

DONGJIN SEO

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Department of Chemical Engineering
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Education

- Doctor of Philosophy, Chemical Engineering Aug. 2010 ~ Dec. 2014
Virginia Tech, Blacksburg, VA
Advisor: Dr. William A. Ducker
Dissertation: Measurement and Control of Slip-Flow Boundary Conditions at Solid-Gas Interfaces
- Master of Science, Chemical Engineering Aug. 2008 ~ Dec. 2009
Carnegie Mellon University, Pittsburgh, PA
Advisor: Dr. Robert Tilton
Thesis: Preparation of Optically Detectable Magnetic Iron Oxide Nanorods
- Bachelor of Science, Chemical Engineering Mar. 1996 ~ Feb. 2005
Yonsei University, Seoul, South Korea

Research Experience

- University of California – Santa Barbara, Postdoctoral Scholar Nov. 2015 ~ present
Advisor: Prof. Jacob Israelachvili
- Low Salinity Water Flooding (LSWF) for oil recovery
 - Contact angle measurement on crystalline calcite simulated to oil well environment
 - Chemical analysis on deposited layers for surface potential analysis
 - Wetting study of micro-patterned surface with fluorescent microscopy
 - Investigation of factors that affect wetting transition
 - Fluorescent microscopy for 3D meniscus imaging
 - Development of fuel additive to reduce friction for energy conservation
 - Evaluating synthesized molecules for viscosity index improver (VII) and lubricant
 - Friction and adhesion forces measurement of additive-mixed base oils
 - Bio-inspired underwater adhesives
 - Quantification of mussel foot protein cohesion and adhesion energies
 - Analysis of protein sequences and adhesion energy
- Virginia Tech, Postdoctoral Scholar Oct. 2014 ~ Sep. 2015
- Grant writing (NSF CBET and NIH R21)
 - Developed fluorophore sensors in determining phase of nanobubbles
 - Analysis of the phase state of nanobubbles with fluorescent microscopy
 - Developed oxygen pressure sensors with fluorophore monolayer
- Virginia Tech, Research Assistant Dec. 2010 ~ Oct. 2014
- Devised an apparatus to measure damping of fluid in different geometric configurations
 - Studied effects of surface characteristics to gas flow in narrow channels
 - Developed a novel way to control flow boundary conditions *in situ* via modification of self-assembled monolayer molecules with external stimuli (thermal and electric)
 - Proved that roughness affected the gas boundary conditions by using AFM

Research
Experience
(continued)

Carnegie Mellon University, M.S. student

Dec. 2008 ~ Dec. 2009

- Synthesized monodispersed non-magnetic iron oxide nanorods
- Stabilized the nanorods in water by coating with silica and/or polymers
- Reduced the nanorods to magnetically responsive materials and magnetism characterization

Yonsei University, B.S. student

Sep. 2003 ~ Dec. 2004

- Investigated optimal metals and their combinations for the best removal efficiency of volatile organic compounds (VOC)
- Measured VOC removal efficiency with gas chromatography

Publications

- [14] Hans Larson, Jeong Woo Kim, and Dongjin Seo
“Replacement Rates of Initially Hydrocarbon-Filled Microscopic Cavities with Water”
Journal of Physical Chemistry Part C, *submitted*
- [13] **Dongjin Seo**, Szu-Ying Chen, Dong Woog Lee, Alex M. Schrader, Kollbe Ahn, Steve Page, Peter H. Koenig, Yonas Gizaw, Jacob N. Israelachvili
“The Shape and Dynamics of Deformations of Viscoelastic Fluids by Water Droplets”
Langmuir, *submitted*
- [12] Bas GP van Ravensteijn, Raghida Bou Zerdan, **Dongjin Seo**, Nicholas A Cadirov, Takumi Watanabe, Jeffrey A Gerbec, Craig J Hawker, Jacob N Israelachvili, Matthew E Helgeson
“Triple Function Lubricant Additives Based on Organic-inorganic Hybrid Star Polymers: Friction Reduction, Wear Protection, and Viscosity Modification”
ACS Applied Materials & Interfaces, 11(1), 1363-1375 (2018)
- [11] Szu-Ying Chen, Kai Kristiansen, **Dongjin Seo**, Nicholas A Cadirov, Howard A Dobbs, Yair Kaufman, Alex M Schrader, Roberto Carlos Andresen Eguiluz, Mohammed B Alotaibi, Subhash C Ayirala, James R Boles, Ali A Yousef, Jacob N Israelachvili
“Time-dependent physico-chemical changes of carbonate surfaces from SmartWater (diluted seawater)-flooding processes for improved oil recovery”
Langmuir, 35 (1), 41-50 (2018)
- [10] **Dongjin Seo**, Alex M Schrader, Szu-Ying Chen, Yair Kaufman, Thomas R Cristiani, Steven H Page, Peter H Koenig, Yonas Gizaw, Dong Woog Lee, Jacob N Israelachvili
“Rates of cavity filling by liquids”
Proceedings of the National Academy of Sciences, 201804437 (2018)
- [9] Szu-Ying Chen, Yair Kaufman, Kai Kristiansen, Howard A Dobbs, Nicholas A Cadirov, **Dongjin Seo**, Alex M Schrader, Roberto C Andresen, Mohammed B Alotaibi, Subhash C Ayirala, James R Boles, Ali A Yousef, Jacob N Israelachvili
“New Atomic to Molecular Scale Insights into SmartWater Flooding Mechanisms in Carbonates”
SPE Improved Oil Recovery Conference, SPE-190281-MS (2018)

Publications
(continued)

- [8] Jacob N. Israelachvili, Yair Kaufman, Szu-Ying Chen, Alex M. Schrader, **Dongjin Seo**, Dong Woog Lee, Steve Page, Peter H. Koenig, Sandra Isaacs, Yonas Gizaw
“Contact angle and adhesion dynamics and hysteresis on molecularly smooth chemically homogeneous surfaces”
Langmuir 33 (38), 10041-10050 (2017)
- [7] Szu-Ying Chen, Yair Kaufman, Kai Kristiansen, **Dongjin Seo**, Alex M. Schrader, Mohammad B. Alotaibi, Howard A. Dobbs, Nicholas A. Cadirov, James R. Boles, Subhash C. Ayirala, Jacob N. Israelachvili, and Ali A. Yousef
“Effects of salinity on oil recovery (the ‘dilution effect’): Experimental and theoretical studies of crude oil/water/calcite surface restructuring and associated physico-chemical interactions”
Energy Fuels, 31, 8925–8941 (2017)
- [6] **Dongjin Seo**, Sean R. German, Tony L. Mega, William A. Ducker
“The Phase State of Interfacial Nanobubbles”
The Journal of Physical Chemistry C 119 (25), 14262-14266 (2015)
- [5] **Dongjin Seo** and William A. Ducker
“Effect of Gas Species on Gas-Monolayer Interactions: Tangential Momentum Accommodation”
The Journal of Physical Chemistry C, **118**, 20275–20282 (2014)
- [4] **Dongjin Seo** and William A. Ducker
“Control of Gas Flow in Narrow Channels using an Electric Field to Modify the Flow Boundary Condition”
The Journal of Physical Chemistry C, **118**, 7480–7488 (2014)
- [3] **Dongjin Seo** and William A. Ducker
“*In situ* control of gas flow by modification of gas-solid interactions”
Physical Review Letters, **111**, 174502 (2013) **chosen as Focus Article, Editor’s Suggestion**
- [2] **Dongjin Seo**, Dean Mastropietro, and William A. Ducker
“Gas Flows near Solids Coated with Thin Water Films”
The Journal of Physical Chemistry C, **117**, 6235–6244 (2013)
- [1] **Dongjin Seo**, Mark R. Paul, and William A. Ducker
“A pressure gauge based on gas density measurement from analysis of the thermal noise of an atomic force microscope cantilever”
Review of Scientific Instruments, **83**, 055005 (2012)

Presentations

Hans Larson, Jeong Woo Kim, Dongjin Seo
Replacement Rates of Initially Oil-filled Microscopic Cavities with Bulk Water
2019 AIChE Annual Meeting, Nov 2019, Orlando, FL

Hans Larson, Jeong Woo Kim, Dongjin Seo
Replacement Rates of Initially Oil-filled Microscopic Cavities with Bulk Water
93rd American Chemical Society Colloid & Surface Science Symposium 2019, June 2019, Atlanta, GA

Bas G. P. van Ravensteijn, Raghida Bou Zerdan, **Dongjin Seo**, Nicholas Cadirov, Jeffrey A. Gerbec, Craig J. Hawker, Jacob N. Israelachvili, Matthew E. Helgeson
Tribological Characterization of Triple Function Lubricant Additives Based on Organic–Inorganic Hybrid Star Polymers
93rd American Chemical Society Colloid & Surface Science Symposium 2019, June 2019, Atlanta, GA

Dongjin Seo, Alex M. Schrader, Szu-Ying Chen, Steve Page, Peter H. Koenig, Yonas Gizaw, Dong Woog Lee, Jacob N. Israelachvili
The Shape and Dynamics of Deformations of Viscoelastic Fluids by Water Droplets
92nd American Chemical Society Colloid & Surface Science Symposium 2018, June 2018, State College, PA

Raghida Bou Zerdan, Bas van Ravensteijn, **Dongjin Seo**, Nicholas Cadirov, Dong-Woog Lee, Jeffrey Gerbec, Takumi Watanabe, Craig Hawker, Matthew Helgeson, Jacob Israelachvili
Robust and scalable macromolecular architectures as additives for lubrication oils
ACS National Meeting 2017, April 2017, San Francisco, CA

Jacob Israelachvili, Sandy Chen, Yair Kaufman, **Dongjin Seo**, Alex Schrader, Kai Kristiansen, Howie Dobbs, Nicholas Cadirov, Jim Boles
Effects of salinity on oil recovery: Experimental and theoretical studies of crude oil-water-calcite surface restructuring and associated physical and (electro) chemical interactions
ACS National Meeting 2017, April 2017, San Francisco, CA

Dongjin Seo, Alex Schrader, Dong-woog Lee, Yair Kaufman, Sandy Chen, Peter Koenig, Yonas Gizaw, Steve Page, Jacob Israelachvili
Filling of initially empty cavities by advancing water fronts
2016 AIChE Annual Meeting, Nov 2016, San Francisco, CA

Dongjin Seo, Tony Mega, Sean German, William Ducker
Do interfacial “nanobubbles” contain gas?
89th American Chemical Society Colloid & Surface Science Symposium 2015, June 2015, Pittsburgh, PA

Dongjin Seo and William Ducker
Effect of gas species on gas–monolayer interactions: Tangential momentum accommodation
89th American Chemical Society Colloid & Surface Science Symposium 2015, June 2015, Pittsburgh, PA

Dongjin Seo and William Ducker
Altering the Flow of Gas through Modification of Surface Films
66th American Physical Society Division of Fluid Dynamics Meeting 2013, November 2013, Pittsburgh, PA

Dongjin Seo and William Ducker

Effect of humidity and surface chemistry on particle impingement on a solid

87th American Chemical Society Colloid & Surface Science Symposium 2013, June 2013, Riverside, CA

Dongjin Seo and William Ducker

Effect of Gas Type, Humidity Levels, and Surface Molecules on Lubrication Forces and Accommodation Coefficients

Korean-American Scientists and Engineers Association, Virginia Regional Conference 2013, March 2013, Blacksburg, VA

Dongjin Seo, Hyung-sik Kim, Byung-ryul Min

Characteristics of modified catalysts in removal of volatile organic compounds

Korean Institute of Chemical Engineering Spring 2004 Conference, Poster sessions, April 2004, Gongju, South Korea

Teaching Experience

Energy Engineering Sep – Dec 2019

Chemical Engineering Department, Brigham Young University, Provo UT

- Teacher-at-record

Chemical Engineering Principles Jan – Apr 2019

Chemical Engineering Department, Brigham Young University, Provo UT

- Teacher-at-record

Energy Engineering Sep – Dec 2018

Chemical Engineering Department, Brigham Young University, Provo UT

- Teacher-at-record

Chemical Engineering Principles Jan – Apr 2018

Chemical Engineering Department, Brigham Young University, Provo UT

- Teacher-at-record

Undergraduate Research Advisor Aug. 2013 ~ Sep. 2015

Department of Chemical Engineering, Virginia Tech, Blacksburg, VA

- Cooperated with several undergraduate students to complete an ongoing project of effect of surrounding fluid to slip length
- Taught students to modify solid surfaces for nanobubble experiments
- Helped students identify tasks and solutions so that they can be independent

Teaching Assistant Aug. 2010 ~ May 2011, Aug. 2012 ~ Dec. 2014

Department of Chemical Engineering, Virginia Tech, Blacksburg, VA

- Advised undergraduate students in Polymer Science, Transport Phenomena, and Thermodynamics classes
- Taught graduate-level classes as a substitute (fluid mechanics, colloid science)

	<p><u>Laboratory Instructor</u> Jul. 2012 ~ Aug. 2012, Jul. 2014 ~ Aug. 2014 Department of Chemical Engineering, Virginia Tech, Blacksburg, VA</p> <ul style="list-style-type: none"> • Managed Unit Operation laboratory, 40 hours a week • Assessed understanding and presentations of students in the experiments, and provided feedbacks for improvement
Professional Experience	<p><u>Process Engineer</u> Dec. 2004 ~ Jul. 2008 Technical Service Team, Hyundai Oilbank Co., Ltd., Seosan, Korea</p> <ul style="list-style-type: none"> • General Responsibilities and Achievements <ul style="list-style-type: none"> - Monitored and troubleshoot units in charge - Provided technical information and evaluation to operators - Simulated various situations and provided modifications using Pro/II - Pipeline and equipment modification for profit improvement • Reforming (UOP CCR & Semi-regeneration) Units Engineer <ul style="list-style-type: none"> - Replaced old CCR Reforming catalyst with a new batch of catalyst - Participated in Real Time Optimization project which adjust the process condition for maximum yield and profit • Naphtha Hydrotreating Units Engineer <ul style="list-style-type: none"> - Profit improvement by producing more diesel stock - Developed a new pipe network for higher throughput • Mogas Hydrotreating Unit Engineer <ul style="list-style-type: none"> - Commissioned the unit after mechanical completion - Optimized reactor outlet temperatures for low thiol production
	<p><u>Internship Engineer</u> Jul. 2004 ~ Aug. 2004 SK Construction & Engineering, Seoul, Korea</p> <ul style="list-style-type: none"> • Involved in a mock design project for heat exchangers and distillation towers • Performed investment and cost analyses for a sulfur hydrotreating unit
Other Experience	<p><u>Full-Time Missionary</u> Mar. 2001 ~ Apr. 2003 The Church of Jesus Christ of Latter-day Saints, Oakland, CA</p> <ul style="list-style-type: none"> • Volunteered for the church's lay proselytizing missionary service • Served in various leadership positions, providing advices and motivation to fellow missionaries
	<p><u>Enlisted Serviceman</u> Dec. 1998 ~ Feb. 2001 Republic of Korea Army</p> <ul style="list-style-type: none"> • Served as an orderly sergeant, strategic cargo driver, and performed maintenance duty • Chemical, Biological, Nuclear (CBN) squad leader: assessed the safety and hazard of the area to be occupied, consulted to the CBN officer for further investigation
Awards	<p>Best Poster Presentation Award In situ control of Gas flow by modifying thin film on solid surfaces Colloid + Surface Symposium, Virginia Tech, Blacksburg VA, April 2014</p> <p>Merit Scholarship, Yonsei University, South Korea, March 2003</p>

Services

4 Paper Reviews

Atomic Force Microscope Mentoring

Oct. 2013 ~ Nov. 2013

Colloids + Surfaces, Virginia Tech, Blacksburg, VA

- Participating a volunteered mentoring program for AFM tutoring
- Provided a hand-on class about customizing AFM

Skills

Scientific Equipment (Operation and Analysis)

- Surface Forces Apparatus
- Atomic Force Microscope
- Fluorescence Microscopy (epifluorescence and total internal reflection)
- X-ray Diffraction
- Dynamic Light Scattering (Malvern Zeta- and Nanosizer, Brookhaven)
- Quartz Crystal Microbalance
- Attenuated Total Reflectance Infrared Spectroscopy
- Focused Ion Beam with Scanning Electron Microscopy