University of Pittsburgh

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Featured Inventors: L. Pocivavsek, MD, PhD; S. Velankar, PhD

TopoSystems

A Surface Technology for Anti-Fouling Applications

Value Proposition

Companies involved in filtration of dirty water currently suffer from surface fouling in fluid pathways. Many have halfhearted solutions to these issues (backwashing, production stoppages, etc.) but continue to have major issues with how foulants impact production. Our technology poses a value to these companies by offering means to increase filtration efficiency, decrease operation/cleaning costs, and increasing the overall life spans of filters and systems in general.

Market Opportunity

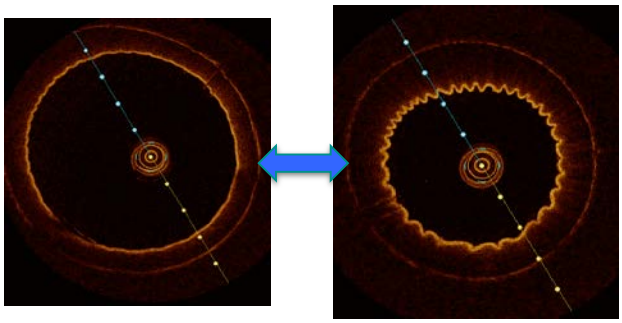
Current methods that tackle the global problem of wastewater fouling include, but are not limited to Nano coating technologies, chemical coatings, large scale mechanical interference, and manual cleaning. All of these have major downsides from being extremely expensive, time consuming, or making the process significantly inefficient. TopoSystems would be marketable to the estimated 20,000 wastewater facilities in the United States. The antifouling market also is reported (via Grand View Research) to have a compound annual growth rate of 5% until 2022.

Competitive Landscape

TopoSystems is a surface technology which utilizes pressure driven surface actuation to wrinkle and unwrinkled the fluid/surface interface. This mechanical interference competes with the chemical adhesion of foulants to the surface and keeps the surface clean. This is unique to current filtration process cleaning methods such as backwashing, vibration pulsing, or manual cleaning during a stoppage in production. TopoSystem's unique technology allows it to separate itself from these competing strategies and poses a permanent solution to fouling issues. Weaknesses to TopoSystems would be the difficulty of implementation and the cost that would be associated.

IP Landscape

Provisional patent application in process.



OCT images of technology oscillating under pulsatile flow conditions.

Technology

TopoSystems is a surface technology which utilizes pressure driven surface actuation to wrinkle and unwrinkled the fluid/surface interface. The adhesive layering of a thin, stiff film under strain on to a thick, soft film not under strain (relative) creates a multilayered strained system. When this system is exposed to an imbedded pressure oscillation, the two films compete to relax, thus an oscillation in wrinkling of the strained film. This oscillating mechanical interference competes with the chemical adhesion of foulants contacting and adhering to the surface and keeps the surface clean.

Stage of Development

Application Validation

Funding

Center for Medical Innovation, University of Pittsburgh, Design of Artificial Polymeric Cylindrical Vascular Grafts with Tunable Luminal Topography, P.I. Luka Pocivavsek, $20,000, 07/15/2015-1/15/2016
(presently on no-cost extension)

FEATURED INVENTORS:

Luka Pocivavsek, M.D. Ph.D.

Education

B. Sc. Chemistry with American Chemical Society Certification Duke University, Durham, North Carolina, 2001 – Magna Cum Laude

B.A. History Duke University, Durham, North Carolina, 2001 – Magna Cum Laude

M. Sc. Physical Chemistry The University of Chicago, Chicago, Illinois, 2005

Ph.D. Physical Chemistry Thesis Title: Mechanical and Thermodynamic Focusing at Membrane Interfaces The University of Chicago, Chicago, Illinois, 2009

M.D. The University of Chicago Pritzker School of Medicine, Chicago, Illinois, 2011

Publications

1. L. Pocivavsek, K. Cao, E. Chi, , B. Lin, J. Majewski, M. Meron, and KYC Lee, Role of lipid headgroup chemistry in controlling interfacial de-mixing of glycerol and water: a neutron and x-ray reflectivity study (in preparation)
2. L. Pocivavsek, K. Krishan, K. Gavrilov, and KYC Lee, General model of lipid monolayer collapse (in preparation)
3. L. Pocivavsek, KYC Lee, and E. Cerda, Wrinkle-to-fold transition on elastic substrates (in preparation)
4. L. Pocivavsek, R. Meza, and K.A. Garrett, Elasticity and Geometry of Ventral Hernia Repair (in preparation)

Sachin Velankar

Education

Undergraduate: Chemical Engineering, Indian Institute of Technology, Bombay, B.Tech., 1993

Graduate: Ph.D., Chemical Engineering, University of Delaware, 1999

Publications

1. S. Chatterjee and S.S. Velankar, “SMA-elastomer composites for reversibly-morphing surfaces”, Journal of Intelligent Material Systems and Structures, 26, 324-339, 2015.
2. S. Chatterjee, C.L. McDonald, J. Niu, S.S. Velankar, P. Wang, and R. Huang “Wrinkling and folding of thin films by viscous stress, Soft Matter, 11, 1814-1827, 2015.
3. S.S. Velankar, V. Lai, R.A. Vaia, “Swelling-induced delamination causes folding of surface-tethered polymer gels”, ACS App. Mat. Int., 4 24-29, 2012.

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