



Curtis Frank

W. M. Keck, Sr. Professor in Engineering, Emeritus
Chemical Engineering

Bio

BIO

The properties of ultrathin polymer films are often different from their bulk counterparts. We use spin casting, Langmuir-Blodgett deposition, and surface grafting to fabricate ultrathin films in the range of 100 to 1000 Angstroms thick. Macromolecular amphiphiles are examined at the air-water interface by surface pressure, Brewster angle microscopy, and interfacial shear measurements and on solid substrates by atomic force microscopy, FTIR, and ellipsometry. A vapor-deposition-polymerization process has been developed for covalent grafting of poly(amino acids) from solid substrates. FTIR measurements permit study of secondary structures (right and left-handed alpha helices, parallel and anti-parallel beta sheets) as a function of temperature and environment.

A broadly interdisciplinary collaboration has been established with the Department of Ophthalmology in the Stanford School of Medicine. We have designed and synthesized a fully interpenetrating network of two different hydrogel materials that have properties consistent with application as a substitute for the human cornea: high water swellability up to 85%, tensile strength comparable to the cornea, high glucose permeability comparable to the cornea, and sufficient tear strength to permit suturing. We have developed a technique for surface modification with adhesion peptides that allows binding of collagen and subsequent growth of epithelial cells. Broad questions on the relationships among molecular structure, processing protocol, and biomedical device application are being pursued.

ACADEMIC APPOINTMENTS

- Emeritus Faculty, Acad Council, Chemical Engineering
- Member, Bio-X
- Member, Cardiovascular Institute

HONORS AND AWARDS

- Fellow, American Physical Society
- CMA Stine Award, American Institute of Chemical Engineers
- Principal Investigator, National Science Foundation

PROFESSIONAL EDUCATION

- PhD, University of Illinois (1972)

Teaching

COURSES

2024-25

- An Exploration of Art Materials: The Intersection of Art and Science: CHEMENG 12SC (Sum)

2023-24

- An Exploration of Art Materials: The Intersection of Art and Science: CHEMENG 12SC (Sum)

2022-23

- An Exploration of Art Materials: The Intersection of Art and Science: CHEMENG 12SC (Sum)
- Graduate Practical Training: CHEMENG 299 (Sum)

Publications

PUBLICATIONS

- **Spontaneous upregulation of stemness and 3D spheroid formation of single cancer cells induced by scaffold-free polypeptide polyelectrolyte multilayer coating.** *Biomaterials*
Chen, J. Y., Liu, C. C., Wang, L., Jiang, H. S., Lu, P. S., Frank, C. W., Pegram, M. D., Huang, C. J., Wu, Y. C., Guo, C. L., Chang, Y. C.
2025; 326: 123702
- **High-resolution stereolithography: Negative spaces enabled by control of fluid mechanics.** *Proceedings of the National Academy of Sciences of the United States of America*
Coates, I. A., Pan, W., Saccone, M. A., Lipkowitz, G., Ilyin, D., Driskill, M. M., Dulay, M. T., Frank, C. W., Shaqfeh, E. S., DeSimone, J. M.
2024; 121 (37): e2405382121
- **Liposome-tethered supported lipid bilayer platform for capture and release of heterogeneous populations of circulating tumor cells.** *Journal of materials chemistry. B*
Yeh, P. Y., Chen, J. Y., Shen, M. Y., Che, T. F., Lim, S. C., Wang, J., Tsai, W. S., Frank, C. W., Huang, C. J., Chang, Y. C.
2023
- **Orthogonal Photo-chemistry Towards Direct Encryption of a 3D Printed Hydrogel.** *Advanced materials (Deerfield Beach, Fla.)*
Chen, D., Ni, C., Yang, C., Li, Y., Wen, X., Frank, C. W., Xie, T., Ren, H., Zhao, Q.
2023: e2209956
- **Multimic characterization and drug testing establish circulating tumor cells as an ex vivo tool for personalized medicine.** *iScience*
Chen, J., Chou, H., Lim, S. C., Huang, Y., Lai, K., Guo, C., Tung, C., Su, C., Wang, J., Liu, E., Han, H., Yeh, P., Hu, et al
2022; 25 (10): 105081
- **Influence of Mixed Imide Composition and Thermal Annealing on Ionic Liquid Uptake and Conductivity of Polyimide-Poly(ethylene glycol) Segmented Block Copolymer Membranes.** *Molecules (Basel, Switzerland)*
Ciftcioglu, G. A., Frank, C. W.
1800; 26 (24)
- **Surface Characteristics of Poly(Alkyl Methacrylate)s from Molecular Dynamics Simulations Using All-Atom Force Field.** *Macromolecular rapid communications*
Lee, S., Jeong, W., Frank, C. W., Yoon, D. Y.
2021: e2100614
- **Effect of Increased Ionic Liquid Uptake via Thermal Annealing on Mechanical Properties of Polyimide-Poly(ethylene glycol) Segmented Block Copolymer Membranes.** *Molecules (Basel, Switzerland)*
Ciftcioglu, G. A., Frank, C. W.
2021; 26 (8)
- **Effect of bubble nucleating agents derived from biochar on the foaming mechanism of poly lactic acid foams** *APPLIED SURFACE SCIENCE ADVANCES*
Haham, H., Riscoe, A., Frank, C. W., Billington, S. L.

2021; 3

- **A General Approach for Monolayer Adsorption of High Weight Loadings of Uniform Nanocrystals on Oxide Supports.** *Angewandte Chemie (International ed. in English)*
Kao, K., Yang, A., Huang, W., Zhou, C., Goodman, E. D., Holm, A., Frank, C. W., Cargnello, M.
2021
- **Structure-property relations of amphiphilic poly(furfuryl glycidyl ether)-block-poly(ethylene glycol) macromonomers at the air-water interface** *POLYMER CHEMISTRY*
Adatia, K. K., Holm, A., Southan, A., Frank, C. W., Tovar, G. E. M.
2020; 11 (35): 5659–68
- **Nanoscale Spatial Distribution of Supported Nanoparticles Controls Activity and Stability in Powder Catalysts for CO Oxidation and Photocatalytic H₂ Evolution.** *Journal of the American Chemical Society*
Holm, A., Goodman, E. D., Stenlid, J. H., Aitbekova, A., Zelaya, R., Diroll, B. T., Johnston-Peck, A. C., Kao, K. C., Frank, C. W., Pettersson, L. G., Cargnello, M.
2020; 142 (34): 14481-14494
- **Interface Characteristics of Neat Melts and Binary Mixtures of Polyethylenes from Atomistic Molecular Dynamics Simulations.** *Polymers*
Lee, S., Frank, C. W., Yoon, D. Y.
2020; 12 (5)
- **Nanoscale Spatial Distribution of Supported Nanoparticles Controls Activity and Stability in Powder Catalysts for CO Oxidation and Photocatalytic H₂ Evolution.** *Journal of the American Chemical Society*
Holm, A. n., Goodman, E. D., Stenlid, J. H., Aitbekova, A. n., Zelaya, R. n., Diroll, B. T., Johnston-Peck, A. C., Kao, K. C., Frank, C. W., Pettersson, L. G., Cargnello, M. n.
2020
- **Polyimide-PEG Segmented Block Copolymer Membranes with High Proton Conductivity by Improving Bicontinuous Nanostructure of Ionic Liquid-Doped Films** *MACROMOLECULAR CHEMISTRY AND PHYSICS*
Woo, E., Coletta, E., Holm, A., Mun, J., Toney, M. F., Yoon, D. Y., Frank, C. W.
2019; 220 (9)
- **General Self-Assembly Method for Deposition of Graphene Oxide into Uniform Close-Packed Monolayer Films**
Holm, A., Kunz, L., Riscoe, A. R., Kao, K., Cargnello, M., Frank, C. W.
AMER CHEMICAL SOC.2019: 4460–70
- **Photocatalytic CO₂ reduction using hybrid nanoporous catalysts**
Kao, K., Riscoe, A., Yang, A., Huang, W., Holm, A., Frank, C., Cargnello, M.
AMER CHEMICAL SOC.2019
- **Human iPSC derived progenitors bioengineered into liver organoids using an inverted colloidal crystal poly (ethylene glycol) scaffold** *BIOMATERIALS*
Ng, S., Saeb-Parsy, K., Blackford, S. J. I., Segal, J. M., Serra, M., Horcas-Lopez, M., No, D., Mastoridis, S., Jassem, W., Frank, C. W., Cho, N., Nakauchi, H., Glenn, et al
2018; 182: 299–311
- **Langmuir-Blodgett Deposition of Graphene Oxide-Identifying Marangoni Flow as a Process that Fundamentally Limits Deposition Control** *LANGMUIR*
Holm, A., Wrasman, C. J., Kao, K., Riscoe, A. R., Cargnello, M., Frank, C. W.
2018; 34 (33): 9683-9691
- **Synthesis, characterization and light-induced spatial charge separation in Janus graphene oxide**
Holm, A., Park, J., Goodman, E., Zhang, J., Sinclair, R., Cargnello, M., Frank, C.
AMER CHEMICAL SOC.2018
- **Langmuir-Blodgett deposition of graphene oxide - identifying Marangoni flow as a process that fundamentally limits deposition control**
Holm, A., Wrasman, C., Riscoe, A., Cargnello, M., Frank, C.
AMER CHEMICAL SOC.2018
- **Langmuir-Blodgett Deposition of Graphene Oxide-Identifying Marangoni Flow as a Process that Fundamentally Limits Deposition Control.** *Langmuir : the ACS journal of surfaces and colloids*

Holm, A., Wrasman, C. J., Kao, K., Riscoe, A. R., Cargnello, M., Frank, C. W.
2018

- **Human iPS derived progenitors bioengineered into liver organoids using an inverted colloidal crystal poly (ethylene glycol) scaffold.** *Biomaterials*
Ng, S. S., Saeb-Parsy, K., Blackford, S. J., Segal, J. M., Serra, M. P., Horcas-Lopez, M., No, D. Y., Mastoridis, S., Jassem, W., Frank, C. W., Cho, N. J., Nakauchi, H., Glenn, et al
2018; 182: 299–311
- **A lignin-epoxy resin derived from biomass as an alternative to formaldehyde-based wood adhesives** *GREEN CHEMISTRY*
Li, R., Gutierrez, J., Chung, Y., Frank, C. W., Billington, S. L., Sattely, E. S.
2018; 20 (7): 1459–66
- **Synthesis, Characterization, and Light-Induced Spatial Charge Separation in Janus Graphene Oxide** *CHEMISTRY OF MATERIALS*
Holm, A., Park, J., Goodman, E. D., Zhang, J., Sinclair, R., Cargnello, M., Frank, C. W.
2018; 30 (6): 2084–92
- **Long-term culture of human liver tissue with advanced hepatic functions.** *JCI insight*
Ng, S. S., Xiong, A., Nguyen, K., Masek, M., No, D. Y., Elazar, M., Shteyer, E., Winters, M. A., Voedisch, A., Shaw, K., Rashid, S. T., Frank, C. W., Cho, et al
2017; 2 (11)
- **Interfacial and topological effects on the glass transition in free-standing polystyrene films** *JOURNAL OF CHEMICAL PHYSICS*
Lyulin, A. V., Balabaev, N. K., Baljon, A. R., Mendoza, G., Frank, C. W., Yoon, D. Y.
2017; 146 (20)
- **Interface characteristics of polystyrene melts in free-standing thin films and on graphite surface from molecular dynamics simulations** *POLYMER*
Lee, S., Lyulin, A. V., Frank, C. W., Yoon, D. Y.
2017; 116: 540-548
- **Microscopic structures in ion exchange fuel cell membranes**
Lu, J., Spakowitz, A., Frank, C., Toney, M.
AMER CHEMICAL SOC.2017
- **Enhanced ionic conductivity of peg-containing polyimide/ionic liquid membrane upon thermal annealing**
Frank, C., Woo, E., Lu, J., Coletta, E., Mun, J., Spakowitz, A., Yoon, D., Toney, M.
AMER CHEMICAL SOC.2017
- **Self-assembly of cholesterol tethered within hydrogel networks** *POLYMER*
Engberg, K., Waters, D. J., Kelmanovich, S., Parke-Houben, R., Hartmann, L., Toney, M. F., Frank, C. W.
2016; 84: 371-382
- **Biocompatibility of poly(ethylene glycol) and poly(acrylic acid) interpenetrating network hydrogel by intrastromal implantation in rabbit cornea** *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART A*
Zheng, L. L., Vanchinathan, V., Dalal, R., Noolandi, J., Waters, D. J., Hartmann, L., Cochran, J. R., Frank, C. W., Yu, C. Q., Ta, C. N.
2015; 103 (10): 3157-3165
- **Biocompatibility of poly(ethylene glycol) and poly(acrylic acid) interpenetrating network hydrogel by intrastromal implantation in rabbit cornea.** *Journal of biomedical materials research. Part A*
Zheng, L. L., Vanchinathan, V., Dalal, R., Noolandi, J., Waters, D. J., Hartmann, L., Cochran, J. R., Frank, C. W., Yu, C. Q., Ta, C. N.
2015; 103 (10): 3157-3165
- **Supramolecular motifs in dynamic covalent PEG-hemiaminal organogels** *NATURE COMMUNICATIONS*
Fox, C. H., Ter Hurne, G. M., Wojtecki, R. J., Jones, G. O., Horn, H. W., Meijer, E. W., Frank, C. W., Hedrick, J. L., Garcia, J. M.
2015; 6
- **Scientific Delirium Madness** *LEONARDO*
Knight, M. H., Jacobs, C. D., Frank, C. W., Sternberg, D., Petrenko, S., Tromble, M., Sumner, D., Sundaralingam, P.
2015; 48 (3): 219-225

- **Tunable mesoscale-structured self-assembled hydrogels synthesized by organocatalytic ring-opening polymerization** *POLYMER*
Fox, C. H., Engler, A. C., Toney, M. F., Hedrick, J. L., Frank, C. W.
2015; 65: 93-104
- **A Semi-Interpenetrating Network Approach for Dimensionally Stabilizing Highly-Charged Anion Exchange Membranes for Alkaline Fuel Cells** *CHEMSUSCHEM*
He, S. S., Strickler, A. L., Frank, C. W.
2015; 8 (8): 1472-1483
- **Effects of Aromatic Regularity on the Structure and Conductivity of Polyimide-Poly(ethylene glycol) Materials Doped with Ionic Liquid** *JOURNAL OF POLYMER SCIENCE PART B-POLYMER PHYSICS*
Coletta, E., Toney, M. F., Frank, C. W.
2015; 53 (7): 509-521
- **Organocatalytic Ring-Opening Polymerization of Trimethylene Carbonate To Yield a Biodegradable Polycarbonate** *JOURNAL OF CHEMICAL EDUCATION*
Chan, J. M., Zhang, X., Brennan, M. K., Sardon, H., Engler, A. C., Fox, C. H., Frank, C. W., Waymouth, R. M., Hedrick, J. L.
2015; 92 (4): 708-713
- **Influences of liquid electrolyte and polyimide identity on the structure and conductivity of polyimide-poly(ethylene glycol) materials** *JOURNAL OF APPLIED POLYMER SCIENCE*
Coletta, E., Toney, M. F., Frank, C. W.
2015; 132 (12)
- **Phosphatidylinositol 4,5-Bisphosphate Is an HCV NS5A Ligand and Mediates Replication of the Viral Genome.** *Gastroenterology*
Cho, N., Lee, C., Pang, P. S., Pham, E. A., Fram, B., Nguyen, K., Xiong, A., Sklan, E. H., Elazar, M., Koytak, E. S., Kersten, C., Kanazawa, K. K., Frank, et al
2015; 148 (3): 616-625
- **A Simple Method for Encapsulating Single Cells in Alginate Microspheres Allows for Direct PCR and Whole Genome Amplification** *PLOS ONE*
Bigdeli, S., Dettloff, R. O., Frank, C. W., Davis, R. W., Crosby, L. D.
2015; 10 (2)
- **Interpenetrating polymer network hydrogel scaffolds for artificial cornea periphery.** *Journal of materials science. Materials in medicine*
Parke-Houben, R., Fox, C. H., Zheng, L. L., Waters, D. J., Cochran, J. R., Ta, C. N., Frank, C. W.
2015; 26 (2): 107-?
- **Interpenetrating polymer network hydrogel scaffolds for artificial cornea periphery.** *Journal of materials science. Materials in medicine*
Parke-Houben, R., Fox, C. H., Zheng, L. L., Waters, D. J., Cochran, J. R., Ta, C. N., Frank, C. W.
2015; 26 (2): 5442-?
- **Supramolecular motifs in dynamic covalent PEG-hemiaminal organogels.** *Nature communications*
Fox, C. H., Ter Hurrne, G. M., Wojtecki, R. J., Jones, G. O., Horn, H. W., Meijer, E. W., Frank, C. W., Hedrick, J. L., García, J. M.
2015; 6: 7417-?
- **Chemoresponsive surface-tethered polypeptide brushes based on switchable secondary conformations** *RSC ADVANCES*
Yang, C., Wang, Y., Frank, C. W., Chang, Y.
2015; 5 (105): 86113-86119
- **Modular composite hydrogels from cholesterol-functionalized polycarbonates for antimicrobial applications** *JOURNAL OF MATERIALS CHEMISTRY B*
Lee, A. L., Venkataraman, S., Fox, C. H., Coady, D. J., Frank, C. W., Hedrick, J. L., Yang, Y. Y.
2015; 3 (34): 6953-6963
- **Impacts of polymer-polymer interactions and interfaces on the structure and conductivity of PEG-containing polyimides doped with ionic liquid** *POLYMER*
Coletta, E., Toney, M. Y., Frank, C. W.
2014; 55 (26): 6883-6895

- **Increasing Cell Homogeneity of Semicrystalline, Biodegradable Polymer Foams With a Narrow Processing Window via Rapid Quenching** *POLYMER ENGINEERING AND SCIENCE*
Wright, Z. C., Frank, C. W.
2014; 54 (12): 2877-2886
- **Comparison of anhydrous and monohydrated forms of orotic acid as crystal nucleating agents for poly(3-hydroxybutyrate-co-3-hydroxyvalerate)** *POLYMER*
Tsui, A., Frank, C. W.
2014; 55 (24): 6364-6372
- **Prediction of Gas Solubility in Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) Melt to Inform Process Design and Resulting Foam Microstructure** *POLYMER ENGINEERING AND SCIENCE*
Tsui, A., Wright, Z., Frank, C. W.
2014; 54 (11): 2683-2695
- **Facilitating hydroxide transport in anion exchange membranes via hydrophilic grafts** *JOURNAL OF MATERIALS CHEMISTRY A*
He, S. S., Frank, C. W.
2014; 2 (39): 16489-16497
- **Impact of Processing Temperature and Composition on Foaming of Biodegradable Poly(hydroxyalkanoate) Blends** *INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH*
Tsui, A., Frank, C. W.
2014; 53 (41): 15896-15908
- **Small-angle X-ray scattering of self-assembled hydrogels in topologically constrained systems**
Fox, C. H., Frank, C. W., Hedrick, J. L., Engler, A. C.
AMER CHEMICAL SOC.2014
- **Directed Axonal Outgrowth Using a Propagating Gradient of IGF-1.** *Advanced materials*
Lee, W., Frank, C. W., Park, J.
2014; 26 (29): 4936-4940
- **Topological constraints in interpenetrating polymer network hydrogels**
Frank, C.
AMER CHEMICAL SOC.2014
- **Vesicle Adhesion and Rupture on Silicon Oxide: Influence of Freeze-Thaw Pretreatment** *LANGMUIR*
Jackman, J. A., Zhao, Z., Zhdanov, V. P., Frank, C. W., Cho, N.
2014; 30 (8): 2152-2160
- **Grafting of Cross-Linked Hydrogel Networks to Titanium Surfaces** *ACS APPLIED MATERIALS & INTERFACES*
Muir, B. V., Myung, D., Knoll, W., Frank, C. W.
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- **Enhanced particle removal using viscoelastic fluids** *JOURNAL OF RHEOLOGY*
Walker, T. W., Hsu, T. T., FitzGibbon, S., Frank, C. W., Mui, D. S., Zhu, J., Mendiratta, A., Fuller, G. G.
2014; 58 (1): 63-88
- **Directed axonal outgrowth using a propagating gradient of IGF-1** *ADVANCED MATERIALS*
Lee, W., Frank, C. W., Park, J.
2014; 26: 4936-4940
- **Instabilities and elastic recoil of the two-fluid circular hydraulic jump** *EXPERIMENTS IN FLUIDS*
Hsu, T. T., Walker, T. W., Frank, C. W., Fuller, G. G.
2014; 55 (1)
- **A Renewable Lignin-Lactide Copolymer and Application in Biobased Composites** *ACS SUSTAINABLE CHEMISTRY & ENGINEERING*
Chung, Y., Olsson, J. V., Li, R. J., Frank, C. W., Waymouth, R. M., Billington, S. L., Sattely, E. S.
2013; 1 (10): 1231-1238

- **Comparison of Extruded and Sonicated Vesicles for Planar Bilayer Self-Assembly.** *Materials (Basel, Switzerland)*
Cho, N. J., Hwang, L. Y., Solandt, J. J., Frank, C. W.
2013; 6 (8): 3294-3308
- **Comparison of Extruded and Sonicated Vesicles for Planar Bilayer Self-Assembly** *MATERIALS*
Cho, N., Hwang, L. Y., Solandt, J. J., Frank, C. W.
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- **Antibody conjugated supported lipid bilayer for capturing and purification of viable tumor cells in blood for subsequent cell culture** *BIOMATERIALS*
Wu, J., Tseng, P., Tsai, W., Liao, M., Lu, S., Frank, C. W., Chen, J., Wu, H., Chang, Y.
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- **Chondro-ocular graft transfer:: An alternative to allograft transplantation?**
Myung, D., Ta, C., Yung, E., Frank, C.
ASSOC RESEARCH VISION OPHTHALMOLOGY INC.2013
- **Graft-polymerization of poly(lactic acid) onto lignin with application to biobased composites**
Chung, Y., Olsson, J. V., Li, R., Billington, S., Frank, C. W., Waymouth, R. M., Sattely, E.
AMER CHEMICAL SOC.2013
- **In vivo biocompatibility of two PEG/PAA interpenetrating polymer networks as corneal inlays following deep stromal pocket implantation** *JOURNAL OF MATERIALS SCIENCE-MATERIALS IN MEDICINE*
Tan, X. W., Hartman, L., Tan, K. P., Poh, R., Myung, D., Zheng, L. L., Waters, D., Noolandi, J., Beuerman, R. W., Frank, C. W., Ta, C. N., Tan, D. T., Mehta, et al
2013; 24 (4): 967-977
- **Biodegradable Polyesters from Renewable Resources** *ANNUAL REVIEW OF CHEMICAL AND BIOMOLECULAR ENGINEERING, VOL 4*
Tsui, A., Wright, Z. C., Frank, C. W.
2013; 4: 143-?
- **Surface Modification of High-Strength Interpenetrating Network Hydrogels for Biomedical Device Applications** *HANDBOOK OF BIOFUNCTIONAL SURFACES*
Myung, D., Kourtis, L., Noolandi, J., Cochran, J., Ta, C. N., Frank, C. W.
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- **Biodegradable Films and Foam of Poly(3-Hydroxybutyrate-co-3-hydroxyvalerate) Blended with Silk Fibroin** *244th National Fall Meeting of the American-Chemical-Society (ACS)*
Tsui, A., Hu, X., Kaplan, D. L., Frank, C. W.
AMER CHEMICAL SOC.2013: 251-279
- **Characterizing the effects of ambient aging on the mechanical and physical properties of two commercially available bacterial thermoplastics** *3rd International Conference on Biodegradable and Biobased Polymers (BIOPOL)*
Srubar, W. V., Wright, Z. C., Tsui, A., Michel, A. T., Billington, S. L., Frank, C. W.
ELSEVIER SCI LTD.2012: 1922-29
- **Role of shear-thinning on the dynamics of rinsing flow by an impinging jet** *PHYSICS OF FLUIDS*
Walker, T. W., Hsu, T. T., Frank, C. W., Fuller, G. G.
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- **Competitive swelling/deswelling in a dual-responsive interpenetrating network hydrogel**
Kelmanovich, S., Toney, M., Frank, C. W.
AMER CHEMICAL SOC.2012
- **Extruded foams from microbial poly(3-hydroxybutyrate-co-3-hydroxyvalerate) and its blends with cellulose acetate butyrate** *POLYMER ENGINEERING AND SCIENCE*
Liao, Q., Tsui, A., Billington, S., Frank, C. W.
2012; 52 (7): 1495-1508

- **Modeling the kinetics of water transport and hydroexpansion in a lignocellulose-reinforced bacterial copolyester** *POLYMER*
Srubar, W. V., Frank, C. W., Billington, S. L.
2012; 53 (11): 2152-2161
- **Mechanisms and impact of fiber-matrix compatibilization techniques on the material characterization of PHBV/oak wood flour engineered biobased composites** *COMPOSITES SCIENCE AND TECHNOLOGY*
Srubar, W. V., Pilla, S., Wright, Z. C., Ryan, C. A., Greene, J. P., Frank, C. W., Billington, S. L.
2012; 72 (6): 708-715
- **Using QCM-D and ellipsometry to determine the orientation and state of hydration of antibodies adsorbed on a hydrophobic surface**
Wiseman, M., Frank, C.
AMER CHEMICAL SOC.2012
- **Antibody Adsorption and Orientation on Hydrophobic Surfaces** *LANGMUIR*
Wiseman, M. E., Frank, C. W.
2012; 28 (3): 1765-1774
- **Meso-ordered soft hydrogels** *SOFT MATTER*
Claesson, M., Engberg, K., Frank, C. W., Andersson, M.
2012; 8 (31): 8149-8156
- **Competitive swelling forces and interpolymer complexation in pH- and temperature-sensitive interpenetrating network hydrogels** *SOFT MATTER*
Kelmanovich, S. G., Parke-Houben, R., Frank, C. W.
2012; 8 (31): 8137-8148
- **Diffusion of Protein through the Human Cornea** *OPHTHALMIC RESEARCH*
Charalel, R. A., Engberg, K., Noolandi, J., Cochran, J. R., Frank, C., Ta, C. N.
2012; 48 (1): 50-55
- **Star polymers with random number of temperature sensitive arms and crosslinked poly(EGDMA)-core and their application to drug delivery** *REACTIVE & FUNCTIONAL POLYMERS*
Alvarez-Sanchez, J., Licea-Claverie, A., Cornejo-Bravo, J. M., Frank, C. W.
2011; 71 (11): 1077-1088
- **Protein diffusion in photopolymerized poly(ethylene glycol) hydrogel networks** *BIOMEDICAL MATERIALS*
Engberg, K., Frank, C. W.
2011; 6 (5)
- **Structure and Mechanism of Strength Enhancement in Interpenetrating Polymer Network Hydrogels** *MACROMOLECULES*
Waters, D. J., Engberg, K., Parke-Houben, R., Ta, C. N., Jackson, A. J., Toney, M. F., Frank, C. W.
2011; 44 (14): 5776-5787
- **Toward the development of an artificial cornea: improved stability of interpenetrating polymer networks.** *Journal of biomedical materials research. Part B, Applied biomaterials*
Hartmann, L., Watanabe, K., Zheng, L. L., Kim, C., Beck, S. E., Huie, P., Noolandi, J., Cochran, J. R., Ta, C. N., Frank, C. W.
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- **Toward the development of an artificial cornea: Improved stability of interpenetrating polymer networks** *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART B-APPLIED BIOMATERIALS*
Hartmann, L., Watanabe, K., Zheng, L. L., Kim, C., Beck, S. E., Huie, P., Noolandi, J., Cochran, J. R., Ta, C. N., Frank, C. W.
2011; 98B (1): 8-17
- **pH-Driven Assembly of Various Supported Lipid Platforms: A Comparative Study on Silicon Oxide and Titanium Oxide** *LANGMUIR*
Cho, N., Jackman, J. A., Liu, M., Frank, C. W.
2011; 27 (7): 3739-3748
- **Role of fluid elasticity on the dynamics of rinsing flow by an impinging jet** *PHYSICS OF FLUIDS*
Hsu, T. T., Walker, T. W., Frank, C. W., Fuller, G. G.
2011; 23 (3)

- **Anaerobic biodegradation of the microbial copolymer poly(3-hydroxybutyrate-co-3-hydroxyhexanoate): Effects of comonomer content, processing history, and semi-crystalline morphology** *POLYMER*
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