JAAFAR A. EL-AWADY, PH.D.

Johns Hopkins University,
Department of Mechanical Engineering
124 Latrobe Hall, 3400 North Charles St., Baltimore, MD 21218

Tel: (410) 516-6683
Fax: (410) 516-7254
E-mail: jelawady@jhu.edu

Lab Webpage: http://compmat.johnshopkins.edu/
Lab Youtube Channel: https://www.youtube.com/channel/UCdenbVa1WILKd6K-Uhj-zsg/videos
Research Gate: https://www.researchgate.net/profile/Jaafar_El-Awady
Google Scholar: http://scholar.google.com/citations?user=qMqsad8AAAAJ&hl=en

EDUCATION

2003-2008 **Ph.D. in Aerospace Engineering, University of California, Los Angeles, USA.**
2001-2003 **M.S. in Aeronautical and Astronautical Engineering, Cairo University, Egypt.**
1996-2001 **B.S. in Aeronautical and Astronautical Engineering, Cairo University, Egypt.**

PROFESSIONAL EXPERIENCE

09/2010 – Present **Assistant Professor**, Department of Mechanical Engineering, Johns Hopkins University, Baltimore, MD.

07/2014 – Present **Secondary Appointment (Assistant Professor),** Department of Materials Science & Engineering, Johns Hopkins University, Baltimore, MD.

09/2008 – 08/2010 **Visiting Scientist**, Materials and Manufacturing Directorate, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH.

09/2005 – 08/2008 **Research Consultant**, Digital Material Solutions Inc., Los Angeles, CA.

HONORS AND AWARDS

- **2015: National Science Foundation CAREER Award.**
- **2014: ASME Materials Division Orr Early Career Award.**
- **2012: DARPA Young Faculty Award.**
- **2008: The Outstanding PhD Award in Aerospace Engineering,** from the Henry Samueli School of Engineering and Applied Science, University of California, Los Angeles.
- **2004: Collegiate All-American Scholar Award**.
- **2001: The Egyptian Engineering Syndicate Award,** for the first on class graduates from Egyptian Engineering Schools, September.
- **2001: The Board of Egyptian Universities,** first place award for best engineering project designed by an undergraduate student team.
- **1999 – 2000: Ideal Student Silver Award**, second place award from the Faculty of Engineering, Cairo University.

JOURNAL PUBLICATIONS

El-Awady's Undergraduate Student$^{\infty}$, El-Awady's Grad Student*, El-Awady's Postdoc‡

Submitted

[1] H. Fan‡, Q. Wang, X. Tian, **J.A. El-Awady**, Temperature effects on the mobility of pyramidal <c+a> dislocations in magnesium, *Submitted*, 2016.

[2] A.M. Hussein*, S.I. Rao, M.D. Uchic, T.A. Parthasarathay, **J.A. El-Awady**, "The Strength and Dislocation Microstructure Evolution in Superalloy Microcrystals", *Submitted*, 2016.

[3] G.-D. Sim‡, G. Kim, S. Lavenstein*, M.H. Hamza*, H. Fan, **J.A. El-Awady**, "Anomalous Hardening in Magnesium Driven by a Size-Dependent Transition in Deformation Modes", *Submitted*, 2016.

[4] A. Aramoon*, T.D. Breitzman, C. Woodward, **J.A. El-Awady**, A Coarse-Grained Molecular Dynamics Study of the Curing and Properties of Highly Cross-Linked Epoxy Polymers, *Submitted*, 2016.

Published

[1] A. Aramoon*, T.D. Breitzman, C. Woodward, **J.A. El-Awady**, "Free-Volume evolution in Epoxy polymers: A coarse-grained molecular dynamics study", *In Press, The Journal of Physical Chemistry*, 2016.

[2] A.M. Hussein*, **J.A. El-Awady**, "Quantifying Dislocation Microstructure Evolution and Cyclic Hardening in Fatigued Nickel Single-Crystals", *Journal of the Mechanics and Physics of Solids*, 91:126–144, 2016.

[3] A.M. Hussein*, **J.A. El-Awady**, "Surface Roughness Evolution during Early Stages of Mechanical Cyclic Loading", *International Journal of Fatigue*, 87:339–350, 2016.

[4] H. Fan‡, S. Aubry, A. Arsenlis, **J.A. El-Awady**, "Grain size effects on dislocation and twinning mediated plasticity in magnesium", *Scripta Materialia*, 112:50–53, 2016.

[5] **J.A. El-Awady**, "Unraveling the Physics of Size Dependent Dislocation Mediated Plasticity", *Nature Communications*, 6:5926, 2015.

[6] S.I. Rao, D.M. Dimiduk, **J.A. El-Awady**, T.A. Parthasarathy, M.D. Uchic, C. Woodward, "Screw dislocation cross slip at cross-slip plane jogs and screw dipole annihilation in FCC Cu and Ni investigated via atomistic simulations", *Acta Materialia*, 101:10–15, 2015.

[7] H. Fan‡, **J.A. El-Awady**, "Towards resolving the anonymity of pyramidal slip in magnesium", *Materials Science and Engineering: A*, 644:318–324, 2015.

[8] H. Fan‡, **J.A. El-Awady**, "Molecular dynamics simulations of the tension, compression and bending deformations of magnesium nano-crystals", *Journal of Applied Mechanics*, 82(10):101006, 2015.

[9] M. Wagih$^{\infty}$, Y. Tang‡, T. Hatem, **J.A. El-Awady**, "Discerning Enhanced Dislocation Plasticity in Hydrogen-Charged α-Iron Nano-Crystals", *Materials Research Letters*, 3:184–189, 2015.

[10] H. Fan‡, S. Aubry, A. Arsenlis, **J.A. El-Awady**, "The role of twinning deformation on the hardening response of polycrystalline magnesium from discrete dislocation dynamics simulations", *Acta Materialia*, 92:126–139, 2015.

[11] H. Fan‡, **J.A. El-Awady**, Q. Wang, "Towards further understanding of stacking fault tetrahedron absorption and defect-free channels – a molecular dynamics study", *Journal of Nuclear Materials*, 458:176–186, 2015.

[12] Z. Aitken, H. Fan‡, **J.A. El-Awady**, J.R. Greer, "The Effect of Size, Orientation and Alloying on the Deformation of Mg Nanopillars", *Journal of the Mechanics and Physics of Solids*, 76:208–223, 2015.

[13] A.M. Hussein*, S.I. Rao, D.M. Dimiduk, M.D. Uchic, **J.A. El-Awady**, "Microstructurally-Based Cross-Slip Mechanisms and their Effects on Dislocation Microstructure Evolution in FCC Crystals", *Acta Materialia*, 85:180–190, 2015.

[14] H. Fan‡, S. Aubry, A. Arsenlis, **J.A. El-Awady**, "Orientation influence on grain size effects in ultrafine-grained magnesium", *Scripta Materialia*, 97:25–28, 2015.

[15] Y. Tang‡, **J.A. El-Awady**, "Highly Anisotropic Slip-behavior of Pyramidal I <*c*+*a*> Dislocations in Hexagonal Close-Packed Magnesium", *Material Science and Engineering A*, 618:424–432, 2014.

[16] Y. Tang‡, **J.A. El-Awady**, "Formation and slip of pyramidal dislocations in hexagonal close-packed magnesium single crystals", *Acta Materialia*, 71:319–332, 2014.

[17] S.I. Rao, D.M. Dimiduk, **J.A. El-Awady**, T.A. Parthasarathy, M.D. Uchic, C. Woodward, "Spontaneous athermal cross-slip nucleation at screw dislocation intersections in FCC metals and L12 intermetallics investigated via atomistic simulations", *Philosophical Magazine*, 93(22):3012-3028, 2013.

[18] **J.A. El-Awady**, M.D. Uchic, P.A. Shade, S.-K. Kim, S.I. Rao, D.M. Dimiduk, C. Woodward, "Pre-Straining Effects on the Power-Law Scaling of Size Dependent Strengthening in Ni Single Crystals" *Scripta Materialia.*, 68(3-4):207–210, 2013.

[19] Y. Tang‡, **J.A. El-Awady**, "Atomistic simulations of the interactions of hydrogen with dislocations in FCC metals", *Physical Review B*, **86**:174102, 2012.

[20] S.I. Rao, D.M. Dimiduk, T.A. Parthasarathy, **J.A. El-Awady**, C. Woodward, M.D. Uchic, "Calculations of Intersection Cross-Slip Activation Energies in FCC Metals Using Nudged Elastic Band Method", *Acta Materialia*, 59(19):7135–7144, 2011.

[21] **J.A. El-Awady**, S.I. Rao, C. Woodward, D.M. Dimiduk, M.D. Uchic, "Trapping and escape of dislocations in micro-crystals with external and internal barriers", *International Journal of Plasticity*, 27(3):372–387, 2011.

[22] S.I. Rao, D. Dimiduk, T.A. Parthasarathy, **J.A. El-Awady**, M.D. Uchic, C. Woodward, "Activated states for cross-slip at screw dislocation intersections in face-centered cubic nickel and copper via atomistic simulation", *Acta Materialia*, 58(17):5547–5557, 2010.

[23] J.D. Sethian et al. "The Science and Technologies for Fusion Energy with Lasers and Direct-Drive Targets", *IEEE Transactions on Plasma Sciences*, 38(4):690–703, 2010.

[24] S.I. Rao, D. Dimiduk, **J.A. El-Awady**, T.A. Parthasarathy, M.D. Uchic, C. Woodward, "Atomistic simulations of cross-slip nucleation at screw dislocation intersections in face-centered cubic nickel", *Philosophical Magazine*, 89(34–36):3351–3369, 2009.

[25] **J.A. El-Awady**, C. Woodward, D. Dimiduk, N.M. Ghoniem, "Effects of focused ion beam induced damage on the plasticity of micropillars", *Physical Review B*, 80(10):104104, 2009.

[26] **J.A. El-Awady**, M. Wen, N.M. Ghoniem, "The Role of the Weakest Link Mechanism in Controlling the Plasticity of Micropillars", *Journal of the Mechanics and Physics of Solids*, 57(1):32–50, 2009.

[27] H. Kim, **J. El-Awady**, V. Gupta, N. Ghoniem, S. Sharafat, "Interface Strength Measurement of Hot Isostatic Pressed Tungsten Coatings on F82H Substrates", *Journal of Nuclear Materials*, 386–388:863–865, 2009.

[28] **J.A. El-Awady**, S.B. Biner, N.M. Ghoniem, "A Self Consistent Boundary Element, Parametric Dislocation Dynamics Formulation of Plastic Flow in Finite Volumes", *Journal of the Mechanics and Physics of Solids*, 56(5):2019–2035, 2008.

[29] S. Sharafat, **J. El-Awady**, S. Liu, E. Diegele and N.M. Ghoniem, "Proposed damage evolution model for large-scale finite element modeling of the dual coolant US-ITER TBM", *Journal of Nuclear Materials*, 367–370:1337–1343, 2007.

[30] H. Kim, **J. El-Awady**, J. Quan, S. Sharafat, V. Gupta, N. Ghoniem, "Failure Strength Measurements of VPS Tungsten Coatings for HAPL First Wall Armor", *Fusion Science & Technology*, 52(4):875–879, 2007.

BOOK CHAPTERS

El-Awady's Grad Student*, El-Awady's Postdoc‡

[1] **J.A. El-Awady**, H. Fan‡, A.M. Hussein*, "Advances in Discrete Dislocation Dynamics Modeling of Size-Affected Plasticity", in Multiscale Materials Modeling for Nanomechanics, Editors: C.R. Weinberger and G.J. Tucker, Springer Publishing, 2016.

PAPERS IN CONFERENCE PROCEEDINGS

El-Awady's Undergraduate Student∞, El-Awady's Grad Student*, El-Awady's Postdoc‡

[1] M. Hamza*, T.M. Hatem, D. Raabe, **J.A. El-Awady**, "Hydrogen diffusion and segregation in alpha iron Σ3 (111) Grain Boundaries", *Proceedings of the ASME 2015 International Mechanical Engineering Congress and Exposition*, 2015.

[2] H. Fan‡, S. Aubry, A. Arsenlis, **J.A. El-Awady**, "Discrete dislocation dynamics simulations of twin size-effects in magnesium", *MRS Proceedings*. Vol. 1741, 2015.

[3] M.A. Wagih∞, N. Salman∞, T.M. Hatem, Y. Tang‡, **J.A. El-Awady**, "Molecular dynamics simulations of hydrogen-dislocation interaction in iron nanocrystals", *Proceedings of the 11th World Congress on Computational Mechanics*, pp. 4067–4078, 2014.

[4] M.A. Wagih∞, T.M. Hatem, Y. Tang‡, **J.A. El-Awady**, "Molecular Dynamics Simulations of Hydrogen-Dislocation Interactions in Iron Nanocrystals", *Proceedings of the FRACT'2 International Workshop*, 2013.

[5] Y. Tang‡, S.I. Rao, **J. A. El-Awady**, "Hydrogen-Dislocation Interactions and Cross-Slip Inhibition in FCC Nickel", *Proceedings of the 142nd TMS Annual Meeting and Exhibition*, 2013.

[6] C.S. Hartley, **J.A. El-Awady**, C. Woodward, "Representation of Dislocation Dynamics Simulations", *Proceedings of the 5th International Conference on Multiscale Materials Modeling*, pp. 426–429, 2010.

[7] N.M. Ghoniem, A. Brown, **J.A. El-Awady**, "Plasticity of Nano- and Micro- Pillars", *Proceedings of the 5th International Conference on Multiscale Materials Modeling*, pp. 185–188, 2010.

[8] **J.A. El-Awady**, M. Wen, N.M. Ghoniem, "The influence of focused ion beam induced damaged and the activation of cross-slip on the experimentally observed size effects", *Proceedings of the 4th International Conference on Multiscale Materials Modeling*, 2008.

[9] **J. El-Awady**, N. Ghoniem, "Plastic Flow in Confined Volumes", *Plasticity, Failure and Fatigue in Structural Materials-from Macro to Nano: Proceedings of the Hael Mughrabi Honorary Symposium*. Editors: K.J. Hsia, M. Göken, T. Pollock, P.D. Portella, N.R. Moody, pp. 77–88, 2008.

[10] S. Sharafat, A. Aoyama, M. Narula, **J. El-Awady**, N. Ghoniem, B. Williams, "Development Status of the Helium-Cooled Porous Tungsten Heat Exchanger Concept", *Proceedings of the 22nd IEEE Symposium on Fusion Engineering*, pp. 1-4, 2007.

[11] **J.A. El-Awady**, N.M. Ghoniem, and H. Mughrabi, "Dislocation Modeling of Localized Plasticity in Persistent Slip Bands", *Proceedings of the 136th TMS Annual Meeting and Exhibition*, *Mechanics and Materials Modeling and Materials Design Methodologies, in the Honor of Dr. Craig Hartley's 40 years of Contributions to the Field of Mechanics and Materials Science*, Editors B.L. Adams, A. Garmestani, pp. 23–35, 2007.

[12] **J.A. El-Awady**, A. Takahashi, N.M Ghoniem, "Three-dimensional Boundary Element-Dislocation Dynamics Modeling of Plastic Flow in Small Volumes", *MRS Proceedings*, Editors: R. Devanathan, M.J. Caturla, A. Kubota, A. Chartier, S. Phillpot, Vol. 978, 2007.

INVITED PRESENTATIONS

[1] ***8th International Conference on Multiscale Materials Modeling***, Dijon, France, "Large scale dislocation dynamics simulations of plasticity and point defect evolution in persistent slip bands", October 11th, 2016.

[2] ***Dislocations***, Purdue University, West Lafayette, IN, "Competition between Slipping, Twinning, and their Interactions on the Hardening Response of Magnesium: Temperature and Strain Rate", September 20th, 2016.

[3] ***Gordon Research Conference, Thin Film & Small Scale Mechanical Behavior***, Bates College, Lewiston, ME, "Unraveling the Competition Between Slip and Twinning in Magnesium Microcrystals", July 27th, 2016.

[4] ***IUTAM Symposium on Integrated Computational Structure-Material Modeling of Deformation & Failure Under Extreme Conditions***, "Large-Scale Dislocation Dynamics Simulations of Plasticity and Point Defect Evolution in Persistent Slip Bands", Baltimore, MD, June 20th, 2016.

[5] ***The Schöntal Symposium on Dislocation-based Plasticity***, Schöntal, Germany, "The role of twining, dislocations, and their interactions on the hardening response of magnesium from discrete dislocation dynamics simulations", February 28th, 2016.

[6] ***TMS Annual Meeting & Exhibition***, Nashville, TN, "Quantifying Dislocation Microstructure and Point Defect Evolutions during Cyclic Loading", February 15th, 2016.

[7] ***North Carolina State University***, Department of Mechanical and Aerospace Engineering Seminar serials, "The Role of Dislocation-Twin and Twin-Twin Interactions on the Hardening Response of Magnesium", February 5, 2016.

[8] ***Materials Research Society Fall Meeting & Exhibit***, Boston, MA, "Discrete Dislocation Dynamics Simulations of Dislocation Microstructure and Point Defect Evolutions during Cyclic Loading of FCC Single Crystals", December 2, 2015.

[9] ***ASME International Mechanical Engineering Congress & Exposition***, Houston, TX, "Discrete Dislocation Dynamics Simulation of the Effect of Tension-Twins on the Plastic Deformation of Magnesium Crystals", Houston, November 19, 2015.

[10] ***University of Virginia***, Department of Mechanical and Aerospace Engineering Seminar serials, "Multiscale Simulations and Experiments of the Role of Dislocation-Twin and Twin-Twin Interactions on the Hardening Response of Magnesium", October 1, 2015.

[11] ***Texas A&M University***, Department of Aerospace Engineering Seminar Series, "Multiscale Simulations and Experiments of the Role of Dislocation-Twin and Twin-Twin Interactions on the Hardening Response of Magnesium", September 17, 2015.

[12] ***Sichuan University***, Department of Mechanics and Engineering, China, "Surface Roughness Evolution under Cyclic Loading in FCC Metals from Discrete Dislocation Dynamics Simulations", July 10, 2015.

[13] ***ASME Applied Mechanics and Materials Conference***, Seattle, WA, "Surface Roughness and Microstructure Evolution during Cyclic Loading of FCC Nickel Microcrystals as Predicted from Discrete Dislocation Dynamics Simulations", July 1, 2015.

[14] ***Mississippi State University***, Mechanical Engineering Department Seminar serials, "Multiscale Simulations of the Role of Dislocation-Twin Boundary Interactions on the Hardening Response of Polycrystalline Magnesium", April 16th, 2015.

[15] ***TMS Annual Meeting & Exhibition***, Orlando, FL, "Unified Framework for Coarse-Grained Modeling of Plastic Deformation in Metals and Polymers", March 16th, 2015.

[16] ***Materials Research Society Fall Meeting & Exhibit***, Boston, MA, "The Role of Dislocation-Twin Boundary Interactions on the Hardening Response of Polycrystalline Magnesium", December 2, 2014.

[17] ***University of California San Diego***, Symposia on New Developments in Defect Mechanics, "Towards the Determination of the Genetics of Size-Dependent Dislocation Mediated Plasticity", January 19th, 2014.

[18] ***Physical Metallurgy Gordon Research Conference***, University of New England, "The Genetics of Size-Dependent Dislocation Mediated Plasticity", July 31st, 2013 (Invited Poster).

[19] ***12th U.S. National Congress on Computational Mechanics***, Raleigh, NC, "Strength, Dislocation Density, and Size Effects in Metals: The Untold Story", July 23rd, 2013.

[20] ***University of California, Los Angeles***, Workshop on Mesoscale and Continuum Scale Modeling of Materials Defects, Institute for Pure & Applied Mathematics, "Multiscale Modeling and Experiments of Size Effects in Single Crystals Metals", November 15th, 2012.

[21] ***Dislocations***, Budapest, Hungary, "The Role of the Dislocation Density in Controlling Size-Dependent Strengthening", August 28th, 2012.

[22] ***Lehigh University***, Mechanical Engineering and Mechanics Seminar Series, "The Role of the Initial Dislocation Density in Controlling Size-Affected Flow Response in FCC Crystals", February 17th, 2012.

[23] ***TMS Annual Meeting & Exhibition***, Orlando, FL, "The Role of the Initial Dislocation Density in Controlling Size-Affected Flow Response", March, 2012.

[24] ***TMS Annual Meeting & Exhibition***, San Diego, CA, "Measurement of Size-Scale Effects in Pure Ni: Effect of Initial Dislocation Density", February, 2011.

[25] ***International Symposium on Plasticity***, Plasticity and Damage Size Scale Effects Symposium, Puerto Vallarta, Mexico, "Modeling Plasticity Size-Effects in FCC Single Crystals", January, 2011.

[26] ***International Symposium on Plasticity***, Plasticity and Creep of Nanostructured Metallic Materials Symposium, St. Kitts, "A Further Step in understanding the plasticity size-dependency: 3D modeling of Solid and Annular Micropillars", January, 2010.

[27] ***Florida State University***, Computational Science Department & Materials Science Program, Tallahassee, FL, "The Plasticity and Size effects of Nano- and Mico-crystals", July, 2009.

[28] ***4th International Conference on Multiscale Materials Modeling***, Tallahassee, FL, "The Influence of Focused Ion Beam Induced Damage on the Plasticity of Nano- and Micro-pillars", October, 2008.

[29] ***Materials Research Society Fall Meeting & Exhibit***, Boston, MA, "Three-dimensional Boundary Element-Dislocation Dynamics Modeling of Plastic Flow in Small Volumes", December, 2006.

[30] ***13th High Average Power Laser Workshop***, University of Rochester, Laboratory for Laser Energetics, "Measurement of W-F82H Bond Strength Using Laser Spallation Interferometer", Rochester, NY, November, 2005.

SUMMER SCHOOL LECTURE SERIES (INVITED)

- "***Microscale plasticity in Solids***", University Immersion Program, Sichuan University, Chengdu, China, July 4th – 15th, 2016.
- "***Microscale plasticity and Thermally Activated Mechanisms in Solids***", University Immersion Program, Sichuan University, Chengdu, China, July 5th – 18th, 2015.

CONTRIBUTIONS IN CONFERENCES AND SYMPOSIA

El-Awady's Undergraduate Student∞, El-Awady's Grad Student*, El-Awady's Postdoc‡, Presenter underlined

[1] K. Srivastava‡, **J.A. El-Awady**, "Atomistically based discrete dislocation dynamics simulations of plastic deformation in Magnesium", 8th International Conference on Multiscale Materials Modeling, Dijon, France, October 12th, 2016.

[2] Z. Molaeinia*, **J.A. El-Awady**, "Dislocation Mediated Plasticity in Hydrogen Charged Metals: Coupled Non-Linear Finite Element and Discrete Dislocation Dynamics Simulations", *International Hydrogen Conference*, Jackson Lake Lodge, Moran, WY, September 13th, 2016.

[3] S. Lavenstein*, G.-D. Sim‡, P. Shade, M.D. Uchic, C. Woodward, **J.A. El-Awady**, "Effect of size on the crack initiation and propagation in nickel-based superalloys microcrystals during high cycle fatigue in situ scanning electron microscopy testing", *Gordon Research Conference, Thin Film & Small Scale Mechanical Behavior*, Bates College, Lewiston, ME, July 24-29, 2016.

[4] K. Srivastava‡, **J.A. El-Awady**, "Atomistically based discrete dislocation dynamics simulations of c-axis compression in Magnesium", *Mach Conference*, Annapolis, April 8th, 2016.

[5] H. Fan‡, S. Aubry, A. Arsenlis, **J.A. El-Awady**, "Grain Size Effects on Dislocation and Twinning Mediated Plasticity in Magnesium–A Discrete Dislocation Dynamics Study", Int. Workshop on Mechanistic Behaviour of HCP Alloys, University of Oxford, Pembroke College, UK, March, 2016.

[6] G.-D. Sim‡, S. Lavenstein*, **J.A. El-Awady**, "Crystal Size, Temperature, and Strain Rate Effects on the Competition between Slip and Twinning in Magnesium Microcrystals", Int. Workshop on Mechanistic Behaviour of HCP Alloys, University of Oxford, Pembroke College, UK, March, 2016.

[7] Q. Jiao*, **J.A. El-Awady**, "Micro-Mechanical Characterization of Micro-Architectured Refractory Metal Coatings", *TMS Annual Meeting*, Nashville, TN, February, 2016.

[8] A.M. Hussein*, S.I. Rao, T. Parthasarathy, M.D. Uchic, **J.A. El-Awady**, "The Strength and Deformation Behavior of Nickel Based Superalloy Microcrystals through Discrete Dislocation Dynamics Simulations", *TMS Annual Meeting*, Nashville, TN, February, 2016.

[9] G.-D. Sim‡, K. Xie, S. Lavenstein*, K. Hemker, **J.A. El-Awady**, "Crystal Size Effects on Twinning of Magnesium Microcrystals", *TMS Annual Meeting*, Nashville, TN, February, 2016.

[10] S.I. Rao, D.M. Dimiduk, M.D. Uchic, T. Parthasarathy, A.M. Hussein*, **J.A. El-Awady**, W. Curtin, "The Strength and Deformation Behavior of Nickel Based Superalloy Microcrystals through Discrete Dislocation Dynamics Simulations", *TMS Annual Meeting*, Nashville, TN, February, 2016.

[11] S. Lockyer-Bratton, **J.A. El-Awady**, K.J. Hemker, "Experimental Measurements of Thermal Barrier Coating Interfacial Fracture Toughness as a Function of Mode-Mix", *UCSB Winter Workshop on High Temperature Coatings*, Santa Barbara, CA, January, 2013.

[12] M. Hindy, M. Hamza*, T.M. Hatem, D. Raabe, **J.A. El-Awady**, "Atomistic simulations of hydrogen and carbon diffusion and segregation in α-iron grain boundaries", *International Symposium on Plasticity*, January 8, 2016.

[13] A. Aramoon*, A.M. Hussein*, H. Fan‡, **J.A. El-Awady**, "Unified Framework for Coarse-Grained Modeling of Plastic Deformation in Metals and Polymers", *Frontiers of Science, Engineering, and Medicine Symposium*, King Abdullah University of Science and Technology, Saudi Arabia, December 5, 2015.

[14] M. Hamza*, T.M. Hatem, **J.A. El-Awady**, "The effect of grain boundary deviation from ideal Σ3 (111) grain boundaries on hydrogen segregation and diffusion in BCC iron", *Materials Research Society Fall Meeting & Exhibit*, Boston, MA, December 4, 2015.

[15] A.M. Hussein*, **J.A. El-Awady**, "Surface Roughness Evolution under Cyclic Loading from Discrete Dislocation Dynamics Simulations", *Materials Research Society Fall Meeting & Exhibit*, Boston, MA, December 3, 2015.

[16] A.M. Hussein*, S.I. Rao, M.D. Uchic, T. Parthasarathy, **J.A. El-Awady**, "Modeling the Strength of Nickel Based Superalloy Microcrystals through Discrete Dislocation Dynamics Simulations", *Materials Research Society Fall Meeting & Exhibit*, Boston, MA, December 1, 2015.

[17] G.-D. Sim‡, S. Lavenstein, K.Y. Xie, K.J. Hemker, **J.A. El-Awady**, "Effect of Crystal Size on the Hardening of Magnesium Microcrystals", *Materials Research Society Fall Meeting & Exhibit*, Boston, MA, December 1, 2015.

[18] G.D. Sim‡, S. Lavenstein, K.Y. Xie, B. Crawford, W. Oliver, J.J. Vlassak, K.J. Hemker, **J.A. El-Awady**, "High Temperature Testing of Small-Scale Materials", *Materials Research Society Fall Meeting & Exhibit*, Boston, MA, December 1, 2015.

[19] H. Fan‡, S. Aubry, A. Arsenlis, **J.A. El-Awady**, "Grain Size Effects on Dislocation and Twinning Mediated Plasticity in Magnesium – A Discrete Dislocation Dynamics Study", *Materials Research Society Fall Meeting & Exhibit*, Boston, MA, November 30, 2015.

[20] M. Hamza*, T.M. Hatem, **J.A. El-Awady**, "Hydrogen diffusion and segregation in alpha iron Σ3 (111) Grain Boundaries", *ASME International Mechanical Engineering Congress & Exposition*, November 19, 2015.

[21] A.M. Hussein*, **J.A. El-Awady**, "Surface Slip Morphology and Dislocation Microstructure Evolution during Cyclic Loading of Nickel Microcrystals as Predicted from Discrete Dislocation Dynamics Simulations", *ASME International Mechanical Engineering Congress & Exposition*, November 19, 2015.

[22] A. Aramoon*, T.D. Breitzman, C. Woodward, **J.A. El-Awady**, "Correlating the Free-Volume Evolution to Plastic Deformation of Highly Cross-Linked Polymers from Large Scale Coarse-Grained MD Simulations", *ASME International Mechanical Engineering Congress & Exposition*, November 18, 2015.

[23] M. Hamza*, T.M. Hatem, **J.A. El-Awady**, "The effect of grain boundary deviation from ideal Σ3 (111) grain boundaries on hydrogen segregation and diffusion in BCC iron", *Society of Engineering Science 52nd Annual Technical Meeting*, October 28, 2015.

[24] G.D. Sim‡, S. Lavenstein, K.Y. Xie, B. Crawford, W. Oliver, J.J. Vlassak, K.J. Hemker, **J.A. El-Awady**, "High Temperature Testing of Small-Scale Materials", *Physical Metallurgy Gordon Research Conference*, Biddeford, ME, July 22, 2015.

[25] A. Aramoon*, T.D. Breitzman, C. Woodward, **J.A. El-Awady**, "Coarse-Grained Simulations of the Evolution of Free Volume and failure of Highly Cross-Linked Epoxy Polymers", *ASME Applied Mechanics and Materials Conference*, July 1, 2015.

[26] Q. Jiao*, **J.A. El-Awady**, "Micro-Mechanical Characterization of Micro-Architectured Refractory Metal Coatings", *ASME Applied Mechanics and Materials Conference*, June 30, 2015.

[27] A.M. Hussein*, **J.A. El-Awady**, "Effect of Dislocation Density and Crystal Size on Surface Roughness Evolution under Cyclic Loading in FCC Metals from Discrete Dislocation Dynamics Simulations", *3rd World Congress on Integrated Computational Materials Engineering*, Colorado Springs, CO, June 3, 2015.

[28] A. Aramoon*, S. Barr, T. Breitzman, C. Woodward, **J.A. El-Awady**, "Coarse-Graining Simulations of the Correlation between Free Volume Evolution and Plastic Deformation of Highly Cross-Linked DGEBA Polymer", *3rd World Congress on Integrated Computational Materials Engineering*, Colorado Springs, CO, June 2, 2015.

[29] H. Fan‡, S. Aubry, A. Arsenlis, **J.A. El-Awady**, "Discrete Dislocation Dynamics Simulation of the Effect of Tension-Twins on the Plastic Deformation of Magnesium Crystals", *3rd World Congress on Integrated Computational Materials Engineering*, Colorado Springs, CO, June 2, 2015.

[30] A.M. Hussein*, S.I. Rao, D.M. Dimiduk, M.D. Uchic, **J.A. El-Awady**, "Discrete Dislocation Dynamics Simulations of Plastic Deformation in Nickel Superalloys", *Mach Conference*, Annapolis, April 10th, 2015.

[31] H. Fan‡, S. Aubry, A. Arsenlis, **J.A. El-Awady**, "Identifying the role of twinning on the hardening behavior of magnesium through discrete dislocation dynamics simulations", *Mach Conference*, Annapolis, April 10th, 2015.

[32] H. Fan‡, S. Aubry, A. Arsenlis, **J.A. El-Awady**, "Discrete dislocation dynamics simulations of the twinning deformation in magnesium", *TMS Annual Meeting*, Orlando, FL, February, 2015.

[33] S. Lockyer-Bratton, **J.A. El-Awady**, K.J. Hemker, "Experimental Measurements of Thermal Barrier Coating Interfacial Fracture Toughness as a Function of Mode-Mix", *TMS Annual Meeting*, Orlando, FL, February, 2015.

[34] A. Aramoon*, T.D. Breitzman, C. Woodward, **J.A. El-Awady**, "Correlating the Free-Volume Evolution to Plastic Deformation of Highly Cross-Linked Polymers from Large Scale Coarse-Grained MD Simulations", *TMS Annual Meeting*, Orlando, FL, February, 2015.

[35] A.M. Hussein*, S.I. Rao, D.M. Dimiduk, M.D. Uchic, **J.A. El-Awady**, "Discrete Dislocation Dynamics Modeling of Plastic Deformation in Nickel Based Superalloys", *TMS Annual Meeting*, Orlando, FL, February, 2015.

[36] A.M. Hussein*, **J.A. El-Awady**, "Microstructure and Surface Roughness Evolution under Cyclic Loads in FCC Metals through Discrete Dislocation Dynamics Simulations", *TMS Annual Meeting*, Orlando, FL, February, 2015.

[37] A.M. Hussein*, S.I. Rao, D.M. Dimiduk, M.D. Uchic, **J.A. El-Awady**, "Dislocation Pattern Evolution and Strain Hardening in FCC Metals through Discrete Dislocation Dynamics Simulations", *7th international Conference on Multiscale Materials Modeling*, Berkeley, CA, October 6-10, 2014.

[38] A. Aramoon*, S. Barr, T.D. Breitzman, C. Woodward , **J.A. El-Awady**, "Correlating the Free-Volume Evolution to Plastic Deformation of Highly Cross-Linked Polymers from Large Scale Coarse-Grained MD Simulations", *7th international Conference on Multiscale Materials Modeling*, Berkeley, CA, October 6-10, 2014.

[39] N. Salman∞, M.A. Wagih∞, T.M. Hatem, Y. Tang‡, **J.A. El-Awady**, "Hydrogen Embrittlement of Iron Bi-crystals", *11th World Congress on Computational Mechanics*, Barcelona, Spain, July 20–25, 2014.

[40] A. Hussein*, S. Rao, D. Dimiduk, M. Uchic, **J.A. El-Awady**, "Implementation of FCC Cross Slip Mechanisms in Discrete Dislocation Dynamics Simulations", *Mach Conference*, Annapolis, April, 2014.

[41] Y. Tang‡, **J.A. El-Awady**, "Formation and slip of pyramidal dislocations in HCP Mg: an atomistic study", *Mach Conference*, Annapolis, April, 2014.

[42] Y. Zhang*, **J.A. El-Awady**, "Micro-mechanical Characterization of Ultra-high Strength Dendritic Tungsten Thermal Barrier Coatings", *TMS Annual Meeting*, San Diego, CA, February, 2014.

[43] M. Wagih∞, Y. Tang‡, T. Hatem, **J.A. El-Awady**, "Effects of Hydrogen Concentration, Dislocation Density and Crystal Size in Deformation of Iron Nano-crystals: A Molecular Dynamics Study", *TMS Annual Meeting*, San Diego, CA, February, 2014.

[44] S. Lockyer-Bratton, **J.A. El-Awady**, K. Hemker, "Determination of the Mode II Interfacial Fracture Toughness of Thermal Barrier Coatings with the Compression Edge-delamination Test", *TMS Annual Meeting*, San Diego, CA, February, 2014.

[45] B. Zhang, R. Jackson, C. Levi, B. Butler, **J.A. El-Awady**, K. Hemker, "Experimental Measurements of the Elastic Response of EBPVD Yttria stabilized Zirconia Thermal Barrier Coatings", *TMS Annual Meeting*, San Diego, CA, February, 2014.

[46] Y. Tang‡, **J.A. El-Awady**, "Large Scale Molecular Dynamics Simulations of the Effect of Dislocation Density on Twinning in c-Axis Compression of Magnesium Single Crystals", *TMS Annual Meeting*, San Diego, CA, February, 2014.

[47] Y. Tang‡, **J.A. El-Awady**, "The Nucleation, Core Structure, and Slip of Pyramidal Dislocations in HCP Magnesium: A Molecular Dynamics Study", *TMS Annual Meeting*, San Diego, CA, February, 2014.

[48] A. Hussein*, **J.A. El-Awady**, "Micro-mechanics Modeling of Surface Roughness Evolution under Thermo-mechanical Fatigue", *TMS Annual Meeting*, San Diego, CA, February, 2014.

[49] A. Hussein*, S.I Rao, D.M. Dimiduk, M.D. Uchic, **J.A. El-Awady**, "Implementation of Cross Slip Mechanisms in Discrete Dislocation Dynamics Simulations", *TMS Annual Meeting*, San Diego, CA, February, 2014.

[50] Y. Tang‡, **J.A. El-Awady**, "Effect of Initial Dislocation Density on Slip and Twinning in c-axis Compression of Magnesium Single Crystals", *Materials Research Society Fall Meeting*, Boston, MA, December, 2013.

[51] Y. Zhang*, **J.A. El-Awady**, "Micro-Mechanical Characterization of Ultra-High Strength Dendritic Tungsten Thermal Barrier Coatings", *Materials Research Society Fall Meeting*, Boston, MA, December, 2013.

[52] M.A. Wagih∞, Y. Tang‡, T.M. Hatem, **J.A. El-Awady**, "Effects of Hydrogen Concentration, Dislocation Density and Crystal Size in deformation of Iron Nano-Crystals: A Molecular Dynamics Study", *Materials Research Society Fall Meeting*, Boston, MA, December, 2013.

[53] Y. Tang‡, **J.A. El-Awady**, "Atomistic Simulations of the Nucleation and Slip of Pyramidal Dislocations in HCP Magnesium", *Materials Research Society Fall Meeting*, Boston, MA, December, 2013.

[54] M.A. Wagih∞, Y. Tang‡, T.M. Hatem, **J.A. El-Awady**, "Molecular Dynamics Simulations of Hydrogen-Dislocation Interactions in Iron Nanocrystals", *FRACT'2 International Workshop*, Algeria, November 24-25, 2013.

[55] Y. Tang‡, **J.A. El-Awady**, "Large Scale Molecular Dynamics Simulations of Slip and Twinning in c-axis Compression of Magnesium Single Crystals", *SES 50th Annual Technical Meeting*, Brown Univ., RI, July, 2013.

[56] **J.A. El-Awady**, "The Genome of Size-Dependent Plasticity in Metals", *SES 50th Annual Technical Meeting*, Brown University, RI, July, 2013.

[57] **J.A. El-Awady**, "Microstructure-based Modeling and Experimental Validations of Dislocation and Twinning Plasticity in Metals", *2nd World Congress on Integrated Computational Materials Engineering*, Salt Lake City, UT, July, 2013.

[58] S.J. Lockyer-Bratton, **J.A. El-Awady**, K.J. Hemker, "An Experimental Method for Determining the Mode Interfacial Toughness of Thermal Barrier Coatings", *International Conference on Metallurgical Coatings and Thin Films*, San Diego, CA, April, 2013.

[59] B. Zhang, S.J. Lockyer-Bratton, J.A. El-Awady, K.J. Hemker, "Experimental Determination of Mode II Fracture Toughness of TBC's", *International Conference on Metallurgical Coatings and Thin Films*, San Diego, CA, April, 2013.

[60] Y. Tang‡, M. Tschopp, J.A. El-Awady, "Large Scale Atomistic Simulations of Twinning during c-axis Compression of Magnesium", *Mach Conference*, Annapolis, MD, April, 2013.

[61] Y. Tang‡, **J.A. El-Awady**, "Hydrogen Trapping at Dislocations in FCC Ni and its Effects on Dislocation Behavior", *TMS Annual Meeting*, San Antonio, TX, February, 2013.

[62] D.M. Dimiduk, M.D. Uchic, S. Papanikolaou, **J.A. El-Awady**, P. A. Shade, "Dislocation Avalanche Behavior in Ni Microcrystals for Varying Strain Rates and Deformation Stages", *TMS Annual Meeting*, San Antonio, TX, February, 2013.

[63] **J.A. El-Awady**, "A Physics-Based Understanding of Size Effects in FCC Single Crystals", *TMS Annual Meeting*, San Antonio, TX, February, 2013.

[64] S.I. Rao, D.M. Dimiduk, M.D. Uchic, T. Parthasarathy, **J.A. El-Awady**, A.M. Hussein, C. Woodward, "Size-Affected Behavior in Pure Compression of Micron-Sized Metallic Crystals", *TMS Annual Meeting*, San Antonio, TX, February, 2013.

[65] S.I Rao, D.M. Dimiduk, M.D. Uchic, T. Parthasarathy, A. Stukowski, **J.A. El-Awady**, C. Woodward, "Massively Parallel Molecular Statics Simulations of the Percolation of Dislocations through a Random Array of Forest Dislocation Obstacles in FCC Nickel", *TMS Annual Meeting*, San Antonio, TX, February, 2013.

[66] S. Lockyer-Bratton, **J.A. El-Awady**, K.J. Hemker, "Determination of the Mode II Interfacial Fracture Toughness of Thermal Barrier Coatings with the Compression Edge-Delamination Test", *UCSB Winter Workshop on High Temperature Coatings*, Santa Barbara, CA, January, 2013.

[67] Y. Tang‡, **J.A. El-Awady**, "Trapping of Hydrogen to Dislocations in FCC Ni and Its Effects on Dislocation Behavior", *22nd International Workshop on Computational Mechanics of Materials, Baltimore*, MD, September 24, 2012.

[68] S.I. Rao, D.M. Dimiduk, **J.A. El-Awady**, M.D. Uchic, "Cross-Slip Nucleation at Screw Dislocation Intersections in Face-Centered Cubic Nickel, Copper and L12 Ni3Al Investigated using Atomistic Simulations", *22nd International Workshop on Computational Mechanics of Materials*, Baltimore, MD, September 24, 2012.

[69] **J.A. El-Awady**, M.D. Uchic, S.-L. Kim, P. Shade, S.I. Rao, D.M. Dimiduk, C. Woodward, "The Role of the Initial Dislocation Density in Controlling Size-Affected Flow Response", *TMS Annual Meeting*, Orlando, FL, March, 2012.

[70] **J.A. El-Awady**, M.D. Uchic, S.I. Rao, D.M. Dimiduk, C. Woodward, "Pre-Straining Effects on the Power-Law Scaling of Size-Dependent Strengthening in Ni Single Crystals", *International Symposium on Plasticity*, San Juan, Puerto Rico, January 3, 2012.

[71] **J.A. El-Awady**, "Advanced Techniques for Modeling Dislocation Evolution at the Micron Scale", *1st World Congress on Integrated Computational Materials Engineering (ICME)*, Seven Springs, PA., July 11, 2011.

[72] **J.A. El-Awady**, M.D. Uchic, S.-L. Kim, P. Shade, S.I. Rao, D.M. Dimiduk, C. Woodward, "Measurement of Cross-Slip Activation Parameters in Pure Ni via Bonneville-Escaig Experiments", *TMS Annual Meeting*, San Diego, CA, February, 2011.

[73] D.M. Dimiduk, M.D. Uchic, E. Nadgorny, S.I. Rao, **J.A. El-Awady**, P. Shade, C. Woodward, "Size-Affected Flow & Intermittency in Small Ni_3Al Crystals", *TMS Annual Meeting*, San Diego, CA, February, 2011.

[74] S.I. Rao, D.M. Dimiduk, **J.A. El-Awady**, T.A. Parthasarathy, M.D. Uchic, C. Woodward, "Atomistic Simulations of Cross-Slip Nucleation at Screw Dislocation Intersections in Face-Centered Cubic Nickel and Copper and $L1_2$ Ni_3Al", *TMS Annual Meeting*, San Diego, Cali., February, 2011.

[75] S.I. Rao, D.M. Dimiduk, **J.A. El-Awady**, T.A. Parthasarathy, M.D. Uchic, C. Woodward, "Atomistic simulations of cross-slip nucleation in $L1_2$ Ni_3Al", *TMS Annual Meeting*, San Diego, CA, February, 2011.

[76] S.I. Rao, D.M. Dimiduk, **J.A. El-Awady**, T.A. Parthasarathy, M.D. Uchic, C. Woodward, "Massively parallel molecular statics simulations of the percolation of dislocations through a random array of forest dislocation obstacles in face-centered cubic Nickel", *TMS Annual Meeting*, San Diego, CA, February, 2011.

[77] C.S. Hartley, **J.A. El-Awady**, P. Shade, C. Woodward, "Dislocation Density Vector Representation of Dislocation Dynamics Simulations", *5th International Conference on Multiscale Materials Modeling*, Freiburg, Germany, October, 2010.

[78] D.M. Dimiduk, M.D. Uchic, E. Nadgorny, S.I. Rao, **J.A. El-Awady**, P. Shade, C. Woodward, "Size-Affected Flow Behavior in Small Metal Crystals", *Materials Science & Technology*, Houston, TX, October, 2010.

[79] S.I. Rao, D.M. Dimiduk, T. Parthasarathy, M.D. Uchic, **J.A. El-Awady**, C. Woodward, "Atomistic simulations of cross-slip nucleation at screw dislocation intersections in FCC Ni", *IV European Conference on Computational Mechanics*, Paris, France, May, 2010.

[80] **J.A. El-Awady**, S.I. Rao, C. Woodward, D.M. Dimiduk, M.D. Uchic, "A Further Step in understanding the plasticity size-dependency: 3D modeling of Solid and Annular Micropillars", *TMS Annual Meeting*, Seattle, WA, February, 2010.

[81] S.I. Rao, D.M. Dimiduk, **J.A. El-Awady**, T. Parthasarathy, M.D. Uchic, C. Woodward, "Atomistic Simulations of Athermal Cross-Slip at Screw Dislocation Intersections in Face-Centered Cubic Nickel", *TMS Annual Meeting*, Seattle, WA, February, 2010.

[82] **J.A. El-Awady**, C. Woodward, D. M. Dimiduk, N.M. Ghoniem, "Focused ion beam induced damage effects on the plasticity of nano- and micro-pillars", *TMS Annual Meeting*, San Francisco, CA, February, 2009.

[83] **J.A. El-Awady**, N.M. Ghoniem, "Size Scaling Aspects of Plastic Flow in Ni-Single Crystal", *TMS Annual Meeting & Exhibition*, New Orleans, LA, March, 2008.

[84] **J.A. El-Awady**, H. Kim, V. Gupta, N. Ghoniem, S. Sharafat "Interface Strength Measurement of Tungsten Coatings on F82H Substrates", *13th International Conference on Fusion Reactor Materials*, Nice, France, December, 2007.

[85] **J.A. El-Awady**, N.M. Ghoniem, "Three Dimensional Dislocation Dynamics Modeling of Size Effects on the Strength of Microcrystals", *9th US National Congress on computational Mechanics*, San Francisco, CA, July, 2007.

[86] **J.A. El-Awady**, H. Kim, V. Gupta, S. Sharafat, N. Ghoniem, "Failure Strength Measurements of VPS Tungsten Coating for HAPL First Wall Armor", *Inertial Fusion Energy Science & Technology Strategic Planning Workshop*, San Ramon, CA, April, 2007.

[87] **J.A. El-Awady**, N.M. Ghoniem, H. Mughrabi, "Dislocation Modeling of Localized Plasticity in Persistent Slip Band", *TMS Annual Meeting*, Orlando, FL, February, 2007.

[88] **J.A. El-Awady**, H. Kim, V. Gupta, S. Sharafat, N. Ghoniem, "Comparison of HIP and VPS Tungsten Coating Behavior Using Laser Spallation Technique", *16th High Average Power Laser Workshop, Princeton Plasma Physics Laboratory*, Princeton, NJ, December, 2006.

[89] **J.A. El-Awady**, H. Kim, J. Quan, V. Gupta, S. Sharafat, N. Ghoniem, "Measurement of Interface Bond Strength between Tungsten Coatings and Steel Substrates for HAPL FW Armor", *17th Topical Meeting on the Technology of Fusion Energy*, Albuquerque, New Mexico, November, 2006.

[90] **J.A. El-Awady**, N. Ghoniem, "Coupled 3-D Parametric Dislocation Dynamic Boundary Element Framework for Finite Geometry", *7th World Congress on Computational Mechanics*, Los Angeles, CA, July, 2006.

[91] S. Sharafat, N. Ghoniem, **J.A. El-Awady**, S. Liu, R. Odette, T. Yamamoto, J. Blanchard, E. Diegele, S. Zinkle, "Large-Scale Finite Element Modeling of the Thermo- Mechanical Behavior of the Dual Coolant US-ITER TBM Incorporating Damage Evolution", *12th International Conference on Fusion Reactor Materials*, Santa Barbara, CA, December, 2005.

[92] **J.A. El-Awady**, Q. Chen, S.B. Biner, N.M. Ghoniem, "Boundary Element Representation of Interfacial Forces in 3-D Dislocation Dynamics", *International Conference on Micromechanics and Microstructure Evolution: Modeling, Simulation and Experiments*, Madrid, Spain, September, 2005.

[93] **J.A. El-Awady**, S. Banerjee, S. Sharafat, N. Ghoniem, V. Gupta, "Measurement of W-Armor Interfacial Properties Using a Nanosecond Laser Source", *12th High Average Power Laser Workshop*, Lawrence Livermore National Laboratory, Livermore, CA, June, 2005.

[94] **J.A. El-Awady**, S. Sharafat, N. Ghoniem, "Dual Coolant Pb-Li ITER-Test Blanket Module: Design for Accident Relevant Loading", *ITER-Test Blanket Module Meeting*, University of California, Los Angeles, CA, March, 2005.

GRANTS AND CONTRACTS

ACTIVE GRANTS:

[G1] **CAREER: Identifying the Micromechanisms Leading to Hydrogen-Induced Intergranular Fracture in Metals (**CMMI-1454072**)**

Sponsor	National Science Foundation (NSF)
PI	J.A. El-Awady
Co-PI(s)	None
Total Award	$500,000
El-Awady Share	Full amount
Period of Performance	01/17/2015 – 01/16/2020
Summary	Identify the underlying deformation and failure mechanisms of Ni under coupled environmental and mechanical conditions through large scale MD and DDD simulations.

[G2] **Quantifying the Thermo-Mechanical Response and Strain-Rate Effects in Magnesium Microcrystals** (DMR-1609533)

Sponsor	National Science Foundation (NSF)
PI	J.A. El-Awady
Total Award	$402,976
El-Awady Share	Full amount
Period of Performance	09/01/2016 – 08/31/2019
Summary	Characterize the deformation of Mg and Mg alloy microcrystals at elevated temperatures and quantify the strain-rate and crystal size effects from both novel in situ SEM high temperature experiments, as well as novel large scale 3D DDD simulations.

[G3] **Center of Excellence on Integrated Materials Modeling (CEIMM) (**FA9550-12-1-0445**)**

Sponsor	Air Force Office or Science and Research (AFOSR)
PI	S. Ghosh (JHU)
Co-PI(s)	El-Awady, Hemker, Graham-Brady (JHU) Pollock (UCSB), Geubelle, Sottos (UIUC).
Total Award	$5,000,000
El-Awady Share	$378,775 (to date)
Period of Performance	09/01/2012 – 08/31/2018
Summary	The goal of El-Awady's task is to develop a 3D coarse grained model to study the plastic deformation of epoxies.

[G4] **In-Situ Experiments and Multiscale Modeling of the Thermo-Mechanical Properties of Ultra-High Strength Micro-Architectured Tungsten Coatings (**FA9550-15-1-0070**)**

Sponsor	Air Force Office of Science Research (AFOSR)
PI	J.A. El-Awady
Co-PI	None
Total Award	$373,940
El-Awady Share	Full amount
Period of Performance	01/15/2015 – 01/14/2018
Summary	Microscale in-situ experiments and 3D characterization of pure tungsten micro-architecture coatings in vacuum at high temperatures. In addition, discrete dislocation dynamics simulations of deformation in tungsten at high temperatures will be performed.

[G5] **Statistics of Short Crack Growth from in situ SEM Microbending Experiments of Notched Beams (**FA8650-11-D-5801**)**

Sponsor	Air Force Office of Science Research (through a subcontract from the Air Force Research Laboratory managed by UES Inc.)
PI	J.A. El-Awady
Co-PI(s)	None
Total Award	$224,592
El-Awady Share	Full amount
Period of Performance	09/2015 – 09/2017
Summary	Design in situ SEM experiments for microbending studies of notched beams in an effort to study the statistics of short crack growth.

[G6] **Micro-Scale Experiments for Characterizing Constituent TBC Properties (**N000140810454**)**

Sponsor	Office of Naval Research
PI	K. Hemker (JHU)
Co-PI	J.A. El-Awady
El-Awady Share	$22,437 (starting in 2012 to present)
Period of Performance	04/23/2014 – 06/30/2017
Summary	Employ novel experiments and numerical simulations to measure the elastic response and delamination toughness of yttrium stabilized zirconia used as thermal barrier coatings for Ni-superalloy turbine blades.

[G7] **Materials in Extreme Dynamic Environments (MEDE) Collaborative Research Alliance (**W911NF-12-2-0022**)**

Sponsor	Army Research Laboratory/Army Research Office (ARL/ARO)
PI	K.T. Ramesh (JHU)
Co-PI(s)	El-Awady with 12 other JHU Co-PIs + other PIs at Caltech, University Delaware, and Rutgers University
Total Award	$21,437,572 (to date)
El-Awady Share	$526,712 (to date)
Period of Performance	04/16/2012 – 12/31/2016 (under review for extension through 2021)
Summary	The goal of El-Awady's task is to develop a unified framework for 3D DDD simulations of HCP Magnesium that accounts for dislocations, twinning, and their interactions.

CONCLUDED GRANTS:

[G8] **Micro-Mechanics Modeling of Surface Roughness Evolution and Subsequent Crack-Initiation under Thermo-Mechanical Fatigue (**N66001-12-1-4229**)**

Sponsor	Defense Advanced Research Projects Agency (DARPA)
PI	J.A. El-Awady
Co-PI(s)	None
Total Award	$300,000
El-Awady Share	Full amount
Period of Performance	06/25/2012 – 06/24/2014 with one year extension to end 06/24/2015
Summary	The goal of this project is to evaluate the role of grain-size and orientation on the morphology of free surface extrusions/intrusions, surface crack initiation, and dislocation substructures, under thermo-mechanical loading using discrete dislocation dynamics simulations.

[G9] **3D DD Simulations using ParaDiS (**FA8650-10-D-5226**)**

Sponsor	Air Force Office of Science Research by a subcontract from the Air Force Research Laboratory managed by UES Inc.
PI	J.A. El-Awady
Co-PI(s)	None
Total Award	$54,114
El-Awady Share	Full amount
Period of Performance	08/11/2014 – 06/30/2015
Summary	Develop necessary methods to model dislocation evolution in Ni-based Superalloys in the ParaDiS code.

TEACHING AND COURSE DEVELOPMENT

[1] EN.530.605 Mechanics of Solids and Materials (Existing Course)

- Semesters (enrollment): Fall 2015 (15)
- Course description: This is a graduate core course in Mechanics and Materials that introduces the fundamental continuum mechanics concepts of deformation, stress, and constitutive laws. Topics covered include the thermodynamic foundations of hyperelasticity, isotropic and anisotropic hyperelastic constitutive models, generalized bases, and solutions of finite hyperelastic boundary value problems.

[2] EN.530.606 Mechanics of Solids and Materials II (Redeveloped Course)

- Semesters (enrollment): Spring 2011 (14), Spring 2012 (10), Spring 2013 (16), Spring 2014 (11), Spring 2015 (9), Spring 2016 (10)
- Course description: This is a graduate core course in Mechanics and Materials that discusses different principles of continuum mechanics, and covers the fundamental concepts of elasticity and fracture as applied to solids and materials.
- Course Modifications: The contents of the course have been revised to cover different techniques (exact and approximate methods) for solving two-dimensional and three-dimensional boundary value problems in elasticity. A one-on-one oral exam has been included as part of the final examination of each student, to help student prepare for their department qualifying exam, which this course is a major component.

[3] EN.530.405 Mechanics of Advanced Engineering Structures – formerly "Mechanics of Solids and Structures" (Redeveloped Course)

- Semesters (enrollment): Fall 2012 (6), Fall 2014 (6)
- Course description: This is an undergraduate elective course that provides an introduction to the mathematical and theoretical foundations of the mechanics of solids and structures. The course begins with the mathematical preliminaries used in continuum mechanics: vector and tensor calculus, then introduce kinematics and strain measures, descriptions of stress in a body, frame indifference, conservation laws: mass, momentum, energy balance, and entropy.
- Course Modifications: The contents of the course have been revised to cover solutions of structures used in different mechanical engineering applications. General solutions of bending and torsions of beams and plates are developed as well as solution techniques for shells.

[4] EN.530.642 Plasticity (Redeveloped Course)

- Semesters (enrollment): Fall 2011 (18), Fall 2013 (18)
- Course description: This is a graduate course of interest to students in the Depart. Mechanical Engineering, Materials Science and Engineering, and Civil Engineering. The course introduces the theory of the inelastic behavior of materials starting from experimental background and fundamental postulates for the plastic stress-strain relations.
- Course Modifications: The contents of the course have been revised to cover topics including microplasticity, continuum plasticity, cyclic plasticity and creep, yield criterion and the yield surface, and solution procedures of different boundary value problems in plasticity.

[5] EN.530.658 Thermally Activated Processes in Solids (New Course)

- Semesters (enrollment): Spring 2013 (9)
- Course description: This is an advanced graduate course on the theoretical treatment and modeling of the mechanisms of deformation in solids at intermediate and high temperatures. Topics include

diffusion of point defects; vacancy migration; diffusion of solutes; cooperative and diffusion-less transformations; dislocation obstacle interactions; dislocation climb and cross-slip; friction forces in metals, alloys and covalent crystals.

ADVISING AND MENTORING

- ***Postdoctoral Fellows***

  Current:
  - **Gi-Dong Sim** (10/2014 – present)
  - **Kinshuk Srivastava** (03/2015 – present)
  - **Yejun Gu** (09/2016 – present)

  Alumni:
  - **Haidong Fan** (07/2013 – 06/2015)
    - Current Position: Associate Professor at Sichuan University, Chengdu, China
  - **Yizhe Tang** (01/2012 – 06/2014)
    - Current Position: Assistant Professor at Shanghai University, Shanghai, China

- ***Ph.D. Students***

  Current:
  - **Amin Araamon** (08/2012 – present)
  - **Quan Jiao** (08/2013 – present)
  - **Steven Lavenstein** (08/2014 – present)
  - **Mohamed Hamza** (08/2015 – present)
  - **Harsh Harsh** (08/2016 – present)
  - **Jason Parker** (08/2016 – present)

  Alumni:
  - **Ahmed Hussein** (01/2011 – 08/2015)
    - **Thesis title:** "*Dislocation Microstructure and Surface Roughness Evolution in Single and Multi-Phase Microcrystals*"
    - Current Position: Received the National Research Council (NRC) postdoctoral fellowship and is currently at the Air Force Research Laboratory, Dayton, OH.
  - **Binwei Zhang (Co-advised with K.J Hemker)** (09/2010 – 08/2015)
    - **Thesis title:** "*Experimental Characterization of Thermal Barrier Coatings using Micro-Scale Bending Techniques*"
    - Current Position: Research Engineer at Corning.

- ***Graduate Student Awards***
  - **2015:** PhD student Ahmed Hussein won the National Research Council (NRC) postdoctoral fellowship to continue his postgraduate studies at the Air Force Research Laboratory.
  - **2014:** PhD student Ahmed Hussein won Best Poster Award, the 7th Multiscale Materials Modeling International Conference held October 6-10 2014 at Berkeley, CA

- ***Masters Students***

  Alumni:
  - **Zahra Molaeinia** (09/2014 – 08/2015)

- **Thesis title:** "*Non-linear Finite Element Simulation of Hydrogen Diffusion and Hydrogen-Dislocation Interactions in Metals*".
- Current Position: PhD student in my group.

- **Kielan C. Crow** (09/2013 – 06/2014)
  - Current Position: Associate Mechanical Engineer at GoPro, CA, USA
- **Yaofang (Katherine) Zhang** (09/2012 – 02/2014)
- **Pegah Ghahrmani** (09/2011 – 06/2013)
  - Current Position: PhD student in the Department of Electrical & Computer Engineering at Johns Hopkins University, MD, USA.

- ***Undergraduate Students***

Current:

- **Sapreen Abbass** (Summer 2016 – Present) – Majoring in Mechanical Engineering at JHU.
- **Ryenne Dietrick** (Summer 2016 – Present) – Majoring in Computer Science at JHU.
- **Roshan Plamthottam** (Summer 2016 – Present) – Majoring in Materials Science & Engineering at JHU.

Alumni:

- **Oreoluwa Adesina** (Summer 2016) – Visiting UG from Morgan State University (Historically Black College).
- **Islam Kibba** (Summer 2016) – Visiting UG from Zewail City of Science and Technology.
- **Neil Fendley** (Summer 2015 – Fall 2015) Majoring in Physics at JHU.
- **Mohamed Hindy** (Summer 2015) Visiting UG from British University in Cairo, Egypt.
- **Carlos Benavides** (Summer 2014 – Fall 2014) Majoring in Mechanical Engineering at JHU.
- **Mohamed Hamza** (Summer 2014) Visiting UG from British University in Cairo, Egypt.
  - Current Position: PhD student in my group.
- **Yunes Salman** (Summer 2014) Visiting UG from British University in Cairo, Egypt
  - Current Position: PhD student at School of Chemical and Process Engineering at the University of Leeds, UK.
- **Thomas Liu** (Fall 2013 – Spring 2015) – Majoring in Mechanical Engineering at JHU
  - Currently an M.Sc. student at Purdue University
- **Sheriff Asokuarami** (Summer 2014) – Visiting UG from Morgan State University (Historically Black College).
- **Nadia Salman** (Summer 2013) – Visiting UG from British University in Cairo, Egypt
  - Current PhD student at the Mechanical Engineering Department at University of Leeds, UK.
- **Mohamed Tawfik** (Summer 2013) – Visiting UG from British University in Cairo, Egypt.
- **Malik Wagih** (Winter 2013) – Visiting UG from British University in Cairo, Egypt
  - Currently a PhD student at the Nuclear Engineering Department at MIT.

- ***Ph.D. Dissertation Committees***
  - **2016:** Yuchong Shao (Physics), Jiahao Cheng (CE), Suman Dasgupta (ME), Simon Lockyer-Bratton (ME).
  - **2015:** Binwei Zhang (ME); Ahmed M. Hussein (ME); Coleman Alleman, (CE).
  - **2014:** Justin Wilkerson (ME); Jun Ding (MS&E).
  - **2013:** Cynthia Byer (ME), Lindsey Lindamood (MS&E).

- **2012:** Devin Burns (ME); Emily Huskins (ME); Guangli Hu (ME); John Sharon (ME).

- ***Master Essay Committees***
  - **2015:** Zahra Molaeinia (ME).
  - **2014:** Chengcheng Tao (ME).

- ***Graduate Board Oral Exam Committees***
  - **2016:** Jingkai Guo (ME), Betsy Congdon (ME), Vignesh Kannan (ME), Nicholas Eminizer (Physics), Jingkai Guo (ME).
  - **2015:** Amin Aramoon (ME), Dan Midgett (ME), Joel Clemmer (Physics), Ian McCue (MSE), Jiaxi Zhang (CE), Jiahao Cheng (CE), Suman Dasgupta (ME), Shu Guo (CE), Josephine Carstensen (CE).
  - **2014:** Ahmed Hussein (ME), Justin Wilkerson (ME), Simon Lockter-Bratton (ME).
  - **2013:** Reza Lotfi (CE), Zhang Liu (CE), Theresa Tonge (ME), Benwei Zhang (ME).
  - **2012:** Rui Xiao (ME).
  - **2011:** Lindsey Lindamood (MSE).

UNIVERSITY SERVICES

Department of Mechanical Engineering, Johns Hopkins University:

- Search Committee for New Faculty in Mechanics and Materials position in ME department – member (Spring 2013 and Spring 2014).
- Mechanics and Materials Graduate Seminar Faculty Advisor (2013 – present).
- ME Undergraduate Curriculum – member (2013 – present).
- ME Newsletter Committee – member (2013 – present).
- ME Centennial Planning Committee – member (2013 – present).
- Graduate Admissions Committee – member (2013 – 2015).
- Graduate Program, Affairs + MEGA – member (2011 – present).
- Library Liaison (2011 – present).

Hopkins Extreme Materials Institute (HEMI):

- Reviewer of the 2015 HEMI Seed Grant proposals (Spring 2015).
- HEMI facilities committee – member (Fall 2013 – present).
- Selection Committee for the HEMI Post-Doctoral Development Awards – member (Spring 2014).
- Search Commit for New Faculty in Mechanics and Materials position – member (Spring 2013, Spring 2016).

Johns Hopkins University

- Hopkins High-Performance Computer (HHPC) Management Committee – member (Spring 2014 – present).
- Innovation Initiative Proposal Reviewer (Winter 2013).

OUTREACH AND EXTERNAL ACTIVITIES

- STEM Achievement in Baltimore Elementary Schools (SABES), (2014 – present)

Activities: Team leader for teacher training and after class visits for student activities.

- Provide research experience for undergraduate students from Morgan State University, a historically black college (Summer 2014 and Summer 2016).

SCHOLARLY ACTIVITIES

MEMBER OF JOURNAL EDITORIAL BOARD

- **Materials Theory –** Springer. A new open access journal approved for launch in 2016.
- **Plasticity and Mechanics of Defects –** De Gruyter (http://www.degruyter.com/view/j/pmd). A new open access journal established in 2015.

PROFESSIONAL SOCIETIES

- American Society for Mechanical Engineers (ASME)
  - Member
- Materials Research Society (MRS)
  - Member and Symposia Organizer
- The Minerals, Metals and Materials Society (TMS)
  - Member of the Mechanical Behavior of Materials Committee
- United States Association for Computational Mechanics (USACM)
  - Member of a five member committee tasked to derive the USACM Technical Thrust Area: "**Multi-Scale, Multi-functional Materials and Structures**"

SYMPOSIA CO-ORGANIZED

- **2016:** "**Materials under Mechanical Extremes**", at the Materials Research Society Fall Meeting & Exhibit, Boston, MA, November 27 – December 2.
- **2014:** "**Defects, Microstructure Complexity and Self-Organization in Materials**", 11th. World Congress on Computational Mechanics (WCCM XI), Barcelona, Spain, July 20-25.
- **2013:** "**Dislocation Plasticity**" at the MRS Fall Meeting & Exhibit, Boston, MA, December 1-6. **2013:** "**Materials for Extreme Environments: Multiscale Experiments and Simulations**", Society of Engineering Science 50th Annual Technical Meeting, Brown University, RI, July 28-31.
- **2013:** "**Dislocation-Based Plasticity: Experiments, Theory, and Modeling**", Int. Symposium on Plasticity, Nassau, Bahamas, January 3-8.
- **2012:** "**Plasticity Bridging the Scales from Micro to Macro**", 22nd Int. Workshop on Computational Mechanics of Materials, Baltimore, MD, September 24-26.
- **2012:** "**Micro-scale deformation and damage mechanisms**", Int. Symposium on Plasticity, San Juan, Puerto Rico, January 3-8.
- **2011:** "**Multiscale methods in plasticity**", 3rd Int. Symposium on Computational Mechanics (ISCM III), Taipei, Taiwan, December 5-7.

MEMBER OF INTERNATIONAL ADVISORY COMMITTEE

- **2016:** Member of the International Scientific Committee of "**Dislocations 2016**", Purdue University, West Lafayette, USA, IN, September 19-23.
- **2016:** Local organizing committee member, "**Mach Conference**", Annapolis, MD, April 8-10.
- **2015:** Local organizing committee member, "**Mach Conference**", Annapolis, MD, April 8-10.
- **2014:** Local organizing committee member, "**Mach Conference**", Annapolis, MD, April 9-11.

- **2012:** Local organizing committee member, "**22nd Int. Workshop on Computational Mechanics of Materials**", Baltimore, MD., Sept. 24-26.
- **2011:** "**3rd Int. Symposium on Computational Mechanics (ISCM III)**", Member of the International Scientific Committee member, Taipei, Taiwan, Dec. 5-7.
- **2008:** "**4th Int. Conference on Multiscale Materials Modeling**", Member of the International Scientific Committee, Tallahassee, FL, Oct. 27-31.

TECHNICAL REVIEWER

- **Scientific Articles:**
  - Acta Materialia
  - ASME Journal of Engineering Materials and Technology
  - Chinese Journal of Aeronautics
  - Computational Materials Science
  - Crystals
  - Experimental Techniques
  - Fusion Science and Technology
  - International Journal of Plasticity
  - International Journal of Solids and Structures
  - Journal of Applied Physics
  - Journal of Applied Mechanics
  - Journal of ASTM International
  - Journal of Materials Research
  - Journal of Nanoparticle Research
  - Journal of Physics: Condensed Matter
  - Journal of the Mechanics and Physics of Solids
  - Materials Research Letters
  - Material Science & Engineering A
  - Metallurgical and Materials Transactions A
  - Microscopy and Microanalysis
  - Modelling and Simulation in Materials Science and Engineering
  - MRS proceedings
  - Nano Letters
  - Nature Communications
  - Philosophical Magazine
  - Philosophical Magazine Letters
  - Proceedings of the Royal Society of London A
  - Scientific Reports
  - Scripta Materialia
- **Proposals for Research Funding:**
  - Department of Energy: Vehicle Technology Office.
  - National Science Foundation.
  - Young Investigator Research Program – Air Force Office of Scientific Research.
  - The European M-ERA.NET consortium.
  - Fonds de recherche du Québec.
  - American University of Beirut Research Board.
  - University of Missouri Research Board.
  - Austrian Science Fund.