

Jeremy I. Martin, Union of Concerned Scientists

As a Senior Scientist in the Washington office of the Union of Concerned Scientists' (UCS) Clean Vehicles Program, Jeremy Martin evaluates the impact of biofuels and fuel policy on global warming pollution and oil dependence. He is an expert on biofuels lifecycle accounting, particularly with regard to changes in land use and accounting for emissions over time. His current projects focus on the Federal Renewable Fuels Standard, the California Low Carbon Fuel Standard and provisions related to biofuels in other legislation and regulations. He is also part of a broad UCS effort to understand the impact of water-intensive energy systems on energy and water systems, particularly in a carbon-constrained world. In this work Dr. Martin will focus on the impact of biofuels on water use, pollution and availability.

Dr. Martin, is the author of more than 15 technical publications and 13 patents on topics ranging from biofuels lifecycle accounting to semiconductor manufacturing and polymer physics. His most recent peer reviewed publication in Environmental Research Letters is a collaboration between UCS, UC Berkeley and UC Davis to correctly account for time in crop based biofuels. This work, titled "Proper accounting for time increases crop-based biofuels' greenhouse gas deficit versus petroleum" was cited in regulatory analyses of both the US Environmental Protection Agency (EPA) and California Air Resources Board. Dr Martin also acted as a technical peer reviewer for EPA Renewable Fuel Standard Regulations on "Methods and Approaches to Account for Lifecycle Greenhouse Gas Emissions from Biofuels Production Over Time".

Dr. Martin has a Ph.D. in chemistry and a minor in chemical engineering from the California Institute of Technology and a bachelor's degree in chemistry and English literature from Haverford College. At Caltech his research focused on the statistical mechanics of polymers. His decade of experience in the semiconductor industry included research, development and manufacturing at facilities in California, Texas, New York, Taiwan and Singapore, providing him concrete experience with how new technology moves through the innovation pipeline from basic science to manufacturing on a global scale.

Dr. Martin's projects at the Union of Concerned Scientists are funded by UCS membership funds and grants from The David and Lucile Packard Foundation, The Energy Foundation, The Kresge Foundation, Wallace Research Foundation, and The William and Flora Hewlett Foundation.

Jeremy I. Martin, Ph. D.
Senior Scientist, Clean Vehicles Program
Union of Concerned Scientists
1825 K St. NW, Suite 800
Washington DC 20006-1232
(202) 331-6946

Education

- Ph. D. California Institute of Technology, Pasadena, California** **September 1992 – September 1997**
Dept. of Chemistry and Chemical Engineering;
Major in Chemistry, Minor in Chemical Engineering
Dissertation: Statistical Mechanics of Polymers at Interfaces
- B. A. Haverford College, Haverford, Pennsylvania** **September 1986 – May 1990**
Chemistry and English Literature double major

Research Experience

- Lifecycle Accounting for Biofuels** **January 2008 to Present**
Studied lifecycle accounting methodology and related regulations pertaining to biofuels regulations in the US Federal government and California. Developed and published a methodology to incorporate emissions over time into a single metric for regulatory use. Peer reviewer for EPA Lifecycle Analysis for Renewable Fuels Standard Draft Rule. Member of Biofuels Advisory Committee for Ecological Society of America.
- Microelectronic Process Integration and Reliability Research** **January 2000 – May 2007**
Studied the mechanical reliability of low permittivity materials under stress, the chemical stability of these materials in oxidative environments and the effect of interfacial properties and plasma treatments on Copper electromigration behavior. Studied the integration of new materials into overall semiconductor manufacturing process and necessary adjustments in other processes to accommodate the new materials.
- Electronic Materials Research** **January 1999 to April 2005**
Developed and characterized new dielectric materials for use in semiconductor interconnects. In particular I worked on thin films deposited by plasma assisted chemical vapor deposition (PE-CVD) with reduced permittivity (or low k) compared with conventional silicon dioxide but adequate mechanical properties. Also investigated novel zeolyte based materials for use as low k dielectrics in conjunction with a research group at the University of California at Riverside.
- Polymer Physics Research** **June 1993 to September 1997**
Studied the physics of polymers at interfaces relevant to problems in colloidal stabilization, thin films, and biological tethered ligand receptor interactions. Developed numerical approaches to the solution of problems of polymer thermodynamics.
- Surface Science Research** **January 1990 to May 1990**
Studied the surface mobility of Gold atoms on the 110 surface using Monte Carlo Simulations

Professional Experience

- Senior Scientist at Union of Concerned Scientists (UCS)** **January 2008 to present**
Washington, DC
Manage, design and carry out research to analyze and assess transportation issues; direct regulatory policy campaigns; compile, write and edit reports to document and communicate research results; develop and

recommend transportation policies; promote policies to media, government and public; provide technical assistance on transportation issues to the public, government, and others; serve as lead spokesperson on key technical and policy issues; represent UCS, its philosophy and positions at various public forums.

Unpaid Internship at National Resources Defense Council **November 2007 – December 2007**
Washington DC

Research and analysis at Climate Center working on Low Carbon Fuels, Coal to Chemicals and water issues.

Paid Consultant to Union of Concerned Scientists **August 2007 - September 2007**
Washington, DC

Researched the public literature and composed a short paper on the state of Cellulosic Ethanol research and development for Food and Environment Program, Union of Concerned Scientists.

Senior Member of Technical Staff: Interconnect Research **April 2007 to July 2007**
Advanced Micro Devices (AMD)

Stationed at Albany Nanotech Center as part of an advanced research alliance (AMD, IBM, Freescale) working on research related to future technology nodes (45nm, 32nm and beyond).

AMD: Senior Member of Technical Staff: External Manufacturing **April 2005 – April 2007**

Stationed at Chartered Semiconductor Manufacturing in Singapore. Responsible for technology transfer, qualification and supervision of manufacturing for AMD products manufactured at Chartered.

- Transferred technology from AMD manufacturing site in Germany to Chartered
- Supervised technology and reliability qualification
- Worked closely with Chartered to optimize yield, review and approve process changes
- Disposition noncompliant or potentially out of spec material

AMD: Senior Member of Technical Staff: Process Development **February 2003 – April 2005**

Stationed at IBM East Fishkill 300mm development/manufacturing site as part of 7 company technology alliance (AMD, IBM, Sony, Toshiba, Chartered, Infineon, Samsung) developing 90nm, 65nm and 45nm manufacturing technology for high performance Semiconductor Devices. Promoted to Senior Member of Technical Staff in December 2004.

- “Dielectric module owner” for 90nm and 65nm BEOL development teams.
- Collaboratively developed new CVD processes to enhance reliability and mechanical properties of dielectric films.
- Transferred knowledge of 90nm and 65nm process and integration to AMD manufacturing site
- Work with AMD global team addressing low k related chip packaging issues
- Participated in 300mm tool selection for AMD’s new manufacturing site in Dresden, Germany

AMD: Member of Technical Staff and Interconnect Process Technology Manager **July 2002 – January 2003**

Stationed at Central Research and Development Facility of United Microelectronics Corporation (UMC) in Hsinchu, Taiwan

- Managed 4 AMD assignees to UMC alliance (metals, dielectrics and CMP)
- Led inter-group effort to address ultra low k process integration issues
- Coordinated interconnect process development between Taiwan, US and Germany

AMD: Member of Technical Staff: Low k Materials and Integration **March 1999 – July 2002**

Member of the AMD/Motorola Technology Alliance working at Motorola’s Advanced Product Research and Development Laboratory in Austin, Texas

- Process/tool selection and process development of CVD low k ILD (SiCOH) and dielectric barrier (SiCN) films (1999 – 2000)
- Integration of CVD Low k materials in 130nm and 90nm technology (2000 - 2002)
- Coordinated low k activities among AMD sites and transfer to manufacturing
- Managed 3 AMD dielectrics assignees to the Alliance

AMD: Senior Engineer, Dielectrics Process Development**October 1997 – March 1999**

AMD R&D Center in Sunnyvale, California

- Completed one-year rotation program through all process areas (thin films, etch, photolithography, diffusion/implant, and yield engineering) in an advanced development and pilot production factory manufacturing logic and flash memory
- Joined Advanced Process Development Organization Dielectric Thin Films group

US Patents

- 7,369,905 Method and apparatus for pressure and plasma control during transitions
6,989,601 Copper damascene with low-k capping layer and improved electromigration reliability
6,927,113 Semiconductor component and method of manufacture
6,797,652 Copper damascene with low-k capping layer and improved electromigration reliability
6,642,619 System and method for adhesion improvement at an interface between fluorine doped silicon oxide and tantalum
6,610,594 Locally increasing sidewall density by ion implantation
6,600,333 Method and test structure for characterizing sidewall damage in a semiconductor device
6,514,844 Sidewall treatment for low dielectric constant (low K) materials by ion implantation
6,500,755 Resist trim process to define small openings in dielectric layers
6,498,112 Graded oxide caps on low dielectric constant (low K) chemical vapor deposition (CVD) films
6,436,808 NH₃/N₂-plasma treatment to prevent organic ILD degradation
6,420,193 Repair of film having an SI-O backbone
6,406,993 Method of defining small openings in dielectric layers
6,294,472 Dual slurry particle sizes for reducing microscratching of wafers

Publications

O'Hare, M.; Plevin, R. J.; Martin, J. I.; Jones, A. D.; Kendall, A.; Hopson, E. "Proper accounting for time increases crop-based biofuels' greenhouse gas deficit versus petroleum." *Env. Res. Lett.* 4, (2009)

Ryan, E. T.; Martin, J. I.; et al. "Line Resistance and Electromigration Variations Induced by Hydrogen-Based Plasma Modifications to the Silicon Carbonitride/Copper Interface." *J. Electrochem. Soc.* 154.7, H604-H610 (2007)

Li, Z.; ..., Martin, J. I.; et al. "Mechanical and dielectric properties of pure-silica-zeolite low-k materials," *Angewandte Chemie - International Edition* 45.38, 6329-6332 (2006)

Martin, J. I.; Zhang, C.-Z.; Wang, Z.-G. "Polymer-tethered ligand-receptor interactions between surfaces," *J. of Polymer Sci., Part B: Polymer Physics* 44.18, 2621-2637 (2006)

Edelstein, D.; ..., Martin, J.; et al. "Comprehensive reliability evaluation of a 90 nm CMOS technology with Cu/PECVD low-k BEOL," *2004 IEEE International Reliability Physics Symposium Proceedings* p 316-319 (2004)

Edelstein, D.; ... Martin; et al. "Reliability, yield, and performance of a 90 nm SOI/Cu/SiCOH technology," *Proceedings of the IEEE 2004 International Interconnect Technology Conference* 214-216 (2004)

Yang, C.-C.; ... Martin, J.; et al. "Electrical and reliability evaluation of Cu/low-k integration: exploration of PVD barrier/seed and CVD SiC(N,H) cap depositions," *Proceedings of the Advanced Metallization Conference 2004* 213-220 (2004)

Rhee, S.-H.; ..., Martin, J.; et al. "Calculation of effective dielectric constants for advanced interconnect

structures with low-k dielectrics” Applied Physics Letters 83.13 2644-2646 (2003)

Martin, J.; et al. “Integration of SiCN as a low kappa etch stop and Cu passivation in a high performance Cu/low kappa interconnect,” Proceedings of the IEEE 2002 International Interconnect Technology Conference 42-44 (2002)

Ryan, E.T.; Martin, J.; et al. “Integration damage in organosilicate glass films,” Proceedings of the IEEE 2002 International Interconnect Technology Conference 27-9 (2002)

Yu, K. C.; ..., Martin, J.; et al. “Integration challenges of 0.1 mu m CMOS Cu/low-k interconnects,” Proceedings of the IEEE 2002 International Interconnect Technology Conference 9-11 (2002)

Ryan, E. T.; Martin, J. I.; et al. “Effect of material properties on integration damage in organosilicate glass films,” J. Materials Research 16.12 3335-3338 (2001)

Tsui, T., J. I.; Martin, J. I.; et al. “The use of the four-point bending technique for determining the strength of Low K dielectric/barrier interface,” Materials Research Society Proceedings 612 D121-D125 (2000)

Martin, J. I., Wang, Z.-G.; Zuckerman, D.; Bruinsma, R.; Pincus, P. “Forces between Surfaces with Weakly End-Adsorbed Polymers,” Journal de Physique II France 7 1111-1121 (1997)

Martin, J. I.; Wang, Z.-G.; Schick, M. “Effects of polymer brush self-assembly on spreading and thin film stability,” Langmuir 12.20 4950-4959 (1996)

Martin, J. I.; Wang, Z.G. “Polymer brushes: scaling, compression forces, interbrush penetration, and solvent size effects,” J. Physical Chemistry 99.9 2833-2844 (1995)

Roelofs, L. D.; Martin, J. I.; Sheth, R. “Competition between direct and concerted movements in surface diffusion with application to the Au(110) surface,” Surface Science 250.1 17-26 (1991)

**Low Carbon Fuel Standard
Expert Workgroup Member Application Form
Please submit a CV along with this form**

APPLICANT: Jeremy Isaac Martin
 First Middle Last

Employer: Union of Concerned Scientists

Current Job Title: Senior Scientist

Address: 1825 K Street NW., Suite 800, Washington, DC 20006

Telephone # - Work: (202) 331-6946

Telephone # - Cell: (301) 542-2509

Telephone # - Fax: (202) 223-6162

Email: martin@ucsusa.org

Broad Areas of Expertise:
Biofuels Policy, lifecycle accounting, especially the treatment of time.

Years of Relevant Experience: 2

Comments: My work on the the treatment of time in biofuels lifecycle analysis
has been cited by in the CARB LCFS ISOR and the US EPA RFS Proposal and I
served as a peer reviewer for the EPA RFS Lifecycle Analysis on the treatment
of emissions over time.

Please return to:
Ms. Manisha Singh, Air Pollution Specialist
Alternative Fuels Section
Air Resources Board
1001 I Street, 6th floor
Sacramento, California 95814
or, email: mansingh@arb.ca.gov