

Department of Chemical and Biomolecular Engineering  
North Carolina State University  
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## Education

- 2003 – present Ph.D. in Chemical Engineering (Advisor: Prof. Orlin D. Velev)  
North Carolina State University, Raleigh, NC
- 1999 – 2001 M.S. in Environmental Science & Engineering (Advisor: Prof. Man Bock Gu)  
Gwangju Institute of Science & Technology, Gwangju, Korea
- 1992 – 1999 B.S. in Chemical Engineering  
Chung-Ang University, Seoul, Korea

## Awards & Honors

- Invitation to the 2nd Annual NC State Graduate Student Research Symposium in recognition of outstanding research, North Carolina State University (Mar. 2007)
- 1st place, NCSU ChE Intradepartmental Schoenborn Poster Presentation Competition (Jan. 2006)
- Graduate Study Abroad Scholarship by the Korea Science and Engineering Foundation (Jul. 2003)
- Excellent Poster Presentation Award, The Korean Society of Toxicology (Nov. 2002)
- Full Scholarship with Honors, Chung-Ang University, Korea (1996, 1997, 1998)
- Scholarship granted by Sindonga Marin & Fire Insurance Co., Ltd., Korea (1996)
- Full Scholarship and Supplemental Stipend during Three Academic Years, Chung-Ang University, Korea (1992)

## Research interests

- Colloidal science and engineering; Particle manipulation on micro-scale via evaporation-induced, dielectrophoretic and electrokinetic forces; Microfluidic manipulation via electrohydrodynamic forces; Microcapsule synthesis; Biosensors

## Research experience

*Velev Research Group in North Carolina State University (2003 – present)*

- Manipulation of droplets with colloidal particles on a dielectrophoretic liquid chip
  - Evaporation-induced microseparation of the particles inside a freely floating droplets
  - Fundamental exploration of the relationship between surface tension gradient driven flow (Marangoni flow) and the vertical particle separation inside the evaporating droplet
  - Application for material synthesis and microbioassays
- Self-propelling semiconductor particle and Microfluidics via applied AC electric field
  - Investigated the motility of remotely powered miniature diodes

- Fundamental exploration of the relationship between the self-propulsion of the miniature diodes and particle-localized electroosmotic flow
- Application for microfluidic pumps and micromixer
- Synthesis of polymer microcapsule
  - Emulsion-based synthesis of reversibly swellable polymer microcapsule embedded with metallic nanoparticles
- Current-rectifying organic-based electronic component
  - Demonstrated unidirectional ionic current flow across a organic junction between aqueous ionic gels

*Korea Institute of Science and Technology, Seoul, Korea (2002 – 2003)*

- Identification of differentially expressed genes in cell

*Hyosung cooperation, Anyang, Korea (2001 – 2002)*

- Developed biofilter system for removal of toxic gas

*Gwangju Institute of Science and Technology, Gwangju, Korea (1999 – 2001)*

- Developed biosensors for the detection of toxic chemicals in environments using recombinant bioluminescent bacteria
- Construction of genetically engineered bacterial cells

## Publications

- **Suk Tai Chang**, Erin Beaumont, Dimiter N. Petsev and Orlin D. Velev, Remotely powered distributed microfluidic pumps and mixers based on miniature diodes, *submitted*, (2007)
- Olivier J. Cayre, **Suk Tai Chang** and Orlin D. Velev, Polyelectrolyte Diode: Nonlinear Current Response of a Junction between Aqueous Ionic Gels, *Journal of The American Chemical Society*, (2007) 129, 10801-10806.
- **Suk Tai Chang**, Vesselin N. Paunov, Dimiter N. Petsev and Orlin D. Velev, Remotely Powered Self-Propelling Particles and Micropumps Based on Miniature Diodes, *Nature Materials*, (2007) 6, 235-240.
- Hye Young Koo, **Suk Tai Chang**, Won San Choi, Jeong Ho Park, Dong Yu Kim, and Orlin D. Velev, Emulsion-Based Synthesis of Reversibly Swellable, Magnetic Nanoparticle-Embedded Polymer Microcapsules, *Chemistry of Materials* (2006) 18, 3308-3313.
- **Suk Tai Chang** and Orlin D. Velev, Evaporation-Induced Particle Microseparations inside Droplets Floating on a Chip, *Langmuir* (2006) 22, 1459-1468.
- **Suk Tai Chang**, Hyun Joo Lee, and Man Bock Gu, Enhancement in the sensitivity of a soil biosensor for the detection of PAH toxicity using an immobilized recombinant bacterium and a biosurfactant, *Sensors and Actuators B: Chemical* (2004) 97, 272-276.
- Man Bock Gu and **Suk Tai Chang**, Soil Biosensor for the Detection of PAH Toxicity Using an Immobilized Recombinant Bacterium and a Biosurfactant, *Biosensors & Bioelectronics* (2001) 16, 667-674.

- Geun Cheol Gil, Robert J. Mitchell, **Suk Tai Chang**, and Man Bock Gu, A biosensor for the detection of gas toxicity using a recombinant bioluminescent bacterium, *Biosensors & Bioelectronics* (2000) 15, 23-30.

## Conference presentations

- Suk Tai Chang, Vesselin N. Paunov, Dimiter N. Petsev and Orlin D. Velev, Remotely powered distributed microfluidic pumps and mixers based on miniature diodes, *The 81st ACS Colloid and Surface Science Symposium, Newark, Delaware, USA* (2007)
- Suk Tai Chang, Vesselin N. Paunov, Dimiter N. Petsev and Orlin D. Velev, Distributed microfluidic pumping, mixing and separations using remotely powered miniature diodes, *2007 MRS Spring Meeting, San Francisco, California, USA* (2007)
- Orlin D. Velev, Suk Tai Chang and Vesselin N. Paunov, Electroosmotic self-propelling particles and distributed microfluidic pumps based on miniature semiconductor diodes, *The 80th ACS Colloid and Surface Science Symposium, Boulder, Colorado, USA* (2006)
- Bridgette M. Budhlall, Suk Tai Chang, Orlin D. Velev and Manuel Marquez, Thermoresponsive polymer microcapsules prepared by liquid-liquid templating and phase separations, *The 80th ACS Colloid and Surface Science Symposium, Boulder, Colorado, USA* (2006)
- Orlin D. Velev, Suk Tai Chang and Vinayak Rastogi, Evaporation-driven mixing and microseparations in droplets on a chip: Fundamentals and applications in materials synthesis and bioassays, *The 231st ACS National Meeting, Atlanta, Georgia, USA* (2006)
- Suk Tai Chang, Orlin D. Velev, and Vesselin N. Paunov, Self-Propelling Semiconductor Devices Demonstrate New Electroosmotic Motility Principles, *AIChE 2005 Annual Meeting, Cincinnati, Ohio, USA* (2005)
- Suk Tai Chang and Orlin D. Velev, Evaporation-Induced Particle Microseparations inside Freely Floating Droplets, *The 79th ACS Colloid and Surface Science Symposium, Potsdam, New York, USA* (2005)
- Orlin D. Velev, Jeffrey Millman, Suk Tai Chang, Ketan Bhatt and Brian Prevo, Assembly of complex microparticle and nanoparticle structure in on-chip microdroplet reactors, *2005 MRS Spring Meeting, San Francisco, CA, USA* (2005)
- Man Bock Gu and Suk Tai Chang, A toxicity biosensor for polycyclic aromatic hydrocarbon (PAH) contaminated soil, *The Sixth World Congress on Biosensors (BIOSENSORS2000), San Diego, USA* (2000)
- Man Bock Gu and Suk Tai Chang, A continuous toxicity monitoring system using bioluminescent bacteria, *Biosensors for Evaluation of the Performance of Waste Water Treatment Works (BIOSET), Barcelona, Spain* (2000)

## Conference posters

- Suk Tai Chang, Olivier J. Cayre and Orlin D. Velev, Gel diodes: Unidirectional current response of an ionic junction between polyelectrolyte aqueous gels, *The 81st ACS Colloid and Surface Science Symposium, Newark, Delaware, USA* (2007)
- Vinayak Rastogi, Suk Tai Chang and Orlin D. Velev, Microbioassays based on nanoparticle

agglutination and evaporation driven separations inside droplets on a chip, *2007 MRS Spring Meeting, San Francisco, California, USA* (2007)

- Suk Tai Chang, Vinayak Rastogi, and Orlin D. Velev, Evaporation-driven particle microseparations in droplets on a chip: Fundamentals and applications in materials assembly and microbioassays, *The 75th Gordon Conference (Colloidal, Macromolecular & Polyelectrolyte Solutions), Ventura, California, USA* (2006)
- Ketan Bhatt, Brian Prevo, Suk Tai Chang, and Orlin D. Velev, Manipulation of droplets with suspended particles on a dielectrophoretic liquid chip, *ACS PRF Summer School in Nanoparticle Materials, Ypsilanti, Michigan, USA* (2004)
- Youn-Jung Kim, Suk Tai Chang, Hye-Jung Yun and Jae-Chun Ryu, Identification of differentially expressed Genes by methyl mercury in neuroblastoma cell line using SSH, *The Meeting of The Korean Society of Toxicology, Seoul, Korea* (2002)
- Suk Tai Chang and Man Bock Gu, Soil biosensor for the detection of PAH toxicity using an immobilized recombinant bacterium, *The 1st International Symposium on Environmental Biosensors and DNA Microarrays for Environmental Biomonitoring, Gwangju, Korea* (2002)
- Suk Tai Chang, Hyun Joo Lee, and Man Bock Gu, Enhancement in the sensitivity of a soil biosensor for the detection of PAH toxicity using an immobilized recombinant bacterium and a biosurfactant, *Setac Europe Conference, Organic Soil Contaminants 2001, Copenhagen, Denmark* (2001)
- Suk Tai Chang, Sue Hyung Choi, P. D. Hansen, and Man Bock Gu, Toxicity monitoring and evaluation of wastewater treatment works in Spain using freeze-dried recombinant bioluminescent bacteria, *The 3rd International Symposium on Advanced Environmental Monitoring, Cheju Island, Korea* (2000)

## Intellectual Property Generated

### *Invention disclosures*

- Orlin D. Velev, Vesselin N. Paunov and Suk Tai Chang, Autonomous self-propelling microcircuit particles, Invention disclosure, NCSU (2005)
- Orlin D. Velev, Dimiter N. Petsev and Suk Tai Chang, Microfluidic pumps based on remotely powered miniature diodes, NCSU (2007)
- Orlin D. Velev, Olivier J. Cayre and Suk Tai Chang, Polyelectrolyte Diode-Nonlinear Current Response of a Junction between Aqueous Ionic Gels, NCSU (2007)

### *Provisional patents*

- Dimiter N. Petsev, Orlin D. Velev and Suk Tai Chang, Microfluidic pumps based on remotely powered miniature diodes, Provisional patent, UNM, (2007)

### *Patents*

- Man Bock Gu and Suk Tai Chang, Equipment for toxicity detection of soil pollution and the method for detection of soil pollution using it, Korea Patent, #10-0355757, (Jan., 12, 2000)
- Man Bock Gu, Geun Cheol Gil, and Suk Tai Chang, Immobilization and detection methods for measuring gas phase toxicity using bioluminescent bacteria, Korea Patent, #10-0329121, (May, 28, 1999)

## Publicity Generated from Research Projects

### - Coverage of research in the US and international mass media

- *Lab on a Chip*, The Royal Society of Chemistry journal: *Research Highlights*, “Miniature semiconductor diodes act as self-propelling particles” – *Nature Materials* paper on self-propelling diodes selected as a one of that volume’s highlighted papers, *Lab Chip*, (2007), 7, 541-543.
- *Daily Tech*: “Self-Propelled Diodes Could Traverse the Human Body” (March, 2007)
- *Chosun Ilbo*, the Korean daily newspaper highlights the *Nature Materials* self-propelling diodes paper (March, 2007)
- *MedGadget*, internet journal of emerging medical technologies: “NC State Researchers Create Robots to Invade Our Bloodstream” (March, 2007)
- *NewScientist*: “Diode propulsion could power microbots” (March, 2007)
- *Science Daily*: “Researchers Create Tiny Devices That Can Propel Themselves In Liquid, Perform Other Functions” (February, 2007)
- *PhysOrg.com*: “Researchers Create Tiny, Self-Propelled Devices” (February, 2007)
- *NCSU press release* on *Nature Materials* paper: “ Researchers Create Tiny Devices That Can Propel Themselves in Liquid, Perform Other Functions” (February, 2007)

## References

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