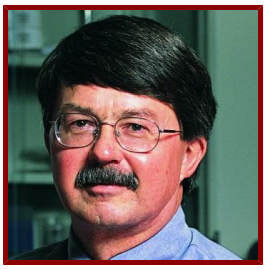
Stanford



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

- Professor Emeritus, 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)

Publications

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- **A General Approach for Monolayer Adsorption of High Weight Loadings of Uniform Nanocrystals on Oxide Supports.** *Angewandte Chemie (International ed. in English)*
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- **Structure-property relations of amphiphilic poly(furfuryl glycidyl ether)-block-poly(ethylene glycol) macromonomers at the air-water interface** *POLYMER CHEMISTRY*
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