1 Grand Ave. Dept of Chemistry and Biochemistry | San Luis Obispo, CA 93407 | 805-756-2692 | pcostanz@calpoly.edu

PHILIP J. COSTANZO

Nanotechnology • Specialty Polymers • Materials Science • Synthetic Chemistry

Academic Credentials

University of California at Davis

Ph.D. Organic Chemistry : "Synthesis, Assembly, and Application of Novel Nanoaggregates."

- June 2005
- Thesis Advisor - Prof. Timothy Patten

Carnegie Mellon University

B.S. in Chemistry with Minor in Engineering Studies and Concentrations in Polymer and Material Science : *"Synthesis of Novel Materials via Atom Transfer Radical Polymerization (ATRP)."*

- May 2001 w/ Departmental Honors
- Thesis Advisor - Prof. Krzysztof Matyjaszewski

Teaching Appointments

California Polytechnic State University, San Luis Obispo, CA : Department of Chemistry and Biochemistry

Professor (9/16 - current)
Associate Professor (9/12 - 8/16)
Assistant Professor (9/07 – 8/12)

Professional Preparation

NRC Postdoctoral Fellow (8/05 – 8/07)

Sponsor - Dr. Rick Beyer @ Army Research Laboratory - Aberdeen Proving Ground, MD

- Invented a thermo-responsive film system
- Controlled film additive dispersion and migration properties using Diels-Alder chemistry and block copolymer phase separation
- Synthesized difunctional, asymmetric polymer ligands
- Created specialty resins for military applications
- Managed laboratory and instrument maintenance

Graduate Research Scientist (7/01 - 7/05)

Advisor - Prof. Timothy Patten @ University of California at Davis - Davis, CA

- Developed and employed innovative synthetic pathways for the preparation of difunctional, asymmetrical PEG linkers
- Designed, prepared and characterized unique nanoparticles for a variety of applications
- Controlled growth, shape, and size of nanoaggregates by dictating particle interactions
- Assembled detection system based upon dielectrophoretic response of nanoaggregates
- Managed laboratory and instrument maintenance

Undergraduate Research Scientist (5/99 - 6/01)

Advisor - Prof. Krzysztof Matyjaszewski @ Carnegie Mellon University - Pittsburgh, PA

- Independently designed, prepared and published the synthesis and characterization of poly(methyl acrylate-*graft*-thiophene), a fluorescent graft copolymer
- Synthesized block and gradient co-polymers via ATRP
- Developed thermoplastic elastomers and hydrogels from prepared macromonomers
- Assisted in laboratory and instrument maintenance

Professional Intern (5/00 - 8/00)

Advisor - Dr. Charles Bauer @ Eastman Kodak Research Labs - Polymer Science Lab - Rochester, NY

- Enhanced the mechanical and thermal properties of thin films via star polymer additives
- Determined the morphology and physical properties of star polymers of varying composition and architecture

Publications (Cal Poly undergraduates are underlined.)

A total of 22 peer-reviewed publications have resulted from work at Cal Poly.

Costanzo is responsible for an additional 14 publications prior to Cal Poly. A detailed list is available upon request.

22) Kumler, M. S., Skinner, N. M., Meyersohn, M. S., Colt, T. A., Valverde, M., Powell, C. E., Costanzo, P. J., "Trials and adventures of the synthesis and evaluation of amphiphilic graft copolymers with dynamic topology." *J. Polym. Sci.* **2022***. 60 (22),* 3117. https://doi.org/10.1002/pol.20220247

21) Malouf, D. M., Richarson, A. D., L'Heureux, S. H. McDonough, E. A., Henry, A. M., Sheng, J. Y., Medhurst, E. A., Canales, A. E., Fleischer, C. J., Cecil, T. B., Thurman, S. E., McMullen, C. C., Costanzo, P. J., Bercovici, D. A. "Ylidenenorbornadiene Carboxylates: Experimental Kinetic Analysis of a Nucleophile-Induced Fragmentation Reaction." *Org. Lett.* **2022**, *24(15),* 2793-2797.

20) Bisbjerg, G., Brown, G. W., Pham, K. S., de Kock, R. A., Ramos, W., Patierno, J. A., Bautista, A., Zawalick, N. M., Vigil, V., Padrnos, J. D., Mathers, R. T., Heying, M. D., Costanzo, P. J., "Exploring polymer solubility with thermally-responsive Diels-Alder monomers: Revisiting the monkey's fist." *J. Polym. Sci.* **2022**, *60(2),* 175-187.

19) Wilborn, E. G., Gregory, C. M., Machado, C. A., Page, T. M., Ramos, W., Hunter, M. A., Smith, K. M., Gosting, S. E., Tran, R. Varney, K. L. Savin, D. A., Costanzo, P. J., "Unraveling polymer structures with RAFT polymerization and Diels-Alder chemistry." *Macromolecules.* **2019.** *52 (3),* 1308-1316.

18) Liu, C. H., Noxon, I. C., Cuellar, L. E., Thraen, A. L., Immoos, C. E., Martinez, A. W., Costanzo, P. J. "Characterization of Reagent Pencils for Deposition of Reagents onto Paper-Based Microfluidic Devices" *Micromcachines.* **2017**, *8 (8),* 242 - 253.

17) Swanson, J. P., Cruz, M. A., Monteleone, L. R., Martinez, M. R., Costanzo, P. J., Joy, A. "The Effect of pendant group structure on the thermoresponsive properties of N-substituted polyesters" *Polym. Chem.* **2017,** *8*. 7195-7206.

16) Earla, A., Li, L., Costanzo, P., Braslau, R. "Phthalate plasticizers covalently linked to PVC via copper-free or copper catalyzed azide-alkyne cycloadditions." *Polymer.* **2017.** *109,* 1-12.

15) Swanson, J. P., Martinez, M. R., Cruz, M. A., Mankoci, S. G., Costanzo, P. J., Joy, A. "A coacervate-forming biodegradable polyester with elevated LCST based on bis-(2-methoxyethyl)amine." *Polym. Chem.* **2016**, *7,* 4693-4702.

14) Mitchell, H. T., Schultz, S. A., Costanzo, P. J., Martinez, A. W. "Poly(*N*-isopropylacrylamide) hydrogels for storage and delivery of reagents to paper-based analytical devices." *Chromatography.* **2015.** *2,* 436-451.

13) Swanson, J. P., Monteleone, L. R., Haso, F., Costanzo, P. J., Liu, T., Joy, A. "A library of thermoresponsive, coacervate-forming biodegradable polyesters." *Macromolecules.* **2015.** *48 (12),* 3834-3842.

12) Bass, G. F., Colt, M. S., Chavez, A. D., DeHoe, G. X., Formal, T. P., Seaver, C. P., Kha, K., Kelley, B. A., Scott, G. E., Immoos, C. E., Costanzo, P. J. "Synthetic design and investigation of novel polymeric surfactants." *Polymer.* **2015.** *72*, 301-306

11) Mitchell, H. T., Noxon, I. C., Chaplan, C.A., Carlton, S. J., Liu, C. H. M., Ganaja, K. A., Martinez, N. W., Immoos, C. E., Costanzo, P. J, Martinez, A. W. "Reagent pencils: a new technique for solvent-free deposition of reagents onto paper-based microfluidic devices." *Lab Chip.* **2015**, *15,* 2213 - 2220.

10) Dirlam, P. T., Simmonds, A. G., Kleine, T. S., Nguyen, N. A., Anderson, L. E., Klever, A. O., Florian, A., Costanzo, P. J., Theato, P., Mackay, M. E., Glass, R. S., Char, K., Pyun. J. "Inverse vulcanization of elemental sulfur with 1,4-diphenylbutadiyne for cathode materials in Li–S batteries." *RSC Adv.* **2015**, *5*, 24718-24722.

9) Amato, N. D., Strange, G. A., Swanson, J. P., Chavez, A. D., Roy, S. E., Varney, K. L., Machado, C. A., Amato, D. V. Costanzo, P. J. "Synthesis and evaluation of thermally-responsive coatings based upon Diels-Alder chemistry and renewable materials." *Polym. Chem.* **2014**, *5 (1),* 69 - 76.

8) Dirlam, P. T., Kim, H. J., Arrington, K. J., Chung, W. J., Sahoo, R., Hill, L. J., Costanzo, P. J., Theato, P., Char, K., Pyun, J. "Single chain polymer nanoparticles via sequential ATRP and oxidative polymerization." *Polym. Chem.* **2013.** *4 (13),* 3765-3773.

Publications continued… (Cal Poly undergraduates are underlined.)

7) Hill, L. J. Bull, M. M., Sung, Y., Simmonds, A. G., Dirlam, P. T., Richer, N. E., DeRosa, S. E., Shim, I-B., Guin, D., Costanzo, P. J., Pinna, N., Willing, M-G., Vogel, W., Char, K., Pyun, J. "Direction the Deposition of Ferromagnetic Cobalt onto Pt-Tipped CdSe@CdS Nanorods: Synthetic and Mechanistic Insights." *ACS Nano* **2012.** *6 (10),* 8632-8645.

6) Kim, B. Y., Shallcross, R. C., Armstrong, N. R., Kim, H., Chung, W. J., Sahoo, R., Char, K., Dirlam, P. T., Costanzo, P. J., Pyun, J. "Surface Initiated Atom Transfer Radical Polymerizations from Indium Tin Oxide Electrodes: Electrochemistry of Polymer Brushes." *ACS Symposium Series, Vol. 1101. Progress in Controlled Radical Polymerization: Materials and Applications.* DOI: 10.1021/bk-2012-1101.ch013. ISBN13: 9780841227576. Chapter 13, pp 197–209

5) Hill, M. R., Mukherjee, S., Costanzo, P. J., Sumerlin, B. "Modular Oxime Functionalization of Well-Defined Alkoxyamine-Containing Polymers." *Polym. Chem.* **2012.** *3*, 1756-1762.

4) Curtzwiler, G. W., Costanzo, P. J., Fernando, R., Danes, J. E., Vorst, K. "Thermal Initiated Hydroxyethyl Methacrylate Functionalization of Multi-Walled Carbon Nanotubes." *J. Appl. Polym. Sci.* **2011.** *121*, 964–969.

3) Carlson, J. S, Hill, M. R, Young, T., Costanzo, P. J. "Novel polymer coupling chemistry based upon latent cysteine-like residues and thiazolidine chemistry." *Polym. Chem.* **2010.** *1,* 1423-1426.

2) Swanson, J. P., Rozvadovsky, S., Seppala, J. E., Mackay, M. E., Jensen, R. E., Costanzo, P. J. "Development of polymeric phase change materials based upon Diels-Alder chemistry." *Macromolecules.* **2010.** *43 (14),* 6135-6141.

1) Dirlam, P. T., Strange, G. A., Orlicki, J. A., Wetzel, E. D, Costanzo, P. J. "Controlling Surface Energy and Wetability with Diels-Alder Chemistry." *Langmuir.* **2010.** *26(6)*, 3942-3948.

2) Co-Primary Investigator. "Development of a bio-based and biodegradable polylactic acid spray coating and hot melt adhesive for corrugate and paperboard packages." Awarded $160,000 from JAN 2010 - JAN 2011 from LBP and Henkel.

1) Primary Investigator. "Development of Thermally Responsive Binders for Insensitive Munitions." Awarded $314,964 from APR 2008 - JUN 2011 by the Army Research Laboratory.

Oral Presentations (Presenting authors are denoted with an *. Undergraduates are underlined.)

A total of 84 oral presentations have resulted from work at California Polytechnic State University.

Students have given 41 oral presentations. Costanzo has given 36 invited talks, including 2 plenary.
Listed below are select presentations.

5) De Hoe, G. X.*, Formal, T. P, O'Bryan, G., Costanzo, P. J. "Synthetic design of block copolymer amphiphiles for nanomaterial dispersion." CSU Research Competition: Hayward, CA. 2 MAY 2014. ***De Hoe received 1st place in the Physical and Mathematical Sciences (PMS) division.***

4) De Hoe, G. X.*, Formal, T. P, O'Bryan, G., Costanzo, P. J. "Synthetic design of block copolymer amphiphiles for nanomaterial dispersion." American Chemical Society: Dallas, TX. 16 MAR 2014. ***De Hoe received the award for Outstanding Undergraduate Presentation in the POLY division of ACS.***

3) Pattillo, C. P.*, Costanzo, P. J. "Controlling Surface Energy and Wettability with a Light Responsive Linker System." CSU Research Competition: Pomona, CA. 9 MAY 2013. ***Pattillo received 1st place in the Physical and Mathematical Sciences (PMS) division.***

2) Amato, D. N.*, Costanzo, P. J. "Re-healable Coatings Based Upon Thermally Responsive Linkages." CSU Research Competition: Pomona, CA. 9 MAY 2013. ***Amato received 2nd place in the Interdisciplinary (Inter) division.***

1) Pattillo, C. C.*, Strange, G. A., Dirlam, P. T., Costanzo, P. J. "Controlling surface energy and wettability with Diels-Alder chemistry." American Chemical Society: San Diego, CA. 25 MAR 2012. ***Pattillo received the award for Outstanding Undergraduate Presentation in the POLY division of ACS.***

Poster Presentations (Presenting authors are denoted with an *. Undergraduates are underlined.)

A total of 52 poster presentations have resulted from work at California Polytechnic State University.

Students have given 40 poster presentations. Listed below are select presentations.

3) Varney, K. L.,* Amato, D. U., and Costanzo, P. J. "Re-healable Coatings Based Upon Thermally Responsive Linkages." Western Coating Symposium: Las Vegas, NV. 22 OCT 2013. Varney ***received Best Technical Student Poster award - 3rd place.***
3) Strange, G. A.*, Richardson, A. D., Savin, D. A., Costanzo P. J. "Controlling nanoparticle dispersion via Diels-Alder chemistry." Western Coating Symposium: Las Vegas, NV. 24 OCT 2011. ***Strange received Best Technical Student Poster award - 1st place.***
1) Curtzwiler, G. W. *, Costanzo, P. J., Fernando, R., Vorst, K. "Thermal Initiated Hydroxyethyl Methacrylate Functionalization of Multi-Walled Carbon Nanotubes." Western Coating Symposium: Las Vegas, NV. 26 OCT 2009. ***Curtzwiler received Best Technical Student Poster award - 1st place.***

Grants and Contracts

A total of 1.9M has been awarded to Costanzo to support students at Cal Poly

Costanzo has been involved in a total of 22 agreements during his tenure at Cal Poly. Listed below are select contracts.

10) Primary investigator. "RUI: Creation and application of nucleophile-induced retro-Diels-Alder linkages in dynamic-covalent polymeric systems." Awarded $297,503 from SEP 2020 - AUG 2023 by the National Science Foundation.
9) Primary investigator. "Polymer Scintillator Development." Awarded $64,818 from NOV 2019 – SEP 2020 by Sandia National Laboratory.
8) Primary investigator. "Development of responsive surfactants for improved oil recovery." Awarded $70,000 from SEP 2019 - AUG 2022 by the Petroleum Research Foundation.
7) Primary investigator. "Emulsion containing Diels-Alder linkages." Awarded $75,000 from JUN 2018 – MAY 2019 by Bona, Inc.
6) Primary investigator. "Organic Scintillator Development." Awarded $50,000 from NOV 2017 – JUL 2018 by Sandia National Laboratory.
5) Primary investigator. "RUI: Investigation into dynamic-covalent linkages through the use of Diels-Alder chemistry and controlled radical polymerization techniques." Awarded $210,000 from SEP 2017 - AUG 2020 by the National Science Foundation, CHE-MSN.
4) Primary investigator. "RUI: Preparation of Polymeric Phase Change materials based upon Diels-Alder chemistry." Awarded $210,000 from AUG 2012 - JUL 2016 by the National Science Foundation, CHE-MSN.
3) Co-Primary Investigator. "Online resources for the polymer education community." Awarded $23,000 from OCT 2013 - SEP 2014 by the Camille and Henry Dreyfus Foundation (Special Grant Program in the Chemical Sciences."
2) Primary investigator. "Novel polymer coupling via thiazolidine chemistry." Awarded $65,000 from SEP 2012 - AUG 2015 by the Petroleum Research Foundation.
1) Primary Investigator. "Incorporation of latent cysteine-like residues for the development novel coupling chemistry." Awarded $46,000 from JUN 2010 - JUN 2012 from the Research Corporation, Cottrell College Science Awards.

Awards Received

- ***Ronald T. Pflaum Award*** *from Alpha Chi Sigma for Outstanding Chapter Advisor : 2014 - 2016*
- ***California Polytechnic State University Award*** *for Distinguished Teaching : 2022-2022*
- ***California Polytechnic State University Award*** *for Distinguished Scholarship : 2014-2015*
- ***California Polytechnic State University Award*** *for Outstanding Undergraduate Advisor : 2010*
- *National Research Council (NRC) Postdoctoral Fellowship (2005-2007)*
- *Gordon Research Council Post-Doctoral Award : Macromolecular Materials Symposium (JAN 2007)*
- *Gordon Research Council Graduate Student Award : Macromolecular Materials Symposium (JAN 2005)*
- *Silver Graduate Student Award from the Material Research Society (MRS) (MAR 2004)*
- *NEAT-IGERT Fellowship (2001-2004)*
- *University of California at Davis : Outstanding Teaching Assistant Award (2003)*
- *University of California at Davis : Borge Scholarship (2001-2003)*
- *Carnegie Mellon Outstanding Undergraduate Chemist Award (2001)*