SYMPOSIUM NM3

Aerogels and Aerogel-Inspired Materials
April 17 - April 21, 2017

Symposium Organizers
Stephanie Brock, Wayne State University
Alexander Eychmueller, TU Dresden
Nicholas Leventis, Missouri University of Science and Technology
Stephen Steiner, Aerogel Technologies, LLC

Symposium Support
Blueshift
NASA- Glenn Research Center

Proceedings Statement
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* Invited Paper

TUTORIAL
Aerogels—Synthesis, Characterization and Applications

Monday Morning, April 17, 2017
8:00 AM – 3:15 PM
PCC West, 100 Level, Room 105 A

The tutorial will bring newcomers and experienced researchers up-to-date with the state of the art of aerogel research in different areas. The format will be hands-on mixed with PowerPoint and open discussion during the whole schedule. A packet of demo procedures will be provided.

8:00 AM - 8:10 AM
Introduction to Aerogels – Stephen Steiner

8:10 AM - 8:35 AM
Synthesis of Gels–Oxides
– Silica – Matthias Koebel
– Metal Oxides – Stephen Steiner

8:35 AM - 9:30 AM
Synthesis of Gels–Polymers
– Isocyanate-Derived – Nicholas Leventis
– Phenolics – Nicholas Leventis
– Derivative Aerogels—Amorphous Carbon, Smeltable Metals, Carbides and Nitrides – Nicholas Leventis
– Amine-Derived – Stephen Steiner

9:30 AM - 10:00 AM
Synthesis of Gels–Non-Oxides Continued
– Nanocarbons – Stephen Steiner
– Quantum Dot – Stephanie Brock
– Noble Metals – Laura Kühn
– Biopolymers – Irina Smirnova

10:00 AM BREAK

10:30 AM - 11:25 AM
Molding, Solvent Exchanging and Chemical Functionalization – Ryan Nelson

11:25 AM - 12:00 PM
Drying I
– Supercritical Drying – Pavel Gurikov
– Evaporative Drying – Debra Rolison

12:00 PM - 12:45 PM LUNCH

12:45 PM - 12:55 PM
Drying II
– Freeze Drying – Justin Griffin

12:55 PM - 2:00 PM
Characterization of Gels and Aerogels
– Physical Properties – Justin Griffin
– Mechanical Properties – Justin Griffin
– Thermal, Temperature and Flammability Properties – Justin Griffin
– Morphology – Nicholas Leventis
– Electrochemical Properties – Debra Rolison

2:00 PM - 3:10 PM
Applications
– Insulation and Daylighting – Matthias Koebel
– Batteries and Supercapacitors – Debra Rolison
– Catalysis – Bin Cai
– Photochemical Properties – Stephanie Brock
– Lightweight Plastics Replacements – Stephen Steiner

3:10 PM - 3:15 PM
Conclusions – Stephen Steiner

Instructors
Stephen Steiner, Aerogel Technologies, LLC
Nicholas Leventis, Missouri University of Science and Technology
Matthias Koebel, Swiss Federal Laboratories for Materials Science and Technology (EMPA)
Stephanie Brock, Wayne State University
Laura Kühn, TU Dresden
Bin Cai, TU Dresden
Pavel Gurikov, Hamburg University of Technology
Debra Rolison, U.S. Naval Research Laboratory
Justin Griffin, Aerogel Technologies, LLC
Ryan Nelson, Aerogel Technologies, LLC
Irina Smirnova, Hamburg University of Technology

SESSION NM3.1: Aerogels from Two-Dimensional Nanostructures
Session Chairs: Nicholas Leventis and Debra Rolison
Monday Afternoon, April 17, 2017
PCC West, 100 Level, Room 105 BC

3:15 PM NM3.1.01
Shape Control via Additively Manufactured Metal Bistetrazoleamine Precursors and Combustion Synthesis for Hierarchical Structure Nanoporous Metal Foams Bryan C. Tappan; Los Alamos National Laboratory, United States.

3:30 PM NM3.1.02
Graphene Aerogel as a Scaffold towards the Creation of Environmentally Friendly Thermoelectric Materials Elizabeth A. Barrios; University of Central Florida, United States.

3:45 PM NM3.1.03
Ultralight and Highly Compressible Graphene/Boron Nitride Aerogel for Multifunctional Applications Hongling Li; Nanyang Technological University, Singapore.

4:00 PM NM3.1.04
2D TiC, Hierarchically Structured Aerogels for Energy Applications Vildan Bayram; University of Manchester, United Kingdom.

4:15 PM NM3.1.05
Manufacture of Complex Graphene Aerogel Structures through Room Temperature Freeze Casting Gabriel Casano; University of Manchester, United Kingdom.

4:30 PM NM3.1.06
Three-Dimensional Nitrogen-Doped Graphene Aerogels Enhance Power Density of Microbial Fuel Cells Tianyu Liu; University of California, Santa Cruz, United States.
SESSION NM3.2: Energy Production and Storage
Session Chairs: Nicholas Leventis and Stephen Steiner
Tuesday Morning, April 18, 2017
PCC West, 100 Level, Room 105 BC

10:30 AM *NM3.2.01
Aerogels—An Architectural Guide to Advances in Energy Debra R. Rolison; U.S. Naval Research Laboratory, United States.

11:00 AM NM3.2.02
Cellulose Nanofibril (CNF)–Reduced Graphene Oxide (RGO)–MoO3 Nanobelt Hybrid Aerogels for High Performance Supercapacitors Qifeng Zheng; University of Wisconsin-Madison, United States.

11:15 AM NM3.2.03
Aerogel Catalysts for Energy Applications Elies Molins; ICMAB-CSIC, Spain.

11:30 AM PANEL DISCUSSION: Gel Talks—Ideas the Aerogel Community Needs to Know

SESSION NM3.3: Polymer Aerogels
Session Chairs: Stephanie Brock and Kazuyoshi Kanamori
Tuesday Afternoon, April 18, 2017
PCC West, 100 Level, Room 105 BC

1:30 PM NM3.3.01
Effect of Backbone Chemistry on Mechanical and Optical Properties of Polyimide Aerogels Stephanie Vivod; NASA Glenn Research Center, United States.

2:00 PM NM3.3.02
Shape Memory Polyurethane Aerogels for Deployable Panels and Biomimetic Applications Nicholas Leventis; Missouri University of Science & Technology, United States.

2:15 PM NM3.3.03
Polyimide Aerogels with Aliphasic Links in the Oligomer Backbone—Towards More Flexible Aerogels Haiquan Guo; Ohio Aerospace Institute, United States.

2:30 PM NM3.3.04
Flexible Polyisocyanate Based Aerogels Roxana Trifu; Aspen Aerogels, United States.

2:45 PM NM3.3.05
Transparent Polymer Aerogels Gabriel Iftime; Palo Alto Research Center, United States.

3:00 PM BREAK

SESSION NM3.4: Silica Aerogels and Composites
Session Chairs: Alexander Eychmueller and Stephen Steiner
Tuesday Afternoon, April 18, 2017
PCC West, 100 Level, Room 105 BC

3:30 PM *NM3.4.01
Silicone-Based Organic-Inorganic Hybrid Aerogels and Xerogels Kazuyoshi Kanamori; Kyoto University, Japan.

4:00 PM NM3.4.02
Advanced Composite Porous Materials—Silica Aerogel with Nanotube Fillers Galit Bar; Soreq NRC, Israel.

4:15 PM NM3.4.03
Rapid Fabrication of Native, Cross-Linked and Hybrid Aerogels Massimo F. Bertino; Virginia Commonwealth University, United States.

4:30 PM NM3.4.04
Ambient-Dried Superinsulating and Monolithic Silica-Based Aerogels via the Use of Short Cellulose Fibers Gediminas Markevicius; MINES ParisTech, France.

4:45 PM NM3.4.05
Exploring the Versatile Surface Chemistry of Silica Aerogels for Multipurpose Application Luisa Dumes; University of Coimbra, Portugal.

SESSION NM3.5: Poster Session I: Aerogels and Aerogel Inspired Materials—Assemblies of 2D Nanostructures, Energy Storage, Silica, Nanocomposites and Polymer Aerogels
Session Chairs: Alexander Eychmueller and Stephen Steiner
Tuesday Afternoon, April 18, 2017
8:00 PM - 10:00 PM
Sheraton, Third Level, Phoenix Ballroom

NM3.5.01
Designing Benzoxazine-Based Carbon Aerogel as Electrode Materials for Supercapacitors Thanyalak Chaisuwan; Chulalongkorn University, Thailand.

NM3.5.02
3D Porous Graphene Nanostructure Fabricated with a Simple, Fast, Scalable Process for Applications in High Performance Flexible Gel-Type Supercapacitors Shih-Yuan Lu; National Tsing Hua University, Taiwan.

NM3.5.03
Development of Low Density Silica Aerogels for Laser Induced Plasma Studies A. Venkateswararao; 1 Shivaji University, India; 2 Blabha Atomic Research Center, India.

NM3.5.04
CuFe2O4–SiO2 Aerogel and Xerogel Nanocomposites—Synthesis and Characterization Anna Corrias; University of Kent, United Kingdom.

NM3.5.05
Applications of Composites Scaffolds Synthesized by a Novel Sol-Gel/Freeze-Casting Hybrid Method under Ambient Conditions Haw-Kai Chang; National Tsing Hua University, Taiwan.

NM3.5.06
High Energy Density Ultrafast Supercapacitors Based on Edge Oriented Graphene in Graphitized Bacterial Cellulose Aerogel Nazifah Islam; Texas Tech University, United States.

NM3.5.07

NM3.5.08
Synthesis of Graphene-Silica Aerogel Composite with Superior Separation Performance for Organic Compounds Yaping Zhao; Shanghai Rao Tong University, China.

NM3.5.09
Polyaccharide-Reinforced Silica Aerogels Zoran Novak; University of Maribor, Slovenia.

NM3.5.10
New Strategy to Mechanically Reinforce Aerogel by In Situ Growing Nanofillers Benxue Liu; Advanced Materials Institute, Shandong Academy of Sciences, China.

NM3.5.11
Silica Aerogel Synthesized under Ambient Pressure Drying, without Surface Hydrophobitization Lorena Alvarez Contrera; Centro de Investigación en Materiales Avanzados, S.C., Mexico.

NM3.5.12
Silica Aerogels Impregnated with Copper-Containing Nanoparticles—An Investigation of Three-Way Catalytic Ability Ann Anderson; Union College, United States.
NM3.5.13 Preparation and Structural Analysis of Magnesium Oxide Aerogels Jiankai Zhang; Beijing University of Chemical Technology, China.

NM3.5.14 Applications for Oleophilic Hydrophobic Graphite Sponges Fabian E. Villalobos; University of California Riverside, United States.

NM3.5.15 Fast Synthesis of Spherical Silica Aerogel Powders via Emulsion Polymerization from Waterglass Haejin Hwang; INHA University, Korea (the Republic of).

NM3.5.16 Nanoporous Silica Aerogel Membranes for CO₂ Capture Yi-Feng Lin; Chung Yuan Christian University, Taiwan.

NM3.5.17 The Effect of Embedded Nanarchitectures on the Mechanical Properties of Silica Aerogels Lucy Moreau; University of Kent, United Kingdom.

NM3.5.18 Preparation of Silica Aerogel and Its Properties as in Thermal Insulation Coating Noppakun Sanpo; SCG Chemicals Co., Ltd., Thailand.

NM3.5.19 Visible Light Induced Photocatalytic Hydrogen Evolution Using a CdS-NiP Hybrid Aerogel System Da Li; Wayne State University, United States.

SESSION NM3.6: Frontier Aerogels I—Chalcogenides, Metals and Shaped Session Chairs: Indika Arachchige and Alexander Eychmueller Wednesday Morning, April 19, 2017 PCC West, 100 Level, Room 105 BC

8:00 AM *NM3.6.01 Platelets, Dots, Rods—Aerogelation of Shape-Controlled Nanocrystals Nadia C. Bigall; Physical Chemistry, Leibniz Universität Hannover, Germany.

8:30 AM NM3.6.02 Programmable Assembly of Nanoparticles into Multicomponent Aerogels Stephanie L. Brock; Wayne State University, United States.

8:45 AM NM3.6.03 Understanding the Formation of Low-Density, Linker-Mediated All-Inorganic Semiconductor Nanocrystal Aerogels Amita Joshi; Los Alamos National Lab, United States.

9:00 AM NM3.6.04 Shape-Engineering of the Building Blocks in Multimetallic Hierarchical Aerogels Bin Cai; TU Dresden, Germany.

9:15 AM NM3.6.05 Synthesis and Characterization of Ceria Cuboidal Nanoparticles Stabilized into a Silica Aerogel Matrix Anna Corrias; University of Kent, United Kingdom.

9:30 AM NM3.6.06 Ultra-Low Density Nanoporous Silver Foams via Freeze-Casting of Nanowires Tyler M. Fears; Lawrence Livermore National Laboratory, United States.

9:45 AM NM3.6.07 Direct Solution-Based Reduction Synthesis of Au, Pd and Pt Aerogels John Purpe; United States Military Academy, United States.

10:00 AM BREAK

SESSION NM3.7: Frontier Aerogels II—Metals Session Chairs: Nadja Bigall and Nicholas Leventis Wednesday Morning, April 19, 2017 PCC West, 100 Level, Room 105 BC

10:30 AM *NM3.7.01 Noble Metal Aerogels—From Model Studies to Polymer Electrolyte Fuel Cell Performance Thomas J. Schmidt; 1, 2 Paul Scherrer Institute, Switzerland; ETH Zurich, Switzerland.

11:00 AM NM3.7.02 Bimetalllic Pt-M (M=Ni, Cu, Co, Fe) Aerogels as Efficient Catalysts for Oxygen Reduction Laura Kuehn; TU Dresden, Germany.

11:15 AM NM3.7.03 3D Ordered Nanostructured Ferromagnetic and Electronic Metal Metallatrices Synthesized from Mesoporous Templates—High Pressure Chemical Deposition, Surface Modification and Confinement-Induced Physical Properties Yinzhi Liu; The Pennsylvania State University, United States.

11:30 AM *NM3.7.04 Oxidation-Induced Self-Assembly of Metal Nanoparticles into High Surface Area, Electrically Conducting Nanostructures—Noble Metal Aerogels Indika U. Arachchige; Virginia Commonwealth University, United States.

SESSION NM3.8: Functional Aerogels for Sensors and Catalysts Session Chairs: Stephanie Brock and Barbara Milow Wednesday Afternoon, April 19, 2017 PCC West, 100 Level, Room 105 BC

1:30 PM NM3.8.01 Protein Nanofiber Gold Aerogels—Properties and Applications Gustav Nyström; ETH Zurich, Switzerland.

1:45 PM NM3.8.02 Effects of Interfacial Design in Au–TiO₂, and Cu–TiO₂, Plasmonic Aerogels for Visible Light–Driven Photocatalysis Debra R. Rolison; U.S. Naval Research Laboratory, United States.

2:00 PM NM3.8.03 Monolithic High Li- and B-Content Aerogels—Lithioborates, Lithiosilicates, Lithioborosilicates and Non-Oxide Lithium Boron, Lithium Boron Carbide and Lithium Boron Silicon Carbide Stephen Steiner; Aerogel Technologies, LLC, United States.

2:15 PM NM3.8.04 Assembly of Tin-Doped Indium Oxide Nanocrystals into Three-Dimensional Plasmonic Gels via Depletion-Attraction Interactions Camila Saez Cabezas; The University of Texas at Austin, United States.

2:30 PM BREAK

SESSION NM3.9: Environmental Remediation Session Chairs: Thomas Schmidt and Stephen Steiner Wednesday Afternoon, April 19, 2017 PCC West, 100 Level, Room 105 BC

3:30 PM *NM3.9.01 Polysaccharide Based Aerogels as Sustainable Absorbing Materials Barbara Milow; DLR, Germany.

4:00 PM NM3.9.02 Composite Aerogels for Water Remediation Applications Maria F. Casula; University of Cagliari, Italy.

4:15 PM NM3.9.03 Mechanically-Durable Aerogels—A Path toward Transformed Oil Remediation Strategies Desiree Plato; Yale University, United States.
4:30 PM NM3.9.04
Sucrose-Derived Carbon Sponge with Superporous, Superhydrophobic, Oleophilic and Ferromagnetic Properties for Environmental Cleaning Daisy Patino; University of California, Riverside, United States.

4:45 PM NM3.9.05
Ultralight and Mechanically Robust Cellulose Ester Aerogels for Environmental Remediation Anurodh Tripathi; North Carolina State University, United States.

SESSION NM3.10: Carbon Aerogels
Session Chairs: Hai Duong and Alexander Eychmueller
Thursday Morning, April 20, 2017
PCC West, 100 Level, Room 105 BC

8:00 AM *NM3.10.01
The Evolution of Carbon Aerogels—Allotropes, Composites and Graphene-Inspired Marcus A. Worsley; Lawrence Livernmore National Lab, United States.

8:30 AM NM3.10.02

8:45 AM NM3.10.03
Polymeric Aerogels as a Point of Departure for Fundamental Mechanistic Studies—the Case of Polybenzoxazine and Other Phenolic Type Aerogels Nicholas Leventis; Missouri University of Science & Technology, United States.

9:00 AM NM3.10.04
Tailoring of Pores in Carbon Aerogels Using 3D Printed Structures Swetha Chandrasekaran; Lawrence Livermore National Laboratory, United States.

9:15 AM NM3.10.05
Mesoscopic Simulations of Structural and Mechanical Properties of Carbon Nanotube Aerogels Alexey N. Volkov; University of Alabama, United States.

9:30 AM COMMERCIALIZATION PANEL

SESSION NM3.11: Assemblies of Zero- and One-Dimensional Biopolymers and Nanocarbons
Session Chairs: Stephanie Brock and Marcus Worsley
Thursday Morning, April 20, 2017
PCC West, 100 Level, Room 105 BC

10:30 AM *NM3.11.01
Mass Production and Applications of Carbon Nanotube Aerogels and Cellulose Aerogels from Environmental Waste Hai M. Duong; National University of Singapore, Singapore.

11:00 AM NM3.11.02
Multiscale Order in Self-Aligned Carbon Nanotube Aerogels Eric B. Meshot; Lawrence Livernmore National Laboratory, United States.

11:15 AM NM3.11.03
Direct Synthesis and Properties of Low-Density Nanofibrous Carbon Structures Roger Welsh; Millersville University, United States.

11:30 AM NM3.11.04
Solvent-Vapor Infusion Driven Self-Assembly of Fullerene Nanostructures Tony Jefferson Gnanaprapaka; The University of Arizona, United States.

11:45 AM NM3.11.05
Cellulose Aerogel and Its Graphitized Aerogel for High-Performance Lithium-Sulfur Battery Guofeng Ren; Texas Tech University, United States.

SESSION NM3.12: Industrialization and Commercialization
Session Chairs: Nicholas Leventis and Wibke Loelsberg
Thursday Afternoon, April 20, 2017
PCC West, 100 Level, Room 105 BC

1:30 PM *NM3.12.01
nexAERO—a Disruptive Aerogel Materials Company—Technology, Key Markets and Vision Matthias M. Koebel; Empa - Swiss Federal Laboratories for Materials Science and Technology, Switzerland.

2:00 PM NM3.12.02
Commercialization of Mechanically Strong, Multifunctional Monolithic Aerogels—Airloy® Ultramaterials Stephen Steiner; Aerogel Technologies, LLC, United States.

2:15 PM NM3.12.03
Lean Aerogel Manufacturing—Overview towards Efficient Industrial Aerogel Productions Francisco Ruiz; Keey Aerogel, France.

2:30 PM NM3.12.04

2:45 PM NM3.12.05
Recent Developments and Applications of Engineered Aerogels at Taasi Yosry Attia; Taasi Corporation, United States.

3:00 PM BREAK

SESSION NM3.13: Advances in Aerogel Insulation
Session Chairs: Matthias Koebel and Stephen Steiner
Thursday Afternoon, April 20, 2017
PCC West, 100 Level, Room 105 BC

3:30 PM *NM3.13.01
SLENTITE®—The Robust PU Aerogel Panel Dirk Weinrich; BASF, Germany.

4:00 PM NM3.13.02
Application of Aerogel Blanket Insulation in Exterior Wall Constructions Phalguni Mukhopadhyaya; University of Victoria, Canada.

4:15 PM NM3.13.03
Stabilization of Alumina and Aluminosilicate Aerogels for High Temperature Applications Frances I. Hurwitz; NASA-GRC, United States.

4:30 PM NM3.13.04
Fibre Reinforced Silica Aerogel Blankets by Ambient Pressure Drying for Thermal Protection A. Venkatesswara Ray; Shivaji University, India.

4:45 PM NM3.13.05
Effect of Aging on Silica Aerogel Properties and the Structure of Glass Wool-Aerogel Composites by X-Ray Tomography Subramaniam Iraw; 1 Swiss Federal Laboratories for Materials Science and Technology, Empa, Switzerland; 2Adolphe Merkle Institute, University of Fribourg, Switzerland.

SESSION NM3.14: Poster Session II: Aerogels and Aerogel Inspired Materials—Carbon, Assemblies of 0D and 1D Nanostructures, Frontier Aerogels, Environmental Remediation, Processing and Light and Sound
Session Chairs: Stephanie Brock and Nicholas Leventis
Thursday Afternoon, April 20, 2017
8:00 PM - 10:00 PM
Sheraton, Third Level, Phoenix Ballroom

NM3.14.01
Tuning Aerogels for High Potential Thermoelectric Materials Kristian Schneider; Dresden University of Technology, Germany.
SESSION NM3.17: Biomedical and Bionic Applications  
Session Chairs: Alexander Eychmueller and Hongbing Lu  
Friday Afternoon, April 21, 2017  
PCC West, 100 Level, Room 105 BC

1:30 PM *NM3.17.01  
Aerogels as Scaffolds—Response of PC 12 Neuronal Cells to Surface  
Topography and Substrate Stiffness Kyle J. Lynch; University of Memphis,  
United States.

2:00 PM NM3.17.02  
Polymer Thermoelectric Aerogels for E-Skin Sensors Shaobo Han;  
Linköping University, Sweden.

2:15 PM NM3.17.03  
Hydrophobically-Modified Nanoporous Silica Aerogel as a Bacteria  
Repelling Hygienic Material for Enhanced Healthcare Jun K. Oh; Texas  
A&M University, United States.

2:30 PM BREAK

SESSION NM3.18: Son et Lumiere (Sound and Light)  
Session Chairs: Stephanie Brock and Firouzeh Sabri  
Friday Afternoon, April 21, 2017  
PCC West, 100 Level, Room 105 BC

3:00 PM *NM3.18.01  
Superior Sound Transmission Loss in Mechanically Strong and Ductile  
Aerogels Hongbing Lu; The University of Texas at Dallas, United States.

3:30 PM NM3.18.02  
First Steps towards Bio-Based Static True Volumetric 3D Displays—  
Transparent Cellulose Scaffolds Covalently Equipped with Photon  
Upconverting Rare Earth Metal Doped Nanophosphors (uc-NP) Falk  
Liebner; BOKU University Vienna, Austria.

3:45 PM NM3.18.03  
Optically Transparent, Thermally Insulating Silica Aerogels for Solar-  
Thermal Receivers Sungwoo Yang; Massachusetts Institute of Technology,  
United States.

4:00 PM NM3.18.04  
Optical Switching of Silica-Aerogels upon Gas Sorption Christian Scherdel;  
Bavarian Center for Applied Energy Research, Germany.

4:15 PM NM3.18.05  
Understanding the Wave-Subwavelength Structure Coupling in the  
Aerogels Ai Du; Tongji University, China.

4:30 PM NM3.18.06  
Preparation and Properties of Transparent Polymethylsiloxane Aerogels  
with Ethylene-Bridging Moiety Taiyo Shimizu; Kyoto University, Japan.

SESSION NM3.19: Art  
Session Chairs: Stephanie Brock and Stephen Steiner  
Friday Afternoon, April 21, 2017  
PCC West, 100 Level, Room 105 BC

4:45 PM NM3.19.01  
Spirited Skies Project—Silica Aerogel in Art and Design  
Applications Ioannis Michaloudis; Charles Darwin University, Australia.