

Ahmed H. Helal
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CAREER INTERESTS: Mechanical Engineering; Hardware Design; New Product Development

EDUCATION

Massachusetts Institute of Technology (MIT), Cambridge, MA Sep. 2009-June 2016

Ph.D. candidate in Mechanical Engineering; GPA: 4.9/5.0

- Thesis: Designing devices with electro-active yield stress fluids/ Minor in Design & Fabrication
Thesis advisors: Prof. Gareth H. McKinley, Prof. Anette (Peko) Hosoi

Ecole Polytechnique, Paris, France 2003-2009

M.S in Materials Science & Engineering, B.Sc. in Science & Engineering; GPA: 4.2/4.5

- Specialized in Physics of Complex Fluids
- France's elite Grande Ecole in Science and Technology
- Graduate & Undergraduate studies include courses in Mathematics, Physics, Mechanics, Computer Science, Economics and Management

EXPERIENCE

Design of semi-solid flow batteries, Hatsopoulos Microfluids Lab, 2013–Present
Department of Mechanical Engineering, MIT

Graduate Research Assistant

- Resident expert on the mechanical properties of electrochemically active semi-solid materials
- Analyzed the effects of the battery slurry mechanical properties & cell surface properties on the performance of novel low-cost Lithium-Sulfur semi-solid flow batteries
- Developed predictive analytical & computational models for the flow of active battery slurries in pumped & gravity-driven semi-solid flow batteries & conducted experimental tests to validate calculations & optimize cell design & performance
- Designed & fabricated a novel fixture enabling in-situ rheo-electrical measurements to study the influence of flow on the conductivity of the semi-solid suspensions
- Designed a rheo-optical fixture to visualize & analyze the microstructure of suspensions under flow
- Collaborated with teams across the US within the JCESR hub (Joint Center for Energy Storage Research) to develop meaningful metrics to optimize the performance of flow batteries

Integrated field-activated valves for small low-cost robotic applications, 2009–Present
Hatsopoulos Microfluids Lab, Department of Mechanical Engineering, MIT

Graduate Research Assistant

- Brainstormed ideas from concept to implementation of hydraulic valves in cm-scale robots & optimized valve design for disposable, cost-effective, high-volume manufacturing
- Studied the effects of geometry & electric/magnetic fields on electrorheological (ER)/magnetorheological (MR) valve holding pressures
- Conducted rheological tests to characterize electrorheological & magnetorheological fluids & build a valve model that can be applied to create valves prototypes with a higher efficiency (Power Out/Power In)
- Conducted root cause & failure analysis on valve design to develop robust modular valve prototypes
- Collaborated with Boston Dynamics & with team members focusing on Smart fluids, Soft Robotics, Robot Climbing and Granular jamming; supervised 3 undergraduate students

New hybrid wind turbine concept, HyWind, Cambridge Jan-Aug 2013

Cofounder, CTO

- Worked on new wind turbine design using hydraulic transmission and colocated pneumatic energy storage
- Finalist in Clean Energy Prize competition

Novel surfactant systems for new foundation textures, L'Oréal Research, Jan–Aug 2009
Paris, France

Project Lead, Research Intern

- Formulated new surfactant systems to create stable foundation make-up with new textures
- Surveyed state-of-the-art surfactant chemistries in foundation products & established correlations with sensory feedback for a more “scientific” approach to make-up formulation processes

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SKILLS

- MATLAB, LabVIEW (CLAD certified), CAD (Solidworks), Mathematica, Microsoft Office Suite, Adobe Suite, LaTeX
- Basic knowledge of C, Python & Java
- Design of Experiments, Instrument design
- Various analytical measurement & instrumentation equipment
- Microfluidics, Polymers & Complex Fluids
- Embedded Electronics/Arduino/ IoT
- Rapid prototyping/Digital fabrication tools (3d printing, lasercutting, machine shop)
- Native French & Arabic speaker; Basic Mandarin
- Significant travel/work in France, Egypt & China
- Thermal Fluids Engineering

LEADERSHIP & SERVICE

Graduate Teaching Assistant, Department of Mechanical Engineering, MIT 2011, 2013, 2014

- Assisted in teaching courses: Advanced Fluid Mechanics, Mechanics & Materials I & Thermal Fluids Science in the Kitchen

VP of Residential Life, Sidney Pacific Graduate Dorm, MIT 2010–2012

- Managed a team of 13 people in the Residential Life Office putting on over 100 large-scale & small-scale social events in order to develop graduate student community

Chair, GradRat Ring Committee, MIT 2010–2011

- Managed the \$30,000 Marketing Budget for the Graduate Ring Committee with a team of four people, spearheaded new events and initiatives leading to a 20% increase in ring sales

SELECTED PUBLICATIONS & PRESENTATIONS

- **“A Low-Dissipation, Pumpless, Gravity-Induced Flow Battery”**, Chen X-W, Hopkins B., Helal A., Chiang Y-M. et al., accepted in *Energy & Environmental Science*, March 2016
- **“Yield hardening of electrorheological fluids in channel flow”**, Helal A., Bian Q., McKinley G., Hosoi, A. E., accepted in *Physical Review Applied*, March 2016
- **“Biphasic Electrode Suspensions for Li-Ion Semi-Solid Flow Cells with High Energy Density, Fast Charge Transport, and Low-Dissipation Flow”**, Wei T-S, Fan F., Helal A., Smith K., McKinley G., Chiang Y-M. & Lewis J., *Advanced Energy Materials*, 2015
- **“Polysulfide Flow Batteries Enabled by Percolating Nanoscale Conductor Networks”**, Fan F., Helal A., Chiang Y-M. et al., *Nano Letters*, 2014
- **“Fast Relaxations in Foam”**, Krishnan K., Helal A., Hoehler R. & Cohen-Addad S., *Physical Review E*, Vol 82/1, 2010
- **“Simultaneous rheo-electric measurements of strongly conductive complex fluids”** Helal A., Divoux T. & McKinley G. H., submitted to *Physical Review Applied*, ArXiv# 1604.00336
- **“Effects of confinement & surface roughness in electrorheological flows”**, 67th American Physics Society Division of Fluid Dynamics Meeting, San Francisco, Nov. 2014
- **“Design of Integrated Electrorheological (ER) Valves”**, 84th Society of Rheology Meeting, Pasadena, Feb. 2013

PATENTS

- **“Gravity Induced Flow Cell”** B. Hopkins et al., US2015/0155585A1
- **“Metal Sulfide Electrodes and Energy Storage Devices Thereof”** Yet-Ming Chiang et al., PCT/US2014014681

AWARDS & HONORS

- MIT Great Dome Award, 2013
- DeFlorez Award 2nd place in Graduate Science, 2012
- MIT Leadership Gift Award, 2012
- Sidney-Pacific House Service Award, 2011
- Eiffel Excellence Scholarship, 2005-2008

INTERESTS

DIY crafts and digital fabrication, Organizing events, Travel, Baking, Puzzle hunts