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## RESEARCH INTERESTS

- Self-healing of fiber-reinforced polymer composite (FRPC)
- Multifunctional micro-/nanofiber via Solution blowing
- Electro-Spinning/ Inkjet-Printing/ Electro-Hydrodynamics (EHD) Spray
- Cold Gas Dynamic Spray (CGDS), Aerosol Deposition (AD) coating
- Supersonic gas flow, Shockwave
- Solar cell: Thin film Solar Cell(II-Gen.), Dye-Sensitized Solar Cell(III-Gen.), Microbial Solar Cell
- Granular flow in Fluidized Bed
- Computational Fluid Dynamics: Compressible & incompressible flows,  $k-\varepsilon$  model

## PROFESSIONAL EXPERIENCE

- Postdoc, University of Illinois at Chicago, Chicago, IL, US (Supervisor: Alexander L. Yarin), 2014.01~present.

## EDUCATION

Doctor of Philosophy in Mechanical Engineering, Feb. 2014 (4.33/4.5)

*Korea University, Seoul, Korea*

Thesis: Self-healing Transparent Core-shell Nanofiber Coatings for Anti-corrosive Protection

Advisor: Prof. Sam Sukgoo Yoon

Master of Science in Mechanical Engineering, Feb. 2010 (4.38/4.5)

*Korea University, Seoul, Korea*

Thesis: Numerical Studies on the Behavior Characteristics of Bi-dispersed Particle in Gas-Solid Fluidized Bed

Advisor: Prof. Sam Sukgoo Yoon

Bachelor of Science in Mechanical Engineering, Feb. 2008 (3.62/4.5)

*Korea University*, Seoul, Korea

Advisor: Prof. Sam Sukgoo Yoon

## AWARDS and GRANTS

- Best Oral Presentation, HYUNDAI Global Talent Award, 2015.
- Best Poster Presentation, "Electrohydrodynamic Inkjet printing and Electrospinning Technology in Solar Cell Applications", Global Photovoltaic Conference (GPVC), 2012
- Outstanding Graduate Student Award, Korea University Graduate School, Dept. of Mech. Engr., 2010
- KWANJEONG Educational Foundation, 2010~2011
- Research Assistant, 2010 Spring, 2011 Spring
- BK21, 2008.3~2009.2, 2009.9~2010.2, 2011.9~2012.2
- DAESUNG Group, 2006~2007

## Reviewing and Refereeing

- Langmuir
- Fluid Dynamics Research
- Physics of Fluids
- Journal of Material Science and Technology
- Experiments in Fluids
- Polymer testing

## PUBLICATIONS (\* corresponding author) (+equal contribution)

### International Journal Papers ([CV on Google Scholar](#))

1. **MW Lee**, S Sett, SS Yoon\*, AL Yarin\*, "Self-healing of nanofiber-based composites in the course of stretching", submitted.
2. S An, J-H Hong, KY Song, **MW Lee**, SS Al-Deyab, JJ Kim, AL Yarin\*, SS Yoon\*, "Optimization of biocompatible membranes for amelioration of sick-building syndrome", submitted.
3. **MW Lee**, S Sett, SS Yoon\*, AL Yarin\*, "Fatigue of Self-Healing Nanofiber-based Composites: Static Test and Subcritical Crack Propagation", *ACS Applied Materials & Interfaces*, 8(28), 18462–18470, 2016.
4. **MW Lee**, SS Yoon\*, AL Yarin\*, "Solution-Blown Core-Shell Self-Healing Nano- and Microfibers", *ACS Applied Materials & Interfaces*, 8(7), 4955–4962, 2016.
5. S An<sup>+</sup>, **MW Lee**<sup>+</sup>, HS Jo, SS Al-Deyab, SS Yoon\*, "Weaving nanofibers by altering counter-electrode electrostatic signals", *Journal of Aerosol Science*, 95, 67-72, 2016.
6. **MW Lee**<sup>+</sup>, S An<sup>+</sup>, KY Song, B Joshi, HS Jo, SS Al-Deyab, SS Yoon\*, AL Yarin\*, "Polyacrylonitrile

- nanofibers with added zeolitic imidazolate frameworks (ZIF-7) to enhance mechanical and thermal stability", *Journal of Applied Physics*, 118, 245307, 2015.
7. S An, M Liou, KY Song, HS Jo, **MW Lee**, SS Al-Deyab, AL Yarin\*, SS Yoon\*, "Highly flexible transparent self-healing composite based on electrospun core-shell nanofibers produced by coaxial electrospinning for anti-corrosion and electrical insulation", *Nanoscale*, 7, 17778-17785, 2015.
  8. **MW Lee**, S An, HS Jo, SS Yoon\*, A Yarin\*, "Self-healing Nanofiber-Reinforced Polymer Composites: 1. Tensile Testing and Recovery of Mechanical Properties", *ACS Applied Materials & Interfaces*, 7, 19546-19554, 2015.
  9. **MW Lee**, S An, HS Jo, SS Yoon\*, A Yarin\*, "Self-healing Nanofiber-Reinforced Polymer Composites: 2. Delamination/Debonding, and Adhesive and Cohesive Properties", *ACS Applied Materials & Interfaces*, 7, 19555-19561, 2015.
  10. S Sett<sup>+</sup>, **MW Lee**<sup>+</sup>, M Weith, B Pourdeyhimi, A Yarin\*, "Biodegradable and Biocompatible Soy Protein/Polymer/Adhesive Sticky Nano-textured Patches for Prevention of Esca Fungi Invasion into Pruning Cuts and Wounds of Vines", *Journal of Materials Chemistry B*, 3, 2147-2162, 2015. (Article: [Plant plaster protects wine from vine decline](#))
  11. S An<sup>+</sup>, **MW Lee**<sup>+</sup>, NY Kim, CM Lee, S Al-Deyab, S James, SS Yoon\*, "Effect of viscosity, electrical conductivity, and surface tension on direct current-pulsed drop-on-demand electrohydrodynamic printing frequency", *Applied Physics Letters*, 105, 214102, 2014.
  12. **MW Lee**<sup>+</sup>, S An<sup>+</sup>, CM Lee, MH Liou, AL Yarin\*, SS Yoon\*, "Hybrid Self-Healing Matrix Using Core-Shell Nanofibers and Capsuleless Microdroplets", *ACS Applied Materials & Interfaces*, 6, 10461-10468, 2014.
  13. S An<sup>+</sup>, BJ Joshi<sup>+</sup>, **MW Lee**, NY Kim, SS Yoon\*, "Electrospun Graphene-ZnO Nanofiber Mats for Photocatalysis Applications", *Applied Surface Science*, 294(1), 24-28, 2014.
  14. **MW Lee**<sup>+</sup>, S An<sup>+</sup>, CM Lee, MH Liou, AL Yarin\*, SS Yoon\*, "Self-healing Transparent Core-shell Nanofiber Coatings for Anti-corrosive Protection", *Journal of Materials Chemistry A*, 2, 7045-7053, 2014.
  15. **MW Lee**<sup>+</sup>, S An<sup>+</sup>, S Latthe, C Lee, S Hong, SS Yoon\*, "Electrospun Polystyrene Nanofiber Membrane with Superhydrophobicity and Superoleophilicity for Selective Separation of Water and Low Viscous Oil", *ACS Applied Materials & Interfaces*, 5, 10597-10604, 2013.
  16. S An<sup>+</sup>, **MW Lee**<sup>+</sup>, BN Joshi, A Jo, J Jung, SS Yoon\*, "Water Purification and Toxicity Control of Chlorophenols by 3D Nanofiber Membranes Decorated with Photocatalytic Titania Nanoparticles", *Ceramic International*, 40, 3305-3313, 2013.
  17. **MW Lee**, NY Kim, S Chandra, SS Yoon\*, "Coalescence of Sessile Droplets of Varying Viscosities for Line Printing", *International Journal of Multiphase Flow*, 56, 138-148, 2013.
  18. **MW Lee**, S Latthe, AL Yarin\*, SS Yoon\*, "Dynamic Electrowetting-on-dielectric (DEWOD) on Unstretched and Stretched Teflon", *Langmuir*, 29(25), 7758-7767, 2013.
  19. S Sinha-Ray<sup>+</sup>, **MW Lee**<sup>+</sup>, S Singho-Roy, S An, B Pourdeyhimi, SS Yoon\*, AL Yarin\*, "Supersonic nanoblowing: A new ultra-stiff phase of nylon 6 in 20-50 nm confinement", *Journal of Materials*

- Chemistry C*, 1, 3491-3498, 2013.
20. **MW Lee**, S An, BN Joshi, SS Yoon\*, "Highly efficient wettability control via 3D suspension of titania nanoparticles to polystyrene nanofibers", *ACS Applied Materials & Interfaces*, 5, 1232-1239, 2013.
  21. Yiyun Zhang<sup>+</sup>, **MW Lee**<sup>+</sup>, S An, Suman Sinha-Ray, Shahrzad Khansari, Bhavana Joshi, Seungkwan Hong, Joo-Hyun Hong, Jae-Jin Kim, Sam S. Yoon\*, Alexander L. Yarin\* and B. Pourdeyhimi, "Antibacterial Activity of Electrospun Titania Nanofiber Mats and Solution-blown Soy Protein Nanofiber Mats Decorated with Silver Nanoparticles", *Catalysis communications*, 34, 35-40, 2013.
  22. **MW Lee**, NY Kim, S An, JY Huh, HY Kim, SS Yoon\*, "Effects of pulsing frequency on characteristics of electrohydrodynamic inkjet using micro-Al and nano-Ag particles", *Experimental Thermal and Fluid Science*, 46, 103-110, 2013.
  23. **MW Lee**, NY Kim, HY Kim, SS Yoon\*, "On pinch-off behavior of electrified droplets", *Journal of Aerosol Science*, 57, 114-124, 2013.
  24. DY Kim, JJ Park, JG Lee, **MW Lee**, HY Kim, JH Oh, TY Seong, DH Kim, M Hest, S Chandra, SS Yoon\*, "Tuning Hydrophobicity with Honeycomb Surface Structure and Hydrophilicity with CF<sub>4</sub> Plasma Etching for Aerosol-Deposited Titania Films", *Journal of the American Ceramic Society*, 95(12), 3955-3961, 2012.
  25. **MW Lee**, JJ Park, MM Farid, SS Yoon\*, "Comparison and correction of the breakup models for stochastic spray flow", *Applied Mathematical Modelling*, 36, 4512-4520, 2012.
  26. **MW Lee**, DK Kang, NY Kim, HY Kim, SC James, SS Yoon\*, "A Study of Ejection Modes for Pulsed-DC Electrohydrodynamic Inkjet Printing", *Journal of Aerosol Science*, 46, 1-6, 2012.
  27. **MW Lee**, DK Kang, SS Yoon\*, AL Yarin\*, "Coalescence of two drops on partially wettable substrates", *Langmuir*, 28, 3791-3798, 2012.
  28. **MW Lee**, JJ Park, DY Kim, SS Yoon\*, HY Kim, DH Kim, SC James, S Chandra, T Coyle, JH Ryu, WH Yoon, DS Park, "Optimization of Supersonic Nozzle Flow for Titanium Dioxide Thin-film Coating by Aerosol Deposition", *Journal of Aerosol Science*, 42, 771-780, 2011.
  29. DK Kang, **MW Lee**, HY Kim, SC James, SS Yoon\*, "Electrohydrodynamic Pulsed-Inkjet Characteristics of Various Inks Containing Aluminum Particles", *Journal of Aerosol Science*, 42, 621-630, 2011. (The most downloaded articles from SciVerse Science Direct in the last 90 days)
  30. **MW Lee**, JJ Park, DY Kim, SS Yoon\*, HY Kim, SC James, S Chandra, T Coyle, "Numerical studies on the effects of stagnation pressure and temperature on supersonic flow characteristics in cold spray applications", *Journal of Thermal Spray Technology*, 20(5), 1085-1097, 2011.
  31. JJ Park, **MW Lee**, SS Yoon\*, HY Kim, SC James, SD Heister, S Chandra, "Supersonic nozzle flow simulations for particle coating applications: Effects of shockwaves, nozzle geometry, chamber pressure, and substrate location upon flow characteristics", *Journal of Thermal Spray Technology*, 20(3), 514-522, 2011.

#### Proceeding/Conference Papers

1. AL Yarin, **MW Lee**, SS Yoon, S An, "Smart composites based on self-healing core-shell nanofibers",

- Electrospin 2016, Ontario Italy, Jun 28-Jul 1, 2016.
2. S Sett, **MW Lee**, AL Yarin, SM Moghadam, M Meinke, W Schroeder, "Electrospinning of Biodegradable and Biocompatible Nanofiber Patches from Solutions of "Green" Materials for Plant Protection against Fungi Attack", Bulletin of the American Physical Society 60, Number 21, Boston, Massachusetts, Nov 22–24, 2015.
  3. HJ Lee, **MW Lee**, YW Park, S An, YY Yu, KB Choi, SS Yoon\*, BK Ju\*, "The effect of composite nanofiber layer base on polyacrylonitrile with SU-8 for light out coupling enhancement", Solid state Surfaces and Interfaces 2013, Smolenice Castle, Slovakia, Nov 25-28, 2013.
  4. **MW Lee**, S Latthe, S An, SS Yoon, "Electrospun Graphene-ZnO Nanofibers for Water Splitting Application", KSME Spring Meeting, Fluid Mechanics Division, Jeju, Korea, May 9-10, 2013.
  5. AL Yarin, S Sinha-Ray, **MW Lee**, SS Yoon, B Pourdeyhimi, "Supersonic Nanotechnology: Forming Ultrastrong Novel-phase of Nylon 6 in a 50 nm Confinement", MRS Spring Meeting, San Francisco, CA, Apr 1-5, 2013.
  6. NY Kim, **MW Lee**, S An, SS Yoon, "Electrohydrodynamic Inkjet printing and Electrospinning Technology in Solar Cell Applications", Global Photovoltaic Conference (GPVC), Busan, Korea, Nov 19-21, 2012. *Best Poster Presentation*
  7. **MW Lee**, S Sinha-Ray, B. Pourdeyhimi, SS Yoon\*, AL Yarin\*, "Solution blowing of electrospun nanofibers in supersonic gas stream", Electrospin 2012, Jeju, Korea, May 29-Jun 1, 2012.
  8. **MW Lee**, DK Kang, NY Kim, SS Yoon, "Electrohydrodynamic Drop-on-Demand Inkjet Technology in Solar Cell Applications", Global Photovoltaic Conference (GPVC), Busan, Korea, Sep 28-30, 2011.
  9. **MW Lee**, JJ Park, H Yoon, SS Yoon, "Utilizing Spray Technologies for Particle and Aerosol Coating in Solar Cell Applications", Global Photovoltaic Conference (GPVC), Busan, Korea, Sep 28-30, 2011.
  10. **MW Lee**, JJ Park, DY Kim, DK Kang, SS Yoon\*, "Utilizing Spray Technologies for Particle and Aerosol Coating in Solar Cell Applications", ILASS-Americas 23rd Annual Conference, Ventura, CA, May 15-18, 2011.
  11. DK Kang, **MW Lee**, SS Yoon\*, HY Kim, "Experiment study on the use of Aluminum suspension via EHD printing", KSME Conference, Pohang, Korea, Apr. 2011.
  12. DY Kim, **MW Lee**, JJ Park, SS Yoon\*, HY Kim, "Optimization of supersonic nozzle flow for thin-film coating by aerosol deposition", KSME Conference, Pohang, Korea, Apr. 2011.
  13. **MW Lee**, JJ Park, SS Yoon\*, HY Kim, SC James, S Chandra, JH Ryu, WH Yoon, DS Park, "Simulation of Aerosol Deposition Supersonic Nozzle Flow for Applications in Nano-particle Coating at Room Temperature", Renewable Energy 2010, Yokohama, Japan, Jun. 27-Jul. 2, 2010.
  14. IH Hwang, DJ Lee, SS Yoon\*, HY Kim, **MW Lee**, JJ Park and SC James, "Splashing Characteristics of Monodisperse Sprays with Significant Viscosity Differences Impacting a Flat Surface", The 6th Asia-Pacific Drying Conference, Bangkok, Thailand, Oct. 19-21, 2009.
  15. **MW Lee**, SS Yoon\*, HY Kim, "Numerical study on characteristics of particle velocity with various particle size in the supersonic flow", KSME Conference, Pyeongchang, Korea, Nov. 4-6, 2009.

16. SS Yoon\*, **MW Lee**, HY Kim, "최신 화재 모델링 및 실험 연구에 관한 국내외 기술 동향 파악", Proceedings of the KMMS 2008 Conference, March, 2008, Seoul, Korea.

### Patent

1. Suk Goo Yoon, **Min Wook Lee**, Sung Pil An, Chang Min Lee, *Self-healing Composite Material, Apparatus and Method for Manufacturing the Same*, 10-2015-134098, Korea, pending.
2. Alexander L. Yarin, Soumyadip Sett, **Min Wook Lee**, Suman Sinha-Ray, *Biodegradable plant wound dressing composed of electrospun nanofibers*, US 14/997,698.
3. **Min Wook Lee**, Suk Goo Yoon, Alexander L. Yarin, Suman Sinha-Ray, B Pourdehimi, *Electrospinning devices*, US20140234457.
4. Jung Jae Park, Do Yeon Kim, Jong Gun Lee, **Min Wook Lee**, Suk Goo Yoon, *Apparatus for manufacturing a solar cell substrate with cold spraying and method for controlling the same*, US20140030825.
5. **Min Wook Lee**, Sung Pil An, Jung Jae Park, Suk Goo Yoon, *Coating Apparatus of Anti-bacterial Coating Layer Using Electrospinning and Electrostatic Spray Deposition Method*, 10-1375996, Korea.
6. Suk Goo Yoon, Sung Pil An, **Min Wook Lee**, *Hybrid Coating Apparatus Using Electrospinning and Electrostatic Spray Deposition Method*, 10-1357483, Korea.
7. **Min Wook Lee**, Suk Goo Yoon, Alexander L. Yarin, Suman Sinha-Ray, B Pourdehimi, *Electrospinning devices*, 10-1382860, Korea.
8. **Min Wook Lee**, Suk Goo Yoon, Alexander L. Yarin, Suman Sinha-Ray, B Pourdehimi, *Electrospinning devices*, 10-2011-004222, Korea, pending.
9. Suk Goo Yoon, Jong Gun Lee, Do Yeon Kim, Jung Jae Park, **Min Wook Lee**, *Apparatus for manufacturing a solar cell substrate with cold spraying and method for controlling the same*, 10-1311107, Korea.
10. **Min Wook Lee**, Dong Kyun Kang, Suk Goo Yoon, *Solar cell substrate with self cleaning function*, 10-1218888, Korea.
11. **Min Wook Lee**, Jung Jae Park, Do Yeon Kim, Suk Goo Yoon, *Apparatus for spraying grid line and passivation layer on a solar cell substrate*, 10-1242352, Korea.
12. **Min Wook Lee**, Jung Jae Park, Do Yeon Kim, Suk Goo Yoon, *Apparatus for manufacturing solar cell substrate and method for controlling the same*, 10-1242299, Korea.
13. **Min Wook Lee**, Dong Kyun Kang, Suk Goo Yoon, Dong Hwan Kim, *Apparatus of fabricating grid electrode on a solar cell*, 10-1202826, Korea.
14. **Min Wook Lee**, Do Yeon Kim, Jung Jae Park, Suk Goo Yoon, Min Jae Ko, *Apparatus for coating blocking layer of DSSC and method for using the same*, 10-1202827, Korea.
15. Jung Jae Park, Do Yeon Kim, **Min Wook Lee**, Yoon Suk Goo, Kim Dong Hwan, *Apparatus for cold spraying grid line on a solar cell substrate*, 10-1217304, Korea.
16. Suk Goo Yoon, **Min Wook Lee**, Dong Kyun Kang, *Nanofibers fabrication apparatus using electrospinning process*, 10-1251731, Korea.

**Theses**

- MW Lee, Self-healing Transparent Core-shell Nanofiber Coatings for Anti-corrosive Protection, Ph.D Thesis, *Korea University*, 2014.
- MW Lee, Numerical Studies on the Behavior Characteristics of Bi-dispersed Particle in Gas-Solid Fluidized Bed, M.S. Thesis, *Korea University*, 2010.

**SOCIETY**

- Korea Society of Mechanical Engineering (2009~)
- MAGEEP Student Network, Student coordinator (2012~)

**CERTIFICATE**

- Training for Nanofabrication & Nanodevice in Solar Cell, Korea Advanced Nano Fab Center, 2010.9.14-16

**TEACHING EXPERIENCE**

- Mentoring program for international undergraduate students, *Fluid Mechanics, Engineering Mathematics*, Department of Mechanical Engineering, Korea University, 2009, 2011
- Teaching Assistant, *Thermal Dynamics, Numerical Calculation*, Department of Mechanical Engineering, Korea University, 2008-2011

**SKILLS**

- Characterization: SEM (Scanning electron microscopy), AFM (Atomic force microscopy), 4-point probe station, XRD (X-ray diffraction), Raman, FTIR, UV-VIS Spectrometer, DSC (Differential scanning Calorimetry), Optical surface profiler, Fluidic Properties (Viscosity, electrical conductivity, surface tension, dielectric constant)
- Device fabrication: Focused ion-beam milling, Photo lithography, E-beam
- Flow visualization: Schlieren imaging (compressed flow), Particle Image Velocimetry (granular flow)
- Electromagnetic simulation: Finite-element and finite-difference time domain methods (COMSOL Physics)
- Computational fluid dynamics code: FORTRAN, FLUENT, CFX
- Computational software program: Mathematica
- Design software program: CATIA, Solid Works, Pro Engineering, AUTO CAD

**RESEARCH PROJECTS**

1. Micro-crack Prevention Nanotechnology via Supersonic Blown Ultra-Thin/Ultra-Light/Transparent Self-Healing Nanofibers, Agency for Defense Development, 2014.06~2018.05.
2. The fabrication of artificial spider-silk via E-beam, National Research Foundation, 2012.06~2014.05
3. 24hr/day Working Microbial Solar Cells, National Research Foundation, 2011.11~2014.10
4. Education and Training Program for Silicon Solar Cell Technology Development, Korea Institute of Energy Technology Evaluation and Planning, 2010.11-2015.06
5. Development of nano thin film Si solar cell technologies, Science/Engineering Research Center, National Research Foundation, 2010.09~2012.02
6. Thin-Film Coating and Dot-Patterning via Electrohydrodynamics(EHD) Inkjet Printing Technique for their uses in Solar Cell and Electronics Applications, National Research Foundation, 2010.05~2013.04
7. PHEV high efficient engine technology, Korea Evaluation Institute of Industrial Technology, 2010.04~2011.03
8. Investigating Drop-Substrate Interaction for Spray Coating Application, National Research Foundation, 2010.04~2012.03
9. Development of mass production technology of high efficiency and long durability flexible CIGS thin film solar cell and module, National Research Foundation, 2009.12-2011.05
10. A Planning Study on Testbed Implementation of Training Simulator for Fire Fighting based on Tangible Technology, National Emergency Management Agency, 2009.11~2010.05.
11. Atomization Characteristics of Electrostatic Sprays: Theory and Experiment, Dongbu Foundation, 2009.06~2009.11
12. Human-Oriented Product Innovation Research Center, Engineering Research Center, National Research Foundation, 2009.03~2010.02
13. Development of Electrostatic Spray Coating Technique for use in Cell Phone Applications, LG Electronics, 2009.01-2010.02
14. Development and Optimization of Solar Cell Precursor Coating Technique using Electrostatic Spray, Korea Institute of Energy Research, 2008.12~2012.02
15. Poly-Si fabrication via fluidized bed and Jet Mill in computational and experimental method, Korea Institute of Energy Technology Evaluation and Planning, 2008.12~2009.09.
16. Development of Efficient Technique for Pharmaceutical Powder Coating inside Fluidized Bed by Electrostatic Spray Producing Nano-scaled Drops, National Research Foundation, 2008.11~2009.10

## Reference

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 University of Illinois at Chicago  
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