Gregory Beaucage, Associate Professor
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http://www.eng.uc.edu/~gbeaucag/BeaucageResearchGroup.html

Education/Research Positions.

ETHZ, Zurich Switzerland 8/2003 to 8/2004 sabbatical leave funded by Swiss National Science Foundation and Dupont Corporation.

University of Cincinnati, Cincinnati, OH, 45221 ***Associate Professor***, Department of Chemical and Materials Engineering,
2000 to present

University of Cincinnati, Cincinnati, OH, 45221 ***Assistant Professor***, Department of Materials Science and Engineering,
1994 to 2000.

Sandia National Laboratory, Albuquerque, NM 87185, ***Staff Member***, Organic Materials Group 1815. Cooperative research agreements with U.S. industrial partners.
1993-1994

Sandia National Laboratory, Albuquerque, NM 87185; ***Post Doctoral Fellow***, Organic Materials Group with ***Dale W. Schaefer***, Group 1703. Characterization of multi-component materials using scattering. Development of scattering theory in these systems.
1991-1993

1991 University of Massachusetts, Amherst, MA 01003 ***Ph.D. Polymer Science and Engineering***. Advisor: ***Richard S. Stein***. Dissertation: *A Morphological, Mechanical and Thermodynamic Investigation of the Isotactic-PVME/PS Polymer Blend.*

1982 University of Rhode Island, Kingston, RI 02881 ***B.S. Chemical Engineering***; Rhode Island State Scholarship, Phi Beta Kappa, Phi Kappa Phi, High Distinction.

1980 University of Rhode Island, Kingston, RI 02881 ***B.S. Zoology***; Rhode Island State Scholarship , Phi Beta Kappa, Phi Kappa Phi, Tau Beta Pi, Highest Distinction

Publications: Total of 91 peer reviewed publications, see publication list.
Publications fall into 5 Main Areas (with selected examples):

Nanostructured Materials and Fractals: In situ studies of nano-structural growth dynamics using SAXS. Work has also focused on aerosol synthesis of nano-structured ceramics using sol-gel chemistry. Application of small-angle scattering to characterization of nano-structure in a wide range of materials including pyrolytic silica, titania and carbon, layered silicates, zeolites. Extensive work has involved structure property relationships for polymer/ceramic nanocomposites.

Probing the dynamics of nanoparticle growth in a flame using synchrotron radiation Beaucage G, Kammler HK, Mueller R, Pratsinis SE, Narayanan T. *Nature Materials* **3** (6): 370-374 (2004). Citations 0.

Rational design of reinforced rubber Kohls DJ, Beaucage G *Curr. Opin. Solid St. M.* **6**(3), 183-194 (2002). Citations 1.

Structural analysis of polydimethylsiloxane (PDMS) modified silica xerogels. Guo L., Hyeon-Lee J, Beaucage G *J. Non-Crystalline Solids* **243** 61-69 (1999). Citations 23.

Morphological development in PDMS/TEOS hybrid materials. HyeonLee J, Guo L, Beaucage G, MacipBoulis MA, Yang AJM *J. Polym. Sci., Polym. Phys.* **34**(17), 3073-3080 (1996). Citations 8.

Morphology of polyethylene-carbon black composites. Beaucage G, Rane S, Schaefer DW, Long G, Fischer D *J. Polym. Sci. Polym. Phys.* **37**, 1105-1119 (1999). Citations 11.

Aero-Sol-Gel Synthesis of Nanostructured Silica Powders Hyeon-Lee J, Beaucage G, Pratsinis SE *Chemistry of Materials* **9**(11) 2400-2403 (1997). Citations 4

Polymer Thermodynamics and Chain Structure: Extensive work in application of light, x-ray and neutron scattering to issues of polymer/polymer miscibility and phase separation kinetics. Early work studied the structural basis for shifts in miscibility with tacticity. More recently investigations of the structural basis for chain conformation and persistence in PDMS and poly hydroxy alkonates (examples of flexible and rigid chain polymers respectively) with the goal of developing a structural basis to long chain polymer thermodynamics. Recently development of a thermodynamic model for the structure of equilibrium swollen polymer gels. The model has been verified using small-angle neutron scattering.

Macroscopic polymer analogues. Beaucage G, Sukumaran S, Rane S *J. Polym. Sci Pol. Phys.* **36**(17), 3147-3154 (1998). Citations 1.

Persistence Length of i-Poly(Hydroxy-Butyrate). Beaucage G, Rane S, Sukumaran S, Satkowski MM, Schechtman LA, Doi Y *Macromolecules* **30**, 4158-4162 (1997). Citations 7.

Symmetric, Isotopic Blends of Poly(dimethylsiloxane). Beaucage G, Sukumaran S, Clarson SJ, Kent MS, Schaefer DW *Macromolecules* **29**(26), 8349-8356 (1996). Citations:16.

A structural model for equilibrium swollen networks. Sukumaran SK, Beaucage G *Europhysics Letters* **59**(5), 714-720 (2002). Citations 1.

Tacticity effects on polymer blend miscibility. 2. Rate of phase separation. Beaucage G, Stein RS *Macromolecules* **26**(7), 1609-1616 (1993). Citations 25.

Tacticity effects on polymer blend miscibility. Beaucage G, Stein RS, Hashimoto T, Hasegawa H *Macromolecules* **24**(11), 3443-3448 (1991). Citations 25.

Semicrystalline Polymers: We have studied the development of correlated lamellar structure in a wide range of semi-crystalline polymer using small-angle x-ray scattering. We have focused on quantification of lamellar orientation in processed polymers such as polymer films and correlation of 3-d orientation with properties such as gas transport in polymer films. This work has also been extended to polyolefin/layered silicate nano-composites.

3D Hierarchical orientation in polymer-clay nanocomposite films Bafna A, Beaucage G, Mirabella F *Polymer* **44** (4), 1103-1115 (2003). Citations 5.

Optical properties and orientation in polyethylene blown films. Bafna A, Beaucage G, Mirabella F. *J. Polym. Sci, Pol. Phys.* **39**(23), 2923-2936 (2001). Citations 2.

Morphological study of HDPE blown films by SAXS, SEM and TEM: a relationship between the melt elasticity parameter and lamellae orientation. Prasad A, Shroff R, Rane S, Beaucage G *Polymer* **42**(7), 3103-3113 (2001). Citations 3.

Nano-Structured, Semicrystalline Polymer Foams. Beaucage G, Aubert JH, Lagasse RR, Schaefer DW, Rieker TP, Ehrlich P, Stein RS, Kulkarni S, Whaley PD *J. Polym. Sci., Part B: Polym. Phys.* **34**(17), 3063-3072 (1996). Citations 7.

Polymer Interfacial Properties: Developed a technique to measure the glass transition in polymer films using the ellipsometer. Several papers have also been published pertaining to chain conformation in thin films using neutron reflectivity. Recently application of the ellipsometer to study the dynamics of polymer films in thermal quench studies. The relaxation time and viscosity of thin films can be determined in this measurement. Results indicate that

polymers in confined geometries deviate kinetically from bulk chains with WLF features reminiscent of tactic analogues in very thin films.

Ellipsometric study of the glass transition and thermal expansion coefficients of thin polymer films. Beaucage, G, Composto R, Stein RS, *J. Polym. Sci., Part B: Polym. Phys.* **31**(3) 319-326 (1993). Citations 47.

Relaxation of polymer thin films in isothermal temperature-jump measurements Beaucage G, Banach MJ, Vaia RA *J. Polym. Sci., Pol. Phys.* **38**(22), 2929-2936 (2000). Citations 1.

Scattering Theory: Developed the unified scattering function which is widely used in studies of complex nanostructured materials (more than 100 combined citations). The unified function describes hierarchical structures such as are seen in mass fractal aggregates and polymeric systems.

Determination of branch fraction and minimum dimension of mass-fractal aggregates Beaucage G., *Physical Review E* **70**(3) (in press 9/2004).

Particle size distributions from small-angle scattering using global scattering functions. Beaucage, G. Kammler HK, Pratsinis SE, *J. Appl. Cryst.* **37**, 523-535 (2004). Citations 0.

Small-Angle Scattering from Polymeric Mass Fractals of Arbitrary Mass-Fractal Dimension. Beaucage G *J. Appl. Crystallogr.* **29**, 134-146 (1996). Citations 47.

Approximations leading to a unified exponential/power-law approach to small-angle scattering. Beaucage G *J. Appl. Crystallogr.* **28**(6), 717-728 (1995). Citations 67.

Fractal analysis of flame-synthesized nanostructured silica and titania powders using small-angle X-ray scattering. Hyeon-Lee J, Beaucage G, Pratsinis SE *Langmuir* **14**(20), 5751-5756 (1998). Citations 16.

Current Graduate Students (5 graduate students)

Doug Kohls, (MS 2002)
"*ASG* Process for Nano-Powders and Their Applications"
Finishing PhD, funded by NSF and P&G.

Amit Kulkarni (MS 6/2004): Spinodal decomposition in hybrid materials, PDMS/Silica nanocomposites. Funded by P&G and Equistar.
Presently interested in studies of branching in disordered materials, polymers and ceramics.

Bryan Reese (MS 8/2004), PhD studies on oriented polymer film structure/property relationships. Funded by Equistar.

Ramnath Ramachandran, Beginning polymer studies for MS.

Ankur Kant, Beginning polymer studies for MS.

Graduated Students/Post Doc

Ayush Bafna (PhD 2004, MS 2002): PhD studies pertain to the importance of structural orientation on properties in polyolefin/layered silicate nano-composites. MS pertained to orientation in processed semi-crystalline polymers. Funded by Equistar Corporation.
Extrusion Technologies, Philadelphia PA.

Nikhil Agashe (PhD 2004, MS 2001): In situ studies of the growth of nanomaterials in flames. Funded by NSF and Sun Chemical Corporation. MS degree pertained to fractal structure and optical properties of organic pigments.
GE Plastics Evansville Indiana.

Suresh Murugesan (PhD Chemistry Department 2003): Development of magnetically responsive, in situ filled elastomers for MEMS applications. Funded by bio-MEMS DARPA Project.
Texas Research Institute.

S. Sukumaran, Applications of Fractal Concepts to Complex Materials PhD 2002, funded by Argonne National Laboratories, PRF and P&G Paper Division. Studies pertained to theoretical and experimental considerations of equilibrium and non-equilibrium hierarchical structures on the molecular to macroscopic scales. Strongest contribution pertains to the structure of equilibrium swollen networks but also contributed in micellar systems, and a variety of other areas.
Max Planck Institute for Polymer Research, Mainz, Germany.

G. Skillas, Post-Doc from ETH Zurich, Studies of polymer dispersed reinforcing fillers using SAXS and 2d-IR. Funded by Swiss Government as well as P&G. Currently a research scientist at Degussa in Hanau Germany (manufacturer of pyrolytic ceramics).
GMX division of Degussa, Hanau, Germany.

J. Hyeon-Lee, "Nano-structured Materials via Sol-Gel and Aero-Sol-Gel Synthesis" PhD 1998, funded by NSF (formerly by P&G MVL and Cabot Corporation). Currently Research Scientist,
Samsung Research Institute, Seoul, South Korea.

Ling Guo, MS 1997, "Polymer Reinforced Ceramic Super-Insulators" funded by P&G, MVL and Armstrong Corporation.
P&G Miami Valley Laboratories (Central Research Division).

S. Rane, "Processing of Semi-Crystalline Polymers"
PhD 1999, funded by Equistar Corporation and P&G MVL.
GE Plastics, Colombus IN.

Gregory Rossi (MS 2002): Dispersion of nano-materials/ceramics in polymers through chemical modification. Funded by Wright Patterson Airforce Base, Materials Directorate.
Law School, University of Dayton.

Jim (Jinhui) Chen (MS 1999): Production of titania-silica mixed oxides for epoxidation catalysis funded by NSF.
PhD candidate Northwestern University Catalytic Chemistry.

Graduate Advisor (own): ***Dr. Richard S. Stein***, Emeritus Professor of Polymer Science and Engineering, University of Massachusetts, Amherst, MA. Member NAS and NAE.

Funding:

NSF CTS-0070214 Aero-Sol-Gel Synthesis of Nanostructured Ceramics.
NSF CTS-9986656 Aerosol Routes to Epoxidation Catalysts
DARPA Bio-MEMS Project: Plastic Micro Fluidic Devices for Bioassay
Equistar Corporation: Support for one student.
P&G Corporation: Support for one student.
Swiss Natoinal Science Foundation Sabbatical Funding 2003-2004.

Courses Taught (9 courses all web based):

see http://www.eng.uc.edu/~gbeaucag/BeaucageResearchGroup.html for full course contents (web page has about 69,000 hits since 1999)

X-ray Diffraction (http://www.eng.uc.edu/~gbeaucag/Classes/XRD.html)

4 credits: 3 hours lecture, 3 hours lab (4 sections).
Web based course and lab with no required text, web book serves as text.
Course gives undergraduates and graduates (non-credit) an introduction to experimental applications of scattering and diffraction techniques in materials science. Course emphasizes the meaning of inverse space through experimental examples, the signature of crystalline and amorphous correlations in inverse space, form factor for simple structures and disordered materials in small angle x-ray, neutron and light scattering. Labs include light scattering and optical microscopy, polymer structural analysis using XRD and SAXS, crystallographic analysis of metals and ceramics, orientation studies using XRD, diffraction techniques in TEM, and small-angle x-ray scattering. Students become proficient in the use of a single-axis Phillips diffractometer.

Polymer Processing (http://www.eng.uc.edu/~gbeaucag/Classes/Processing.html)

4 credits: 3 hours lecture, 3 hours lab (6 sections). (listed as two courses 3 credit lecture and 1 credit polymer lab)
Web based course and lab with no required text, web book serves as text.
Course is aimed at materials engineering undergraduates with no background in rheology though it has been listed as a dual level graduate elective and undergraduate required course. Students are introduced to basic concepts of rheology as they apply to polymer melts with emphasis on concepts crucial to polymer processing unit operations. Labs use research equipment donated to our group and Jim Borieo's injection molding instrument to produced polymer mixtures, extruded streams, blown films, and injection molded parts. Processing parameters are compared with product and the relationships are coupled through predictions of rheological theory. Tours of local polymer processing facilities at Equistar, P&G, International Paper, US Precision Lens, and Sun Chemicals are included in the course as optional compliments to the lab and lecture. Students become familiar with polymer processing equipment and terminology and develop an understanding of the technical and scientific basis of common problems in the processing polymers.

Polymer Properties (Physics I) (http://www.eng.uc.edu/~gbeaucag/Classes/Properties.html)

3 credit required graduate course. 3 hours lecture.
Web based course with no required text.
Course adds to the fundamentals introduced in Jim Borieo's introductory course targeting "Physcal" Polymer Science (in analogy to Physical Metallurgy). The major discoveries in Polymer Physics, post 1970, are summarized along with necessary background information. The course is designed for graduate students intending to pursue research in Polymer Science as a career. Students learn to find research papers using internet search tools, to critically read research papers and to develop and present their scientific opinions concerning papers related to polymer physics, although the tools learned are widely translatable. The course is partly intended as a preparatory course for the oral PhD qualifier examination in Polymer Science.

Polymer Dynamics (Physics II) (http://www.eng.uc.edu/~gbeaucag/Classes/Physics.html)

3 credit graduate elective course (undergraduates by petition). 3 lecture hours.
Web based course with no required text.
Polymer dynamics provides a basis for understanding the dynamic response of anelastic materials. Students are introduced to the mechanical features and measurements that signify anelasticity. The concept of physical relaxation and mathematical tools to understand relaxation in simple, dilute systems are presented. Complications related to entanglement and hydrodynamic effects are discussed towards the end of the course. Students become familiar with dynamic mechanical analysis and dynamic light and neutron scattering.

Mechanics of Materials (http://www.eng.uc.edu/~gbeaucag/Classes/MechanicsofMaterials.html)

3 credit undergraduate required course. 3 lecture hours.
Web based course with no required text.
This course provides tools to understand the mechanical behavior of polymers, ceramics and metals. The course centers on an expansion of the discussion of continuum mechanics and constitutive equations begun in the prerequisite introductory mechanics course. Mechanics of Materials focuses on a tensoral description of stress, strain and strain rate. The course considers both dynamic and static behavior and the coupling of these in viscoelastic materials. Comparison between the approaches to mechanics in polymers, metals and ceramics is a corner stone of this course. Students learn to describe stress, strain and strain rate in materials using tensors, compare and contrast mechanical energy absorption mechanisms in metals, polymers and ceramics. Describe fracture and failure in polymers, metals and ceramics. Describe the mechanical response of simple composite systems.

Nanostructured Powders (http://www.eng.uc.edu/~gbeaucag/Classes/NanoPowder.html)

3 credit graduate elective course (undergraduates by petition). 3 lecture hours.
Web based course with no required text.
This course was developed under NSF funding to address the absence of fundamental courses and texts in nanomaterials. The course first deals with the fundamentals of non-equilibrium thermodynamics and physical chemistry associated with the synthesis of nanomaterials. Homogeneous nucleation and surface nucleation as well as coagulation and Ostwald ripening are covered. The course then makes a comparison between solution growth and growth in aerosols with some details concerning vapor phase growth. The end of the course is a critical survey of specific nano-materials such as carbon nanotubes, fumed ceramics, layered silicates, fullerenes and the like with the aim of distinguishing real advantages of the nanoscale from unsupported claims.

Polymer Morphology (http://www.eng.uc.edu/~gbeaucag/Classes/Morphology.html)

3 credit dual level elective course. 3 lecture hours with lab demonstrations.
Web based course with no required text.
Polymer Morphology explores the details of structures commonly encountered in polymeric materials. The course covers both well understood morphologies as well as more applied, less well understood morphologies important to industrial applications. The approach involves a hierarchical description of morphology. Atomic level structure, is often governed by thermodynamics and chemistry. The colloidal scale, which dominates polymeric materials, depends on a combination of kinetics and thermodynamics.

Macroscopic scale structures generally are dominated by kinetic effects. The relationship between these levels of structure are used to develop a full picture of the complex morphology of polymeric materials. The course is by nature topical reflecting the broad scope of morphologies seen in polymeric systems including: semi-crystalline phases, liquid/liquid phases, and immiscible phases of organic polymers and inorganic fillers.

Polymer Analysis (http://www.eng.uc.edu/~gbeaucag/Classes/Analysis.html)

3 credit dual level elective course. 3 lecture hours with lab demonstrations.
Web based course with no required text.
The focus of this course is analysis and characterization of polymers and plastics. Analysis of polymeric systems is essentially a subtopic of the field of chemical analysis of organic materials. Because of this, spectroscopic techniques commonly used by organic chemists are at the heart of Polymer Analysis, e.g. infra-red (IR) spectroscopy, Raman spectroscopy, nuclear magnetic resonance (NMR) spectroscopy and to some extent ultra-violet/visible (UV/Vis) spectroscopy. In addition, since most polymeric materials are used in the solid state, traditional characterization techniques aimed at the solid state are often encountered, x-ray diffraction, optical and electron microscopy as well as thermal analysis. Unique to polymeric materials are analytic techniques which focus on viscoelastic properties, specifically, dynamic mechanical testing. Additionally, techniques aimed at determination of colloidal scale structure such as chain structure and molecular weight for high molecular weight materials are somewhat unique to polymeric materials, i.e. gel permeation chromatography, small angle scattering (SAS) and various other techniques for the determination of colloidal scale structure. Students learn the technical basis of common analytic techniques used in polymer research and plastics product development and process control.

Polymer Characterization (http://www.eng.uc.edu/~gbeaucag/Classes/Characterization.html)

3 credit required graduate course (undergraduate by petition). 6 hours lab, 8 sections.
Web based course with no required text.
Students are presented with 7 physical chemistry-type labs pertaining to polymer analysis each week and are given 6 days to complete the write-up (generally 20 to 30 pages). Extensive web notes and previous experimental results are available on the web. The course includes a group project involving reverse engineering of a plastic product and a required computer program pertaining to polymer analysis. Students are required to maintain an industrial-type lab notebook. Students learn skills needed to perform experimental work in a research or industrial laboratory as well as being introduced to common analytic techniques used in polymer science and in the plastics industry.

Academic Committees

PhD Qualifier Committee
Head Search Committee
MS committees 5/year (have served in Electrical Engineering and Materials Science and Engineering)
PhD committees 4/year (have served in Chemistry, Electrical Engineering, Chemical Engineering and Materials Science and Engineering as well as 3 PhD committees in Process Engineering at ETHZ)

External Committees

Chairman of Small-Angle Scattering Group of the American Crystallographic Association
Organizing American Crystallography Association Scattering Sessions for 2005 meeting
Advisory board and review panel for Intense Pulsed Neutron Source, Argonne National Laboratory, Argonne Illinois
Advisor Indiana University Low Energy Neutron Source (LENS) Bloomington Indiana http://www.iucf.indiana.edu/neutronsource/
Active reviewer for *PRL, J. Appl. Cryst., J. Polym. Sci. Polym. Phys., Polymer, Macromolecules, J. Nanoparticle Research*, typically review 15 papers per year.

Invited Presentations of note

Gordon Research Conference on Composites
ESRF, Grenoble France
APS, Argonne National Laboratories
Swiss Light Source, Paul Scherrer Institute
ETHZ, Department of Physics
ETHZ, Process Engineering Department
Department of Physics, Indiana University, Bloomington Indiana
Denver X-ray Conference
American Crystallography Association

Collaborators:

Dr. M. M. Satkowski, Miami Valley Laboratories, Procter and Gamble Corporation, Cincinnati.
Dr. S. E. Pratsinis, Process Engineering, ETHZ, Zurich, Switzerland.
Dr. T. Trevoort, Materials Science, ETHZ, Zurich Switzerland.
Dr. D. W. Schaefer, Dept. of Materials Science and Engineering, University of Cincinnati.
Dr. J. E. Mark, Dept. Chemistry, University of Cincinnati.
Dr. F. Mirabella, Equistar Chemical, Cincinnati, OH.
Dr. P. Jemian, UNICAT, APS, Argonne National Laboratories, Argonne Illinois.
Dr. J. Ilavsky, UNICAT, APS, Argonne National Laboratories, Argonne Illinois.
Dr. D. Londono, Dupont Central Research, Wilmington DE.
Dr. H. K. Kammler, Clarion Technologies, Basel Switzerland.
Dr. T. Narayanan, ESRF ID02, Grenoble France.
Dr. P. Thiyagaran, IPNS, Argonne National Laboratories, Argonne Illinois
Dr. S. K. Sukumaran, Polymer Institute, Mainz Germany (Former Graduate Student).

Member ACS, AIChE, MRS, APS, American Crystallography Association.

Publications G. Beaucage

Total publications listed below: 91 and one edited book.

The number of times a paper has been cited is listed after the paper for those publications listed on *ISI Web of Science*, Thompson Scientific as of the end of August 2004.
Papers are listed in order of number of citations for each year from 1991 to present (as of August 2004). 12 papers are in preparation or are in the process of submission and are not listed. They deal with in situ SAXS measurements on aerosols (8 papers), sol-gel synthesis in aerosols (1 paper), semi-crystalline polymer films (2 papers), and polymeric networks (1 paper).

2004

Probing the dynamics of nanoparticle growth in a flame using synchrotron radiation Beaucage G, Kammler HK, Mueller R, Pratsinis SE, Narayanan T. *Nature Materials* **3** (6): 370-374 (2004).
Citations 0.

Determination of branch fraction and minimum dimension of mass-fractal aggregates Beaucage G., *Physical Review E* **70**(3) (in press 9/2004).

Particle size distributions from small-angle scattering using global scattering functions. Beaucage, G. Kammler HK, Pratsinis SE, *J. Appl. Cryst.* **37**, 523-535 (2004).
Citations 0.

Reaction-induced phase separation controlled by molecular topology. Kulkarni A, Beaucage G. *Polymer* (accepted 8/2004).

In situ studies of nano-particle growth dynamics in premixed flames. Kammler HK, Beaucage G, Kohls DJ, Agashe N, Ilavsky J, Pratsinis SE *J. Appl. Phys.* (accepted 8/2004).

Non-agglomerated dry silica nanoparticles. Mueller R, Kammler HK, Pratsinis SE, Vital A, Beaucage G, Burtscher P *Powder Tech.* **140** (1-2): 40-48 (2004).
Citations 0.

Structure of flame-made silica nanoparticles by ultra-small-angle X-ray scattering Kammler HK, Beaucage G, Mueller R, Pratsinis SE *Langmuir* **20** (5), 1915-1921 (2004).
Citations 2.

Structure of arylene-bridged polysilsesquioxane xerogels and aerogels. Schaefer DW, Beaucage G, Loy DA, Shea KJ, Lin JS *Chemistry of Materials* **16** (8), 1402-1410 (2004).
Citations 0.

Sol-gel condensations to form polytetrahydrofuran networks and their elastomeric behavior. Hassan MK, Abdel-Sadek GG, Beaucage G, Mark JE, Sharaf MA *J. Macromol. Sci.-Pure Appl. Chem.* **A41** (1), 1-13 (2004).
Citations 0.

Disposable Smart lab on a chip for point-of-care clinical diagnostics. Ahn CH, Choi JW, Beaucage G, Nevin JH, Lee JB, Puntambekar A, Lee JY *Priceedings of the IEEE* **92** (1), 154-173 (2004).
Citations 1.

2003
3D Hierarchical orientation in polymer-clay nanocomposite films Bafna A, Beaucage G, Mirabella F *Polymer* **44** (4), 1103-1115 (2003).
Citations 5.

The effect of external electric fields during flame synthesis of titania. Kammler HK, Jossen R, Morrison PW, Pratsinis SE, Beaucage G *Powder Tech.* **135,** 310-320 Sp. Iss. (2003).
Citations 1.

A functional on-chip pressure generator using solid chemical propellant for disposable lab-on-a-chip. Hong CC, Murugesan S, Kim S, Beaucage G, Choi JW, Ahn CH *Lab on a Chip.* **3**(4), 281-286 (2003).
Citations 1.

Preparation and characterization of some unusually transparent poly(dimethylsiloxane) nanocomposites. Rajan GS, Sur GS, Mark JE, Schaefer DW, Beaucage G *J. Polym. Sci. Part B Polym. Phys.* **41**(16), 1897-1901 (2003).
Citations 1.

Structure-property relationships for poly(dimethylsiloxane) networks in situ filled using titanium 2-ethylhexoxide and zirconium n-butoxide. Murugesan S, Mark JE, Beaucage G *Synthesis and Propperties of Silicones and Silcone-Modified Materials, ACS Symposium Series* 838, 163-169 (2003).

Analysis of average particle size in flame-made oxide nanoparticles using ultra small-angle x-ray scattering and nitrogen adsorption. Kammler, H. K.; Beaucage, G.; Mueller, R.; Pratsinis, S. E. *Chemie-Ingenieur-Technik* **75**(8) 1138-1139 **(**2003).

A disposable plastic biochip cartridge with on-chip power sources for blood analysis Choi J-W, Puntambekar A, Hong C-C;, Gao C, Zhu X, Trichur R, Han J, Chilukuru S, Dutta,M, Murugesan,S, Kim,S, Sohn,Y-S, Nevin,JH.; Beaucage,G, Lee J-B, Ahn CH *Proceedings of the IEEE Micro Electro Mechanical Systems (MEMS)* 447-450 (2003).

A functional on-chip pressure generator using solid chemical propellant for disposable lab-on-a-chip. Hong C-C, Murugesan S, Kim S, Beaucage G, Choi, J-W, Ahn, CH *Proceedings of the IEEE Micro Electro Mechanical Systems (MEMS)* 16-19 (2003).

2002

Bottom-up synthesis of polymer nanocomposites and molecular composites: Ionic exchange with PMMA latex. Rossi GB, Beaucage G, Dang TD, Vaia R *Nano Letters* **2**(4), 319-323 (2002).
Citations 5.

Non-agglomerated Fumed Silica Nano-particles. Muller R, Vital A, Kammler HK, Pratsinis SE, Beaucage G *Chemie Ingenieur Technik* **74**(5), 543-544 (2002).
Citations 3.

Relation of the fractal structure of organic pigments to their performance Skillas G, Beaucage G, Agashe N, Kohls DJ *J. Appl. Phys.* **91**(9), 6120-6124 (2002).
Citations 2.

Rational design of reinforced rubber Kohls DJ, Beaucage G *Curr. Opin. Solid St. M.* **6**(3), 183-194 (2002).
Citations 1.

Fabrication and characterization of planar and channel polymer waveguides. III. Compositional distribution and solute loss in polymer thin films. Banach MJ, Clarson SJ, Beaucage G, Benkoski J, Mates T, Kramer EJ, Vaia RA *J. Appl. Polym. Sci.* **86**(8), 2021-2024 (2002).
Citations 1.

A structural model for equilibrium swollen networks. Sukumaran SK, Beaucage G *Europhysics Letters* **59**(5), 714-720 (2002)
Citations 1.

Surface modification of cyclic olefinic copolymers for bio-mems microfluidic devices. Ahn C, Kim S, Chao H, Murugesan S, Beaucage G *Materials Research Society Symposium - Proceedings* **729** 131-136 (2002).

Disposable smart plastic biochips for clinical diagnostics. Ahn CH, Choi J-W, Kim, S, Sohn, Y-S, Puntambekar,A, Murugesan,S, Beaucage G, Nevin JH *Materials Research Society Symposium-Proceedings* **729** 29-38 (2002).

2001

PEO-PPO-PEO block copolymer micelles in aqueous electrolyte solutions: Effect of carbonate anions and temperature on the micellar structure and interaction. Sukumaran S, Beaucage G, Mao GM, Thiyagaran P *Macromolecules* **34**(3), 552-558 (2001).
Citations 12.

Morphological study of HDPE blown films by SAXS, SEM and TEM: a relationship between the melt elasticity parameter and lamellae orientation. Prasad A, Shroff R, Rane S, Beaucage G *Polymer* **42**(7), 3103-3113 (2001).
Citations 3.

Carbon coated silica for elastomer reinforcement Kohls DJ, Beaucage G, Pratsinis SE, Kammler HK, Skillas G. *Materials Research Society Symposium-Proceedings* **661** 941-952 (2001).
Citations 3.

Optical properties and orientation in polyethylene blown films. Bafna A, Beaucage G, Mirabella F. *J. Polym. Sci, Pol. Phys.* **39**(23), 2923-2936 (2001).
Citations 2.

2000
Multilevel structure of reinforcing silica and carbon. Schaefer DW, Rieker T, Agamalian M, Beaucage G *J. Appl. Crystallogr.* **33**(1), 587-591 Part 3 (2000).
Citations 7.

Relaxation of polymer thin films in isothermal temperature-jump measurements Beaucage G, Banach MJ, Vaia RA *J. Polym. Sci., Pol. Phys.* **38**(22), 2929-2936 (2000).
Citations 1.

1999
Structural analysis of polydimethylsiloxane (PDMS) modified silica xerogels. Guo L., Hyeon-Lee J, Beaucage G *J. Non-Crystalline Solids* **243** 61-69 (1999).
Citations 23.

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