

CURRICULUM VITAE

Kimberly A. DeFriend, Ph.D.

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Current Research:

2005-Present:

Technical Staff Member, Los Alamos National Laboratory, MST-7, Polymers & Coating Groups, Los Alamos, NM

- Synthesizing silica aerogels with well-defined densities and compositions for ICF experiments
- Studying and understanding density variations and water uptake in silica aerogels
- Sol-gel chemistry of organosilicon monomers forming silica and organically bridged silsesquioxane gels and developing low density aerogels through super-critical solvent and CO₂ drying
- Gas phase elemental modification of silica and organically bridged silsesquioxane aerogels through deposition of silicon mono- and multi-layers on the aerogel surface forming robust low density gradient structures
- Forming gradient mixed-metal oxide silica aerogels through the deposition of transition metal layers on the aerogel surface
- Forming low density robust aerogels by architectural templating

Previous Research:

2003- 2005:

Postdoctoral Research Associate, Los Alamos National Laboratory, Los Alamos, NM

Supervisor: Dr. Douglas A. Loy

- Sol-gel chemistry of organosilicon monomers forming silica and organically bridged silsesquioxane gels and developing low density aerogels through super-critical solvent and CO₂ drying
- Gas phase elemental modification of silica and organically bridged silsesquioxane aerogels through deposition of silicon mono- and multi-layers on the aerogel surface forming robust low density gradient structures
- Forming gradient mixed-metal oxide silica aerogels through the deposition of transition metal layers on the aerogel surface
- Investigating the mechanical properties of surface modified gradient silica based aerogels

- Forming low density robust aerogels by architectural templating
- Synthesizing silica aerogels with well-defined densities and compositions for ICF experiments

2002-2003:

Postdoctoral Research Associate, Los Alamos National Laboratory, Los Alamos, NM

Supervisor: Dr. James L. Maxwell

- Synthesis of carbon, tungsten, tungsten carbide fibers using Laser Assisted CVD techniques
- Investigating the thermodynamics, growth conditions, and resulting phase formation of Laser Assisted CVD grown carbon fibers

1998-2002:

Ph.D. in Inorganic Chemistry, Rice University, Houston, TX

Thesis: *Controlling Ceramic Porosity using Carboxylate-Alumoxane Nanoparticles*

Research Advisor: Professor Andrew R. Barron

- Synthesis and application of carboxylate-alumoxane and metal doped alumina pre-ceramic nanoparticles for forming gradient structures through infiltration to reinforce porous ceramics, ceramic surface repair, protective coating agents for porous monolith ceramics and carbon composites, the development of membranes ultra- and nano-filtration membranes, and synthesizing hollow alumina and aluminate spheres for hierarchical membranes and composites
- Utilization of alumina membranes for gas separations
- Investigating chemical and physical surface modifications of alumina membrane to increase the flow and flux through a narrow pore size and narrow pore distribution membrane

1994-1998:

B.A. in Chemistry, Texas A&M University, College Station, TX

Research Advisor: Professor David Russell

- Operated MALDI (Matrix Assisted Laser Desorption Ionization) Mass Spectroscopy to optimize the resolution of Bradykinin protein on an alpha-cyano matrix using various extraction times and water concentrations

1997:

Summer Internship, Shell Westhollow Research Center, Houston, TX

Research Advisor: Bruce Winquist

- Removal of framework aluminum from commercially available zeolites

Education:

- 2005-Present: Technical Staff Member at Los Alamos National Laboratory, Materials Science and Technology Division, Fundamental and Applied Polymer Research Team; Aerogel Science and Technology
- 2002-2005: Postdoctoral Research, Los Alamos National Laboratory, Materials Science and Technology Division, Los Alamos, NM.
- 1998-2002: Ph.D. in Inorganic Chemistry, Department of Chemistry, Rice University, Houston, TX. Thesis title "Controlling Ceramic Porosity Using Carboxylate-alumoxane Nanoparticles", Research under the supervision of Professor Andrew R. Barron.
- 1994-1998: BA in Chemistry, Department of Chemistry, Texas A&M University, College Station, TX.

Professional Awards:

LANL Spot Award for Meeting a Level Two Milestone, Los Alamos National Laboratory, Materials Science and Technology Division, June 2005

LANL Spot Award for Management Self-Assessments Team for Training/Qualifications Participation, Los Alamos National Laboratory, Materials Science and Technology Division, August 2004

LANL Spot Award for Aerogel Processing, Los Alamos National Laboratory, Materials Science and Technology Division, 2003-2004

LANL Spot Award for Laser CVD Operations, Los Alamos National Laboratory, Materials Science and Technology Division, 2002-2003

Texas A&M University Chemistry Department Achievement Award, 1998

College of Science Outstanding Leadership and Academic Award, Texas A&M University, 1998

Distinguished Student in the College of Science, Texas A&M University, 1998

Texas A&M George Bauer Memorial Scholarship, 1997

Texas A&M Department of Chemistry Undergraduate Analytical Chemistry Award, 1997

Texas A&M Player of the Game Academic Excellence Scholarship, 1997

Professional Recognition:

Los Alamos National Laboratory News Letter, Hanson, T., “Laboratory Advances the Art and Science of Aerogels”, *Los Alamos National Laboratory News Letter*, Vol 5, No 19, week of September 13, 2004

Santa Fe New Mexican Newspaper, Hiel, D., “The Science of Aerogel”, *Santa Fe New Mexican*, Health and Science Section, pg. D1-D2, Monday, September 6, 2004

Los Alamos National Laboratory Daily News Bulletin, Hanson, T., “Laboratory Advances the Art and Science of Aerogels”, *Los Alamos National Laboratory Daily News Bulletin*, August 26, 2004

Journal Cover, Journal of Materials Science, vol. 38, number 12, June 15, 2003 issue

Journal Cover, Journal of Materials Science, vol. 38, number 5, March 1, 2003 issue

Journal Cover, Journal of Materials Science, vol. 37, number 14, July 15, 2002 issue

Professional Development:

Dispersions in Liquids: Suspensions, Emulsions, and Foams, 229th ACS National Meeting, San Diego, CA, 2005

Writing Award Winning Proposals, Los Alamos National Laboratory, 2004

Management and Technology, Rice University, 1999, Jesse H. Jones Graduate School of Business and Administration and Department of Chemistry

Scientific and Leadership Committees:

Management Self-Assessments Team for Training/Qualifications, Los Alamos National Laboratory, Materials Science and Technology Division, 2004

Rice Quantum Institute Chemical and Materials Characterization Committee, Rice University, 2001

Vice President of Rice University Graduate Student Association, 1999-2001

Vice President of the Texas A&M ACS Student Affiliate Chapter, 1997-1998

Secretary of the Texas A&M ACS Student Affiliate Chapter, 1996-1997

Teaching and Educational Development:

Discussion Leader for General Chemistry Laboratory, Department of Chemistry, Rice University, 2000-2001

General Chemistry Laboratory Assistant, Department of Chemistry, Rice University, 1998-2000

General Chemistry Laboratory Assistant, Department of Chemistry, Texas A&M University, 1997

US Patents:

Kimberly A. DeFriend and Douglas A. Loy, 2002, **Strengthening an aerogel monolith by chemical vapor deposition**, US Patent Pending

Andrew Ross Barron and Kimberly A. DeFriend, **High strength polycrystalline sphere**, 2002, United States Letters Patent Application Serial No. 10/774,319

Andrew Ross Barron and Kimberly A. DeFriend, **Strengthening of porous ceramic bodies by the in-situ formation of a composite structure**, 2002, US Patent Pending

Andrew Ross Barron and Kimberly A. DeFriend, **A simple approach to hierarchical ceramic ultra-filtration membranes**, 2002, US Patent Pending

International Patents:

Andrew Ross Barron and Kimberly A. DeFriend, **High strength polycrystalline spheres**, 2002, Venezuelan Application No. 23022

Publications:

DeFriend, K.A., Salazar, K.V., Nobile, A., Espinoza, B.F., Day, R.D., Pierce, T.H., Elliot, N.E., Elliot, J.E., Schmidt, D.W., Fierro, F., Sandoval, D., Valdez, A.C., Droege, M, **Chemical Compatibility of Silica Aerogel Processes with ICF Hohlräume**, *Fusion Science and Technology*, submitted August 2005.

DeFriend, Kimberly A., Douglas A. Loy, Salazar, Kenneth V., Small, James H., and Wilson, Jr., Kennard V., **Forming TMS and Silicon Multi-layers on the Surface of Silica and Polysilsesquioxane Aerogels using CVD Techniques**, (In Preparation)

Loy, Douglas A., Small, James H., DeFriend, Kimberly A., Wilson, Kennard V., Minke, M., Baugher, B. M., Baugher, C. R., Schneider, D. A., Shea, K. J., **Collapse of porosity during drying of alkylene-bridged polysilsesquioxane gels. Influence of the bridging group length**, *Materials Research Symposium Proceedings*, 847, 2005, 165-170.

Loy, Douglas A., Small, James H., DeFriend, Kimberly A., Wilson, Kennard V., Minke, M., Baugher, B. M., Baugher, C. R., Schneider, D. A., Shea, K. J., **Evolution of porosity and morphology in alkylene-bridged polysilsesquioxane**

xerogels as a function of gel aging time *Materials Research Symposium Proceedings*, 847, 2005, 99-106.

Loy, Douglas A., Small, James H., DeFriend, Kimberly A., Minke, McKenzie, Baugher, Brigitta M., Baugher, Colleen R., Schneider, Duane A., Jamison, Gregory M., and Shea, Kenneth J., **Influence of the Alkoxide Group, Solvent, Catalyst, and Concentration on the Gelation and Porosity of Hexylene-Bridged Polysilsesquioxanes**, *Chemistry of Materials*, submitted 2004.

Maxwell, James L., Bowman, Mats, Springer, Robert W., Nobile, Jr., Arthur, DeFriend, Kimberly, Espada, Loren, Sandstrom, Mary, Kommireddy, Dinesh, **A Process-Structure Map for Diamond-like Carbon Fibers from 1-Ethene at Hyperbaric Pressures**, *Advanced Functional Materials*, 15, 7, 2005, 1077 - 1087.

DeFriend, Kimberly A., Wiesner, Mark R. and Barron, Andrew R., **Alumina and Aluminate Ultra-filtration Membranes Derived from Alumina Nanoparticles**, *Journal of Membrane Science*, 224, 2003, 11-28.

DeFriend, Kimberly A. and Barron, Andrew R., **A Simple Approach to Hierarchical Ceramic Ultra-filtration Membranes**, *Journal of Membrane Science*, **212**, 1-2, 2003, 29-38.

DeFriend, Kimberly A. and Barron, Andrew R., **A Flexible Route to High Strength α -Alumina and Aluminate Spheres for Composite Applications**, *Journal of Materials Science*, **38**, 12, 2003, 2673-2678.

DeFriend, Kimberly A. and Barron, Andrew R., **Strengthening of Porous Alumina Bodies using Carboxylate-alumoxane Nanoparticles**, *Journal of Materials Science*, **38**, 5, 2003, 927-935.

DeFriend, Kimberly A. and Barron, Andrew R., **Surface Repair of Porous and Damaged Alumina Bodies using Carboxylate-Alumoxane Nanoparticles**, *Journal of Materials Science*, **37**, 2002, 2909-2916.

Conference Proceedings:

Jones, Chris. D., Callender, Rhonda. L., Vogelson, Cullen. T., Obrey, Stephen. J., DeFriend Varela, Kimberly. A., Wiesner, Mark. R., Barron, Andrew. R.; **Carboxylate-Alumoxanes: Materials Processing and Manufacturing of Alumina Based Materials**, *Proceedings of the 2000 NSF Design and Manufacturing Research Conference*, Vancouver, B.C., Canada

Presentations at Seminars, Conferences and Symposia:

DeFriend, KA, Loy, D.A., Small, J.H., Nobile, A., Salazar, K.V., **Gas phase deposition on low-density silica aerogels to improve mechanical properties**

and form gradient structures., International Meeting on Sol-Gel Science and Technology, Los Angeles, CA, August 21-26, 2005.

DeFriend, K.A., Salazar, K.V., Nobile, A., Espinoza, B.F., Day, R.D., Pierce, T.H., Elliot, N.E., Elliot, J.E., Schmidt, D.W., Fierro, F., Sandoval, D., Valdez, A.C., Droege, M., **Aerogel Technology at Los Alamos National Laboratory**, 16th Target Fabrication Meeting, Scottsdale, AZ, May 1-5, 2005.

DeFriend, K.A., Loy, D.A. and Small, J.H., **CVD Modification of Low-Density Silica and Bridged Polysilsesquioxane Aerogels**, *MRS 2004 Fall National Meeting*, Boston, MA, November 29 – December 3, 2004.

DeFriend, K. A., Loy, D. A., Small, J. H., Minke, M., and Shea, K. J., **Alkylene-Bridging Group Length in Bridged Silsesquioxanes and Its Effects on Gel Morphology**, *American Chemical Society 228th National Meeting*, Philadelphia, PA, August 26, 2004

DeFriend, K. A., Loy, D. A., Small, J. H., Shea, K. J., and Minke, M., **Influence of Aging Time on Porosity, Morphology & Structure of Hexylene-Bridged Polysilsesquioxane Gels**, *American Chemical Society 228th National Meeting*, Philadelphia, PA, August 24, 2004

DeFriend, K. A., Loy, D. A. and Small, J. H., **CVD Modification of Low-Density Silica and Bridged Polysilsesquioxane Aerogels**, *American Chemical Society 228th National Meeting*, Philadelphia, PA, August 25, 2004

DeFriend, K. A., Loy, D. A., Salazar, K. V., Wilson Jr., K. V., **Silylation of Low-Density Silica and Bridged Polysilsesquioxane Aerogels**, 37th Silicon Symposium, Philadelphia, PA, May 21, 2004

DeFriend, K. A., Loy, D. A., Salazar, K. V., Wilson Jr., K. V., **Surface Modification of Low-Density Silica and Bridged Polysilsesquioxane Aerogels**, *American Chemical Society 227th National Meeting*, Anaheim, CA, April 1, 2004

DeFriend, K. A., **Controlling Ceramic Porosity Using Carboxylate-alumoxane Nanoparticles**, *Los Alamos National Laboratory, MST 7*, Los Alamos, NM, December 5, 2002

DeFriend, K. A., Barron, A. R., **Strengthening Porous Alumina Bodies Using Carboxylate-Alumoxane Nanoparticle Ceramic Precursor**, *American Chemical Society 57th Southwest Regional Meeting*; San Antonio, TX, October 2001

DeFriend, K. A., Barron, A. R., **Carboxylate-Alumoxanes: Formation of Alumina Based Hollow Nanospheres**, *American Chemical Society 57th Southwest Regional Meeting*; San Antonio, TX, October 2001

DeFriend, K. A., Barron, A. R., **Strengthening Ceramic Bodies by Infiltration and Surface Repair Utilizing Carboxylate-Alumoxanes**, *American Chemical Society 221st National Meeting*; San Diego, CA, April 2001

DeFriend, K. A., Barron, A. R., **An Investigation of Carboxylate-Alumoxanes as Surface Repair and Strengthening Agents for Ceramic Bodies**, *American Chemical Society 52nd Southeast/ 56th Southwest Regional Meeting*; New Orleans, LA, December 2000

DeFriend, K. A., Barron, A. R., **Application of Carboxylate-Alumoxanes Nanoparticles as Post-Processing Infiltration, Surface Repair, and Strengthening Agents for Ceramic Bodies**, *American Chemical Society 220th National Meeting*; Washington D.C., August 2000

DeFriend, K. A., Barron, A. R., **Application of Carboxylate-Alumoxane Nanoparticles as Surface Repair, Strengthening, and Coating Agents for Ceramic Bodies and Composites**, *Rice Quantum Institute, 14th Annual Research Colloquium*; Houston, TX, August 2000

DeFriend, K. A., Jones, C. D. and Barron, A. R., **Application of Carboxylate-Alumoxanes as Chemical Infiltration and Surface Repair Agents**, *American Chemical Society 218th National Meeting*, New Orleans, LA, August 1999

Invited Seminars:

DeFriend, K. A., Loy, D. A., Nobile Jr., A., and Salazar, K. V., **Processing, Properties and Surface Modification of Silica Aerogels**, *Los Alamos National Laboratory, Materials Science and Technology Division*, Los Alamos, NM, September 29, 2004

DeFriend, K. A., Loy, D. A., Nobile Jr., A., and Salazar, K. V., **Processing, Properties and Surface Modification of Silica Aerogels**, *Los Alamos National Laboratory, Structural Inorganic Chemistry Group, Chemistry Division*, Los Alamos, NM, June 16, 2004

DeFriend, K. A., **Controlling Ceramic Porosity: Reducing to Strengthen Alumina Bodies and Increasing for Ultra-filtration**, *Los Alamos National Laboratory*, March 4, 2002

Thesis:

DeFriend, K. A., **Controlling Ceramic Porosity Using Carboxylate-alumoxane Nanoparticles**, *Rice University*, Houston, TX, April 9, 2002

Industrial Partnerships and Collaborations:

Gelest, Inc., Non-Disclosure Agreement and Licensing Agreement, 2005.

Aspen Aerogels, Non-Disclosure Agreement, 2005.

Ocellus, Inc., Alameda, CA, Chemical compatibility and tolerance identification for processing considerations in aerogel production.

Halosource, Inc., Seattle, WA, Development of nano-porous alumina ceramic membranes for selective ultra-filtration of polio viruses with high rejection criteria.

NASA Glenn Research Center, Cleveland, OH, Alumina coatings on carbon composites for oxidation prevention, thermal insulation and synthesis of binary aluminum metal oxides for ceramic coatings and ceramic infiltrations.

Dixie Chemical, Houston, TX, Identification of polymorphous complexes utilizing powder X-ray diffraction.

Foster-Miller, Waltham, MA, Strengthening and reinforcement of porous materials using carboxylate alumoxane nanoparticles as ceramic precursors

Peer Reviewed Manuscripts and Proposals:

Reviewed a proposal September 2005 for Cooperative Grants Program 2005 of the U.S. Civilian Research and Development Foundation (CRDF).

Peer review a paper for **Journal of Colloid and Interface Science** in December 2004.

Professional Affiliations:

Center for Nanoscale Science and Technology, Rice University (1998-2002)

Rice Quantum Institute, Rice University (1998-2002)

Center for Biological and Environmental Nanotechnology, Rice University (1998-2002)

American Chemical Society (1995-2002)

Other:

Born: October 9, 1975, Houston, TX

Citizenship: United States of America

Security Clearance: DOE Q-Security Clearance, Granted June 22, 2004

References:

Arthur Nobile, Jr.

Los Alamos National Laboratory

TNX Program Leader

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