/8/27_849/_article

6. "Infrared Spectroscopy of the TiO2/Aqueous Solution Interface," P.A. Connor, K.D. Dobson and A.J. McQuillan, Langmuir **15**, 2401 (1999). http://pubs.acs.org/doi/abs/10.1021/la980855d

7. "*In Situ* Infrared Spectroscopic Analysis of the Adsorption of Aliphatic Carboxylic Acids to TiO_2, ZrO_2, Al2O3, and Ta_2O_5 from Aqueous Solutions," K.D. Dobson and A.J. McQuillan, Spectrochim. Acta Part A **55**, 1395 (1999). http://dx.doi.org/10.1016/S1386-1425(98)00303-5

8. "*In Situ* Infrared Spectroscopic Analysis of the Adsorption of Aromatic Carboxylic Acids to TiO_2, ZrO_2, Al_2O_3, and Ta_2O_5 from Aqueous Solutions," K.D. Dobson and A.J. McQuillan, Spectrochim. Acta Part A **56**, 557 (2000). http://dx.doi.org/10.1016/S1386-1425(99)00154-7

9. "Stability of CdTe/CdS Thin-Film Solar Cells," K.D. Dobson, I. Visoly-Fisher, G.Hodes and D. Cahen, Sol. Energy Mater. Sol. Cells **62**, 295 (2000). http://dx.doi.org/10.1016/S0927-0248(00)00014-3

10. "An in situ infrared spectroscopic investigation of adsorption of sodium dodecylsulfate and of cetyltrimethylammonium bromide surfactants to TiO_2, ZrO_2, Al_2O_3, and Ta_2O_5 particle films from aqueous solutions," K.D. Dobson, A.D. Roddick-Lanzillota and A.J. McQuillan, Vib. Spectros. **24**, 287 (2000). http://dx.doi.org/10.1016/S0924-2031(00)00096-5

11. "An *In Situ* Infrared Spectroscopic Investigation of Adsorption of Hexa- and Penta-cyanoferrates to Metal Oxides from Aqueous Solution," K.D. Dobson and A.J. McQuillan, Phys. Chem. Chem. Phys. **2**, 5180 (2000). http://dx.doi.org/10.1039/B005246I

12. "Electroless Ni and $NiTe_2$ Ohmic Contacts for CdTe/CdS PV Cells," O. Rotlevi, K.D. Dobson, D. Rose and G. Hodes, Thin Solid Films **287**, 155 (2001). http://dx.doi.org/10.1016/S0040-6090(00)01738-7

13. "When, Why and Where are CdTe/CdS Solar Cells Stable?", K.D. Dobson, I. Visoly-Fisher, R. Jayakrishnan, K. Gartsman, G. Hodes and D. Cahen, Proc. Mat. Res. Soc. Symp. **668**, H8.24.1 (2001).

14. "Stabilizing CdTe/CdS Solar Cells with Cu-Containing Contacts to p-CdTe," K.D. Dobson, I. Visoly-Fisher, G. Hodes, and D. Cahen, Advanced Materials, **13**, 1495 (2001). http://www3.interscience.wiley.com/cgi-bin/fulltext/85513469

15. "Preparation and Characterization of Electroless Ni and $NiTe_2$ Back Contacts to CdTe/CdS Thin-Film Solar Cells," J. Electrochem. Soc. **149**, G147 (2002). http://scitation.aip.org/journals/doc/JESOAN-ft/vol_149/iss_2/G147_1.html

16. "Role of Process Chemistry and Stability on CdTe-Based", B.McCandless, K. Dobson, S. Hegedus, and P. Paulson, Proc. NCPV Rev. Mtg., 401 (2003).

17. "The Dynamics of Cadmium Telluride Etching," K.D. Dobson, P.D. Paulson, B.E McCandless, R.W. Birkmire, Proc. Mat. Res. Soc. Symp.**763** B3.1 (2003).

18. "Photoconductive CdS: how does it affect CdTe/CdS Solar Cell Performance?," S Hegedus, D Ryan, K Dobson, BE McCandless, D Desai, Proc. Mat. Res. Soc. Symp.., **763**, B9.5 (2003).

19. "Formation and Characterization of Electroless-Deposited $NiTe_2$ Back Contacts to CdTe/CdS Thin-Film Solar Cells," Kevin D. Dobson, Ofer Rotlevi, Doug. Rose and Gary Hodes, J. Electrochem. Soc. **149**(2), G147 (2003).

20. "Thin Semiconductor Films for Radiative Cooling Applications," K.D. Dobson, G. Hodes, Y. Mastai, Solar Energy Mater. & Solar Cells, **80**(3), 283 (2003). http://dx.doi.org/10.1016/j.solmat.2003.06.007

21. **"**Factors Affecting the Stability of CdTe/CdS Solar Cells, Deduced from Stress Tests at Elevated Temperature," I. Visoly-Fisher, K. D. Dobson, J. Nair, E. Bezalel, G. Hodes, D. Cahen, Adv. Funct. Mater. **13**, 289 (2003). http://dx.doi.org/10.1002/adfm.200304259

22. "Processing Options for CdTe Thin Film Solar Cells," B.E. McCandless, K.D. Dobson, Solar Energy **77**(6), 839 (2004). http://dx.doi.org/10.1016/j.solener.2004.04.012

23. "Single Bath Electrodeposition of $CuInSe_2$ and $Cu(In,Ga)Se_2$ for Thin Film Photovoltaic Cells," M.E. Calixto, K.D. Dobson, B.E. McCandless, R.W. Birkmire, 31st IEEE PVSC, 378 (2005).

24. "Understanding Aniline Surface Treatment of CdTe," Kevin D. Dobson, Stephanie A. Einstein, Daniel D. Sadowsky, Brian E. McCandless and Robert W. Birkmire, Mat. Res. Soc. Symp. Proc. **865**, (2005) F8.2.

25. "Growth Mechanisms of Electrodeposited $CuInSe_2$ and $Cu(In,Ga)Se_2$ and $Cu(In,Ga)Se_2$ Determined by Cyclic Voltammetry," M. Estela Calixto, Kevin D. Dobson, Brian E. McCandless, and Robert W. Birkmire, Mater. Res. Soc. Symp. Proc. **865** (2005) F14.17.

26. "Thin CdTe Solar Cells with High Throughput Processing," B.E. McCandless, K.D. Dobson, S.S. Hegedus, W.A. Buchanan, D. Desai, R.W. Birkmire, presented at the Solar Program Review Meeting, (2005).

27. "Controlling Growth Chemistry and Morphology of Single-Bath Electrodeposited $Cu(In,Ga)Se_2$ Thin Films for Photovoltaic Application," M. Estela Calixto, Kevin D. Dobson, Brian E. McCandless and Robert W. Birkmire, J. Electrochem. Soc. **153(6)**, G521 (2006). http://dx.doi.org/10.1149/1.2186764

28. "How CdTe Solar Cells Operate: Determining Collection Using Bifacial Device Characterization," D. Desai, S. Hegedus, B. McCandless, R. Birkmire, K. Dobson, D. Ryan, Proc. 32nd IEEE PVSC and WCPEC-4, 368 (2006).

29. "Electrodeposition of $CuInSe_2$ Absorber Layers from pH Buffered and Non-buffered Sulfate-based Solutions," C. Sene, M. Estela Calixto, Kevin D. Dobson, Robert W. Birkmire, Thin Solid Films 516, 2188 (2008). http://dx.doi.org/10.1016/j.tsf.2007.07.142

30. "Processing of $Cu(In,Ga)Se_2$ Solar Cells from Electrodeposited Precursors," Kevin D. Dobson and Robert W. Birkmire, Proc. 34th IEEE PVSC, Philadelphia, PA, June 8-12, 2009.

31. "Comparative Study of Tungsten Monocarbide and Platinum as Counter Electrodes in Polysulfide-Based Photoelectrochemical Solar Cells," D. V. Esposito, K. D. Dobson, B. E. McCandless, R. W. Birkmire and J. G. Chen, J. Electrochem. Soc., 156 (2009) B962-B969. http://dx.doi.org/10.1149/1.3148304

32. "A New Photoelectrochemical Test Cell and Its Use for a Combined Two-electrode and Three-electrode Approach to Cell Testing," Daniel V. Esposito, Ouloide Y. Goue, Kevin D. Dobson, Brian E. McCandless, Jingguang G. Chen, and Robert W. Birkmire, Rev. Sci. Instrum. **80**, 125107 (2009). http://dx.doi.org/10.1063/1.3267777

33. "Low-Cost Hydrogen-Evolution Catalysts Based on Monolayer Platinum on Tungsten Monocarbide Substrates," Daniel Esposito, Sean T. Hunt, Alan L. Stottlemyer, Kevin Dobson, Brian McCandless, Robert Birkmire, Jingguang Chen, *Angew. Chem. Int. Ed.* **49**, 9859-9862 (2010). http://onlinelibrary.wiley.com/doi/10.1002/anie.201004718/abstract

PATENTS

1. "Improvements In or Relating to Spectroscopic Surface Analysis"
   Inventors: A.J. McQuillian, P.A. Connor and K.D. Dobson
   Provisional Patent filed 24 June 1996, New Zealand

2. U.S. Patent 2007/0151862 "Post Deposition Treatments of Electrodeposited $CuInSe_2$-based Thin Films," Kevin D. Dobson, M. Estela Calixto, Brian E. McCandless and Robert W. Birkmire.

AWARDS

* Postdoctoral Fellowship, Feinberg Graduate School of the Weizmann Institute of Science, Rehovot, Israel, 1999
* Postgraduate Scholarship, University of Otago, Dunedin, New Zealand, 1994
* Joseph and Emma Mellor Prize in Chemistry, University of Otago, 1993

SYNERGISTIC ACTIVITIES

Postdoctoral Fellowship from the Feinberg Graduate School, Weizmann Institute of Science, Rehobot, Israel (1999).

University of Otago, Dunedin, New Zealand, Postgraduate Scholarship (1994), Joseph and Emma Mellor Prize in Chemistry, Department of Chemistry, University of Otago, Dunedin, New Zealand (1993).