Djamel Kaoumi

2115 Stinson Dr, Raleigh, 27695, NC, USA
Phone: (w) 919 515 2046; E-mail: dkaoumi@ncsu.edu
Associate Professor of Nuclear Engineering
with affiliation in the Materials Science & Engineering department
North Carolina State University

Nuclear Materials: Alloy development and Materials degradation under extreme environment

Education and Training:

- **Ph.D. Nuclear Engineering**, The Pennsylvania State University, (GPA=3.92/4) (May 2007)
- **M.Sc. Nuclear Engineering** with a **minor in Materials Science and Engineering**, University of Florida, (GPA=3.94/4.0) (Aug. 2001).
- **B. Sc. Physics**, Institut National Polytechnique de Grenoble, France (with honors) (2000).

Research and Professional Experience:

- **Aug 2016 – present: Associate Professor (tenured)** (NCSU, Nuclear Engineering Department);

Research interests: Alloys and metallic systems for harsh environment; Advanced alloy development; Materials degradation in extreme environments: Effect of irradiation, temperature, corrosion and mechanical stress on materials microstructure. Ion and neutron irradiation effects in metals; Corrosion in nuclear reactor simulated environment; Mechanical properties and deformation mechanisms of high-temperature alloys; *Materials of interest including* Advanced Steels, Ni-based superalloys, nanostructured ODS alloys; *Characterization techniques of predilection:* Electron Microscopy techniques, In-situ irradiation in a TEM, In-situ straining in a TEM, (in-situ) Synchrotron XRD and tomography, ion irradiation, (in-situ) neutron diffraction.

- **Aug 2009 – Aug 2016: Assistant/Associate Professor (tenured)** (The University of South Carolina, Mechanical and Nuclear Engineering Department);

Nuclear materials (structural and classing materials); Effect of irradiation, temperature, and mechanical stress on materials microstructure.

- **May 15, 2008 – August 2009: Research Faculty:** (The Pennsylvania State University, Mechanical and Nuclear Engineering Department).

Cladding and Structural Materials for Advanced Reactor Systems; advanced F/M steels (HT9, T91, 316, D9, 304); In-situ TEM, Synchrotron XRD characterization.

- **May 2007 - May 2008: Postdoctoral Researcher** (PSU/ANL):

Mechanisms of Void Swelling Suppression in Stainless Steel; Model steels (Fe-15Cr, Fe-15Cr-15Ni) and advanced steels (D9, 316LN).

- **Aug 2001 - May 2007: Research Assistant** (The Pennsylvania State University):

Microstructure Evolution of Nanocrystalline Metals under In-Situ Charged-Particle Irradiation in a Transmission Electron Microscope (PhD thesis)**:** Processing and characterization of nanocrystalline metal thin-films; Ion irradiation; High-energy electron irradiation; Study of irradiation-induced second-phase precipitation and irradiation-induced grain-growth.

Stability of Oxide Dispersion Strengthened (ODS) Steel Alloys Relevant for Generation IV Reactors Under Irradiation: synchrotron XRD characterization; Ion-irradiation.

- **Jun, 1999 – Aug, 2001: Research Assistant** (University of Florida, Department of Nuclear and Radiological Engineering Sciences):

Study of the compatibility of UO_2 with refractory metal rhenium at different temperatures using x-ray diffraction analysis (sponsored by NASA) (Master's Thesis).

Publications (peer-reviewed):

1. R. Schoell, J. Kabel, S. Lam, A. Sharma, J. Michler, P. Hosemann, D. Kaoumi, Corrosion Behavior of a Series of Combinatorial Physical Vapor Deposition Coatings on SiC in a Simulated Boiling Water Reactor Environment, Journal of Nuclear Materials, ***submitted***

2. R. Schoell, L. Xi, Y. Zhao, X. Wu, Y. Hong, Z. Yu, P. Kenesei, J. Almer, Z. Shayer, D. Kaoumi, Uncovering the Mechanism of Chlorine-Induced Stress Corrosion Cracking in a Simulated Marine Environment through In Situ X-Ray Tomography and Diffraction, Journal of Materials Characterization, ***under review***

3. R. Auguste, H. L. Chan, E. Romanovskaia, J. Qiu, R. Schoell, M. O. Liedke, M. Butterling, E. Hirschmann, A. G. Attallah, A. Wagner, F. A. Selim, D. Kaoumi, B. P. Uberuaga, P. Hosemann, J.R. Scully; Revisiting Oxidation Defects in Cr2O3; a multimodal approach, NPJ Materials Degradation, ***under review***

4. S. Jublot-Leclerc, M. Owusu-Mensah, V. Borodin, J. Ribis, L. Largeau, R. Schoell, D. Kaoumi, M. Descoins, D. Mangelinck and A. Gentils, Synthesis of metallic nano-oxide particles by implantation of Ti, Y and O ions in Fe-10%Cr: towards an understanding of precipitation in ODS steels, Materials, ***invited paper, under review***

5. H. Gardner, R. Schoell, J. Qiu, P. Hosemann, M. Moody, D. Kaoumi, D. Armstrong, Effect of ion irradiation and FLiNaK molten salt corrosion on Hastelloy N, Acta Materialia, ***under review***

6. R. Schoell, L. Xi, H. West, P. Hosemann, D. Kaoumi, Fatigue Deformation and Cracking Behavior of 304 Stainless Steel through Micro Synchrotron X-ray Tomography, Journal of Materials Characterization, ***under review***

7. M. Owusu-Mensah, J. Cooper, A. Lopez Morales, K. Yano, S. D. Taylor, D. K. Schreiber, B. P. Uberuaga, D. Kaoumi, Surprisingly high irradiation-induced defect mobility in Fe3O4 as revealed through in situ Transmission Electron Microscopy, Materials Characterization, ***in print***

8. T. Horn & C. Rock, D. Kaoumi, I. Anderson, E. White, T. Prost, J. R., S. Saptarshi[1], R. Schoell, M. DeJong, S. Timmins, R. Napolitano, D. Zhang[7], J. Darsell, Oxide Dispersion Strengthened Steel Produced by Laser Powder Bed Fusion Additive Manufacturing of Gas Atomized Reaction Synthesis (GARS) Powder, Journal of Materials & Design, ***in print***

9. S. Agarwal, M. Butterling, M. O. Liedke, K. H. Yano, D. K. Schreiber, A. C. L. Jones, B. P. Uberuaga, Y. Q. Wang, M. Chancey, H. Kim, B. K. Derby, N. Li, D. J. Edwards, P. Hosemann, D. Kaoumi, E. Hirschmann, A. Wagner, and F. A. Selim; The mechanism behind the high radiation tolerance of Fe–Cr alloys, Journal of Applied Physics, s. 131, 125903 (2022) (***Editor's pick***)

10. X. Fang, Z. Li, Y. Wang, M. Ruiz, X. Ma, H. , R. Schoell, C. Zheng, D. Kaoumi, Y. Zhu, Achieving Hetero-deformation Induced (HDI) Strengthening and Hardening in Brass by Dual Heterostuctures, Journal: Journal of Materials Science & Technology, 98, 2022, Pages 244-2472021

11. Y. Zhao, R. Schoell, M. N. Cinbiz, M. Frost, D. Kaoumi, Creep properties of advanced austenitic steel 709 determined through short experiments under in-situ neutron diffraction followed by TEM characterization, Materials Characterization, 182, 2021

12. J. Qiu, D. D Macdonald, R. Schoell, J. Hanc, S. Mastromarino, J. R Scullyc, D. Kaoumi, Peter Hosemann, Electrochemical study of the dissolution of oxide films grown on Type 316L stainless steel in molten fluoride salt, Corrosion Science, 186, 2021, 109457

13. K. Duemmler, C. Zheng, C. Baumier, A. Gentils, D. Kaoumi, Helium Bubble Nucleation and Growth in Alloy HT9 through the use of In-Situ TEM: Sequential He-Implantation and Heavy-Ion Irradiation versus Dual-Beam Irradiation, Journal of Nuclear Materials, 2021, 545, 152641

14. J. Qiu, J. Han, R. Schoell, M. Popovic, E. Ghanbari, D. Kaoumi, J. R Scully, D. D Macdonald, P. Hosemann, Electrical Properties of thick Oxide scales on pure iron in liquid lead-bismuth eutectic, Corrosion Science, 2020, 176, 109052

15. B. Derby, J. Cooper, T. Lach, E. Martinez, J.K. Baldwin, D. Kaoumi, D.J. Edwards, D.K. Schreiber, B.P. Uberuaga, N. LiA Pathway to Synthesizing Single-crystal Fe and FeCr Films, Surface and Coatings Technology, 2020, 403, 126346

16. S. Agarwal, M. O. Liedke, A. C. L. Jones, E. Reed, A. A. Kohnert, B. P. Uberuaga, Y. Q.Wang, J. Cooper, D. Kaoumi, N. Li, R. Auguste, P. Hosemann, L. Capolungo, D. J. Edwards, M. Butterling, E. Hirschmann, A. Wagner and F. A. Selim, A New Mechanism for

Void-Cascade Interaction from Non-destructive Depth-resolved Atomic-scale Measurements of Ion Irradiation-induced Defects in Fe, Science Advances, 2020, 6 : 8437

17. C. Zheng, and D. Kaoumi, Dislocation loop evolution in F/M Steel T91 Under In-Situ Ion Irradiation: influence of the presence of initial dislocations, Journal of Nuclear Materials, 540, 2020, 152363

18. R. Schoell, L. Xi, Yuchen Zhao, J. Almer, X. Wu, Z. Yu, Z. Shayer, D. Kaoumi, "In Situ Synchrotron X-ray Tomography and Diffraction of 304 Stainless Steel undergoing Stress Corrosion Cracking", Corrosion Science, 170, 2020, 108687

19. Y. Zhao, M. Nedim Cinbiz, J-S Park, J. Almer, D. Kaoumi, Tensile Behavior and Microstructural Evolution of a Fe-25Ni-20Cr Austenitic Stainless Steel (Alloy 709) from Room to Elevated Temperatures through In-situ Synchrotron X-ray diffraction characterization and Transmission Electron Microscopy, Journal of Nuclear Materials, 540, 2020, 152367

20. R. Schoell, D. Frazer, C. Zheng, P. Hosemann, D. Kaoumi, In Situ Micro-Pillar Compression Tests of 304 Stainless Steel after Ion Irradiation and Helium Implantation, Journal of Metals (JOM), 2020

21. X.T. Fang, G.Z. He, C. Zheng, X.L. Ma, D. Kaoumi, Y.T. Zhu, Effect of Heterostructure on the Strength and Ductility of Brass, Acta Materialia, Vol 186, March 2020, p. 644-655

22. J. Qiu, D. Macdonald, N. Li, R. Schoell, D. Kaoumi, P. Hosemann, An electrochemical impedance spectroscopic study of oxide films in liquid metal, JOM, 2020

23. M. C. Remillieux, D. Kaoumi, Y. Ohara, M. A. Stuber Geesey, L. Xi, R. Schoell, C. R. Bryan, D. G. Enos, D. A. Summa, B. E. Anderson, Z. Shayer, Detecting and Imaging Stress Corrosion Cracking in Stainless Steel with Application to Inspecting Storage Canisters for Spent Nuclear Fuel, Journal of Nondestructive Testing and Evaluation International (NDT&E Int.), 2020, Vol 109, 102180

24. C. Zheng, E. R. Reese, K. G. Field, E. Marquis, S. A. Maloy, D. Kaoumi, "Microstructure response of ferritic/martensitic steel HT9 after neutron irradiation: effect of temperature", Journal of Nuclear Materials, 528, 2020, 151845

25. C. Barr*, O. El-Atwani, D. Kaoumi, K. Hattar. "Interplay Between Grain Boundaries and Radiation Damage", JOM, 71(4), 2019, p.1233-1244.

26. C. Zheng, E. R. Reese, K. G. Field, E. Marquis, S. A. Maloy, D. Kaoumi*, "Microstructure response of ferritic/martensitic steel HT9 after neutron irradiation: effect of dose", Journal of Nuclear Materials, **523** (421-433), 2019

27. D. Kaoumi*, V. Jammot, “Insights into the plastic behavior of irradiated metals through in-situ TEM experiments: formation and evolution of defect-free channels”, Journal of Nuclear Materials, 523, p. 33-42, 2019

28. C. Marsh, R. Schoell, D. Kaoumi*, “Environmental effect on mechanical properties of a gamma-prime strengthened nickel-based alloy: Effect of the surface oxidation and formation of gamma-prime free zones”, Journal of Materials Science and Engineering A, 752, p. 136–144, 2019

29. C. Zheng, R. Schoell, P. Hosemann, D. Kaoumi*, Irradiation-Enhanced Precipitation in PH 13 8 Mo maraging steel Corrax, Journal of Nuclear Materials, 514, p. 255-265, 2019

30. C. Zheng*, Jia-Hong Ke, S. Maloy, D. Kaoumi, Correlation of In-situ TEM Observation and Microchemistry Analysis of Radiation-Induced Precipitation and Segregation in Ion Irradiated Ferritic/Martensitic Steel HT9, Scripta Materialia, 162, p. 460-464, 2019

31. C. Zheng, S. Maloy, D. Kaoumi*, “Dose effect on the irradiation induced loop density and burgers vector in Ion irradiated F/M steel HT9”, Philosophical Magazine, 98 (26), p. 2440-2456, 2018

32. J. Liu, D. Kaoumi*, “Use of In-Situ TEM to Characterize the Deformation-Induced Martensitic Transformation in 304 Stainless Steel at Cryogenic Temperature”, Journal of Materials Characterization, **136**, 331-336, 2018

33. D. Kaoumi*, J. Liu, “Deformation Induced Martensitic Transformation in 304 Stainless Steel: In-situ versus Ex-situ Characterization”, Journal of Materials Science & Engineering A, **715**, p. 73-82, 2018

34. C. Zheng, D. Kaoumi*, “Void swelling and radiation-induced segregation & precipitation in Dual Beam irradiated Ferritic/Martensitic HT9 steel”, Materials Characterization **134**, 152–162, 2017

35. C. Marsh, D. Kaoumi*, “Serrated Tensile Flow in Inconel X750 Sheets: Effect of Heat Treatment”, Materials Science & Engineering A, **707**, p. 136–147, 2017

36. Ce Zheng, M. A. Auger, M. P Moody, D. Kaoumi*, Radiation induced segregation and precipitation behavior in self-ion irradiated Ferritic/Martensitic HT9 steel; *Journal of Nuclear Materials*, **v 491**, p 162-176, 2017

37. C. Marsh, S. Depinoy, D. Kaoumi*, “Effect of Heat Treatment on the Temperature Dependence of the Fracture Behavior of X-750 alloy”, Materials Science & Engineering A, v **677**, p 474-484, 2016.

38. Z. Huang, M.D. Abad, M. Rebelo de Figueiredo, D. Kaoumi, N. Li, M. Astad, N. Gronbech-Jensen, P. Hosemann*, “A high temperature nanoindentation study on PH 13-8 Mo maraging steel”, *Materials Science & Engineering A*, ***v. 651,*** *2016*.

39. T.R. Allen, D. Kaoumi, J. Wharry, L. Barnard, A. Certain, K. Field, Z. Jiao, G. S. Was, D. L. Morgan, A. T. Motta, C. Topbasi, B. D. Wirth, Y. Yang, "Characterization of Microstructure and Property Evolution in Advanced Cladding and Duct: Materials exposed to High Dose and Elevated Temperature", *Journal of Materials Research*, **v 30, n 9**, p 1246-1274, 2015.

40. D. Catalini, D. Kaoumi*, T. Reynolds, and G. Grant, "Dispersoid distribution and microstructure in Fe-Cr-Al ferritic oxide dispersion strengthened alloy prepared by Friction Consolidation", *Metallurgical and Materials Transactions A*, **v 46**, n 10, p 4730-4739, July 9, 2015.

41. C. Topbasi*, D. Kaoumi, A. T. Motta, M. A. Kirk, "Microstructural Evolution in NF616 (P92) and 9Cr0.1C-Model Alloy under Heavy Ion Irradiation", *Journal of Nuclear Materials*, **v 466**, p 179-186, 2015

42. H. Vo, A. Reichardt, C. Howard, M.D. Abad, D. Kaoumi, P. Chou, P. Hosemann*, "Small Scale Mechanical Testing on Proton Beam Irradiated 304 SS from Room Temperature to Reactor Operation Temperature", *Journal of Materials (JOM), **p1-6,*** 2015.

43. D. Kaoumi*, K. Hrutkay, "Tensile deformation behavior and microstructure evolution of Ni-based superalloy 617", *Journal of Nuclear Materials*, **454**, p 265-273, 2014.

44. D. Kaoumi*, J. Adamson, "Self-Ordered Defect Structures in F/M Steels Under Ion Irradiation", *Journal of Nuclear Materials*, **448**: p 233–238, 2014

45. K. Hrutkay, D. Kaoumi*, "Tensile Deformation Behavior of a Nickel-based Superalloy Haynes 230 at Different Temperatures", *Journal of Materials Science and Engineering A*, **599**, p 196–203, 2014.

46. D. Kaoumi*, J. Adamson, M. Kirk, "Microstructure Evolution of Two Model Ferritic/Martensitic Steels under In-situ Ion Irradiation at low doses (0-2dpa)", *Journal of Nuclear Materials*, **445** (1–3): p. 12–19, 2014.

47. D. Catalini, D. Kaoumi*, A. Reynolds, G. Grant, "Friction Consolidation of MA956 powder", *Journal of Nuclear Materials*, **442**, S112-S118, 2013

48. M. A. Kirk*, P. M. Baldo, A. C. Y. Liu, E. A. Ryan, R. C. Birtcher, Z. Yao, S. Xu, M. L. Jenkins, M. Hernandez-Mayoral, D. Kaoumi and A. T. Motta, "In-situ TEM and Ion Irradiation of Ferritic Materials", *Microscopy and Research Technique*, **72**, 3, p. 182–186, 2009

49. D. Kaoumi*, A. Motta, R. Birtcher, "A Thermal Spike Model of Grain Growth under Irradiation", *Journal of Applied Physics*, **104**, 7, 2008

50. D. Kaoumi*, A. Motta, R. Birtcher, “Influence of alloying elements on grain-growth in Zr(Fe) and Cu(Fe) thin-films under in situ ion irradiation”, *Journal of Nuclear Materials*, **382**, 2-3, 2008

51. D. Kaoumi*, A. Motta, and R.C. Birtcher, "Grain Growth in Nanocrystalline Metal Thin-Films under In Situ Ion-Beam Irradiation", *Journal of ASTM International*, **4**, 8, 2007.

52. D. Kaoumi*, A.T. Motta, and R.C. Birtcher, "Grain growth in Zr–Fe thin films during in situ ion irradiation in a TEM", *Nuclear Instruments and Methods in Physics Research B*, **242**, p. 490–493, 2005

Publications in progress:

53. A. Lopez Morales, M. Owusu-Mensah, D. Kaoumi, In situ TEM investigation of irradiation-induced amorphization of Magnetite, On the irradiation-induced amorphization of Fe3O4, Scripta Materialia, ***to be submitted***

54. F-Y Tsai, R. Schoell, K. Hattar, D. Kaoumi, Effect of ion irradiation on the corrosion of 304 stainless steel in simulated water chemistry of pressurized water reactor (PWR), Corrosion Science, ***to be submitted***

55. R. Auguste, L. Chan, J. Qiu, E. Romanovskaia, R. Schoell, M. O. Liedke, M. Butterling, A. Wagner, F. Selim, D. Kaoumi, B. Uberuaga, P. Hosemann, J. Scully, Comprehensive characterization of Cr_2O_3 via advanced spectroscopy techniques, ***in preparation***

56. F. A. Selim, S. Agarwal, D. Kaoumi, J. Cooper, Y. Q. Wang, N. Li, M. Butterling, M. O. Liedke, A. Wagner and B. P. Uberuaga, Recovery of radiation induced defects via nanovoids in pure Fe, Acta Materialia, ***to be submitted***

57. G. Beausoleil, Marcus E. Parry, K. Mondal, S. Kwon, T. D. Sparks, D. Kaoumi, J. Aguiar, Spark Plasma Sintered MoNbTi based Multi Principal Element Alloys with Cr, V, and Zr, journal of alloys and compounds, ***in preparation***

58. C. Zheng, D. Kaoumi, Role of precipitates and twin boundaries on the plastic behavior of Austenitic Alloy 709: Insights from in-situ TEM Deformation experiments, Scripta Materialia, ***in preparation***

59. D. Kaoumi, V. Jammot, T. Gautier, Observations of Mechanisms of plastic deformation in a Ni-based alloy observed through in-situ TEM deformation experiments, Journal of Materials Science and Engineering A, ***in preparation***

60. D. Kaoumi, T. Gautier, “Mechanisms of crack propagation in Ni-based alloy foils investigated in-situ in a TEM”, Journal of Materials Characterization, ***in preparation***

Book Chapters:

1. Z. Shyer, Z. Yu, D.L. Olson, S. Liu, S. Gordon, X. Wu, K.L. Murty, N. Kumar, D. Kaoumi, University of South Carolina, B. Anderson, Brigham Young University, M. Remillieus and T.J. Ulrich, C. Bryan, D. Enos, J.D. Almer, J.R. Johns, D. Lewis, "Integrated Research Program Overview on the Innovative Approaches Marine Atmospheric Stress Corrosion Cracking Inspection, Evaluation and Modeling in Used-Fuel Dry Storage Canisters, Advances in Materials Science for Environmental and Energy Technologies VI: Ceramic Transactions Series, Volume 262, 2017

Peer-Reviewed Conference proceedings:

1. A. M. Lopez, M. Owusu-Mensaha, D. Kaoumi, In-situ TEM ion irradiation of oxidized nickel based X-750 alloy, American Nuclear Society proceedings, 2022

2. L. R. Gomez Hurtado, D. Kaoumi, A Literature Review of the Physical Effects of Radiation Damage in Multicomponent Alloys, American Nuclear Society Student conference proceedings, April 2022

3. C. McRobie, R. Schoell, T. Kaspar, D. Schreiber, and D. Kaoumi, In Situ Grain Growth of Nanograined Magnetite under Ion Irradiation at Room Temperature and 500 °C, *Microscopy and Microanalysis*, 27, 2021

4. H. Gardner, D. Kaoumi, P. Hosemann, M. Moody and D. Armstrong, Towards development of a nickel-based oxide dispersion strengthened alloy for use in Molten Salt reactors, Microscopy Microanalysis, 27 (Suppl 1), 2021

5. A. Lopez Morales, M. Owusu-Mensah, K. Yano, D. K. Schreiber, D. Kaoumi, In situ TEM investigation of irradiation-induced amorphization of Fe3O4 and γ -Fe2O3, *Microscopy and Microanalysis*, 27, 2021

6. R. Schoell, D. Frazer, P. Hosemann, D. Kaoumi, Stainless Steel 304 Micro-pillar Mechanical Response to Ion Irradiation and Helium Implantation Under Transmission Electron Microscopy Observation, Microscopy and Microanalysis , Vol 26 S2 , 2020 , pp. 878 – 881

7. M. Owusu-Mensah, J. Cooper, D. Kaoumi In Situ TEM Investigation of Irradiation Induced Amorphization of Fe Oxide, Microscopy and Microanalysis, Vol 26 S2 , 2020 , pp. 882 – 884

8. R. Schoell, C. Zheng, K. Hattar, D. Kaoumi, In Situ Micropillar Compression of Irradiated HT9, Microscopy and Microanalysis , Vol S2 , 2020 , pp. 2420 – 2422

9. J. Kabel, P. Hosemann, R. Schoell, D. Kaoumi, T. Koyanagi, Y. Katoh, Interface characterization of candidate dual-purpose barrier coatings for SiC/SiC accident tolerate fuel

cladding, Environmental Degradation of Materials in Nuclear Power Systems – Water Reactors, Boston, MA, 2019

10. D. Kaoumi, C. Zheng, Microstructure characterization of ion-irradiated Ferritic/Martensitic HT9 steel, *Microscopy and Microanalysis*, **23**, 2017

11. P. Hosemann, D. Frazer, D. Kaoumi and C. Zheng, Microstructural and Nanomechanical Characterization of In-Situ He Implanted and Irradiated fcc Materials, *Microscopy and Microanalysis*, **23**, 2017

12. D. Kaoumi, A. Garde, G. Pan "In-situ Ion Irradiation of ZIRLO® Alloy", Top Fuel 2016, Boise, ID, USA, 2016

13. P. Hosemann, A. Reichard, A. Lupinacci, C. Howard, H. Vo, M.D. Abad, D. Kaoumi, P.Chou, "Small Scale Mechanical Testing on Ion Beam Irradiated 304SS", Environmental Degradation of Materials in Nuclear Power Systems – Water Reactors, Ottawa, ON, Canada, 2015

14. D. Kaoumi*, T. Gautier, J. Adamson, M. Kirk, Using In-Situ TEM to Characterize the Microstructure evolution of Metallic Systems under External Solicitation, Microscopy and Microanalysis, **v. 21** S3, 2015.

15. D. Kaoumi, J. Liu, F-L Paul, "Deformation Induced Martensitic Transformation in 304SS", International Conference on Solid-Solid Phase Transformations in Inorganic Materials, Whistler, BC, Canada, 2015.

16. K. Hrutkay, D. Kaoumi, "Tensile Behavior of Inconel 617 vs. Haynes 230: Effects of Temperature and Strain Rate", *Transactions of the American Nuclear Society*, **109**, 2013.

17. J. Goddard, D. Kaoumi, "Precipitate Characterization in Two ODS Steels using Synchrotron XRD of Consolidated Samples and Cu-Kα XRD of Precipitate Extractions" *Transactions of the American Nuclear Society,* **109**, 2013.

18. D. Catalini, D. Kaoumi*, A. Reynolds and G. Grant, "Friction Consolidation of an Oxide Dispersion Strengthened Steel", *Transactions of the American Nuclear Society***, 107,** 2012.

19. D Kaoumi*, AT Motta, M Kirk, T Faney, B Wirth and J Bentley, "In-situ TEM Studies of Microstructure Evolution under Ion Irradiation for Nuclear Engineering Applications", *Microscopy and Microanalysis*, **16**, 2, 2010

20. J. Bentley, D.T. Hoelzer, J.T. Busby, A.G. Certain, T.R. Allen, D. Kaoumi*, A.T. Motta, and M.A. Kirk, "TEM Characterization of Crept and Irradiated Nano-structured Ferritic Alloys" *Microscopy and Microanalysis*, **15**, 2, 2009

21. D. Kaoumi, A. Motta, R. Birtcher, "In Situ Studies of Phase Stability and Microstructural Evolution in Metal Alloys Under Ion Irradiation in the IVEM at ANL", Proceedings of the

Workshop on the Use of In-Situ TEM-Ion Accelerator Techniques in the Study of Radiation Damage in Solids, The University of Salford, UK, 2009.

22. D. Kaoumi*, A. T. Motta, and M. Kirk, "Characterization and In-Situ Ion-Irradiation of MA957 ODS Steel", *Transactions of the American Nuclear Society*, **98**, 1, 2008.

23. D. Kaoumi, A. Motta, and R.C. Birtcher. "Irradiation-Enhanced Second-Phase Precipitation in Zr-Fe Nanocrystalline Thin Films", in *Mater. Res. Soc. Symp.*, **908E**, Boston, 2006

- ***Invited talks:***

1. D. Kaoumi, The use of in-situ transmission electron microscopy to investigate microstructure evolution under ion irradiation, First International Conference on Accelerators for Research and Sustainable Development at the International Atomic Energy Agency, Vienna, Austria, May 2022 (**invited**)

2. D. Kaoumi, In-Situ Straining TEM Experiments for the Characterization of Deformation Induced Phase Transformations, Symposium on Advances in In Situ and Operando TEM Methods for the Study of Dynamic Processes in Materials, Materials Research Society Meeting, Hawaii, USA, May 2022 (**invited**)

3. D. Kaoumi, A. Lopez Morales, J. Cooper, M. Owusu-Mensah, In-Situ TEM Investigation of Irradiation-Induced Defect Formation and Evolution in Fe/Fe-oxide heterostructures: Evidence of Surprisingly High Mobility of Defects in the Fe oxide scale, Symposium on n Situ Material Performance and Dynamic Structure Characterization Under Coupled Extremes, Materials Research Society Meeting, Hawaii, USA, May 2022 (**invited**)

4. D. Kaoumi, M. Owusu-Mensah, A. Lopez Morales, K. Yano, T. Kaspar, D. Schreiber, B. Uberuaga, Surprisingly High Irradiation-induced Defect Mobility in Fe3O4 as Revealed through In Situ Transmission Electron Microscopy, MS&T 2021, Columbus OH Oct 2021 (**invited**)

5. D. Kaoumi, R. Schoell, F. Fehri, P. Hosemann, J. Bickel, H. Zhao, J. P. Octavio, M. V. Glazoff, D. Armstrong and M. Moody, H. Gardner, Development of Ni-based ODS alloys for MSR, Advanced Reactor Technologies, DOE Advanced Materials Program Review meeting, June 10th 2021 (**invited**)

6. D. Kaoumi, B. Uberuaga, N. Li, Synergy of radiation damage with corrosion processes through a separate effect investigation approach, Nuclear Science User Facilities FY 2020 Annual Program Review, Nov 2020 (**invited**)

7. D.Kaoumi, R. Schoell, Effect of Irradiation-Induced Microstructure Evolution on the Mechanical Properties of Steels, Annual NSUF External Board Review, San Diego, Feb 2020

8. D. Kaoumi, Ryan Schoell, Li Xi, In-situ Synchrotron X-Ray Micro-Tomography of Stress Corrosion Cracking in 304 SS under humid air environment, International Corrosion Engineering Conference (ICEC 2019), Incheon, Korea, October 2019 (**keynote talk**)

9. D. Kaoumi, F-L. Paul, Yuchen Zhao, Use of In-situ Methods to Investigate the Deformation induced martensitic transformation, Materials Science & Technology annual meeting, Portland, Sept 2019, (Symposium on Advances in Understanding of Martensite in Steels)

10. D. Kaoumi, C. Zheng, Combined use of in-situ and ex-situ TEM to characterize irradiation induced dislocation loops in F/M Steels for Nuclear Applications, Materials Science & Technology annual meeting, Portland, Sept 2019 (Symposium on Nuclear Materials)

11. D. Kaoumi, Combined use of in-situ and ex-situ TEM to characterize ion irradiation induced dislocation loops in F/M steels, Annual NSUF External Board Review, Idaho Falls, Aug 2018

12. D. Kaoumi, C. Zheng, In-situ ion irradiation induced microstructure evolution in ferritic/martensitic steel HT9, Microscopy and Microanalysis meeting 2017, St Louis, MO, Aug 2017

13. D.Kaoumi, "Plasticity studies using in-situ straining TEM experiments: deformation-induced martensitic transformation and dislocation dynamics in steels", 21st International Symposium on Plasticity, January 3-9, 2017, in Puerto Vallarta, Mexico **(keynote talk).**

14. D. Kaoumi, "Nuclear Materials Research at NCSU", ASM Local Chapter Meeting, Raleigh, NC, January 2017

15. D. Kaoumi, T. Gautier, V. Jammot, M. Kirk, "Effect of Ion-Irradiation Induced Defects on Dislocation Dynamics in Ni-based Alloys", The Nuclear Materials Conference, Nov. 7-10, 2016.

16. D. Kaoumi, Using In-Situ TEM to Study the Response of Ni-Based Superalloys Under Tensile Deformation, 20th International Symposium on Plasticity, January, 2016, in Hawaii.

17. D. Kaoumi, T. Gautier, J. Adamson, M. Kirk, "Using In-Situ TEM to Characterize the Microstructure evolution of Metallic Systems under External Solicitation", Microscopy and Microanalysis meeting 2015, Portland, OR, Aug 2015.

18. D. Kaoumi, "Use of In-Situ TEM to Study the Response of Metallic Systems Under Ion-Beam Irradiation", Symposium on Accelerated Materials Evaluation for Nuclear Application Utilizing Test Reactors, Ion Beam Facilities and Modeling at the 2014 TMS Annual Meeting and Exhibition, San Diego, CA, Feb 16-20, 2014.

19. D. Kaoumi, "In-situ Deformation of a Ni-based Structural Alloy in a Transmission Electron Microscope", 19th International Symposium on Plasticity, January 3 - 8, 2013, in Nassau, Bahamas.

20. D. Kaoumi, In-situ Ion Irradiation of Advanced F/M steels for Nuclear Applications, Symposium on Material Challenges in Current and Future Nuclear Technologies, Materials Research Society annual meeting 2011, Boston, MA, Nov 2011.

21. D. Kaoumi, "In-situ TEM Studies of Microstructure Evolution under Ion Irradiation for Nuclear Engineering Applications", Symposium on *Structural and Chemical Analysis of Materials in Nuclear Power Industry*, Microscopy & Microanalysis 2010 Meeting, Portland, OR, Aug 2010.

22. D. Kaoumi, A. T. Motta, R. C. Birtcher and M. Kirk, "In Situ Studies of Phase Stability and Microstructural Evolution in Metal Alloys Under Ion Irradiation in the IVEM at ANL", *Workshop on the Use of In-Situ TEM-Ion Accelerator Techniques in the Study of Radiation Damage in Solids*, June 2008, The University of Salford, UK.

- ***Invited Departmental Seminars at Universities:***

23. R. Schoell, H. Gardner, F. Fehri, D. Kaoumi, D. Armstrong, Degradation of alloys for Molten Salt reactors, Departmental seminar, **Oxford University**, June 2021

24. D. Kaoumi, The Use of In-Situ Transmission Electron Microscopy to Observe and Understand Materials Response to External Solicitation, **Bowling Green State University** colloquium, Nov 2019

25. D. Kaoumi, The Use of In-Situ Techniques to Characterize the Microstructure Evolution in Metals Under Irradiation and Mechanical Stress, departmental Seminar, MSE department, **NCSU**, Jan 2018

26. D. Kaoumi, Studies of Irradiation Induced Microstructure Evolution in Metals using in-situ TEM, departmental Seminar, NE department, **University of New Mexico**, April 2016

27. D. Kaoumi, "Studies of phase transformations and microstructure evolution under in-situ straining experiments in a TEM", Nuclear Engineering Department, **North Carolina State University**, March 2015.

28. D. Kaoumi. "Seeing Is Believing: The Use of In-situ TEM to Investigate Metallic Systems under External Stimuli", **University of California Berkeley**, CA, April 2013.

29. D. Kaoumi. "Microstructure Studies of Metallic Systems under External Stimuli", **Georgia Institute of Technology**, Atlanta, GA, Nov 2012.

30. D. Kaoumi, "In-Situ studies of Microstructure Evolution in F/M steels under Ion Irradiation", Local American Nuclear Society Meeting, **University of South Carolina**, Oct 2010.

Contributed Conference presentations:

1. A. M. Lopez, M. Owusu-Mensaha, D. Kaoumi, In-situ TEM ion irradiation of oxidized nickel based X-750 alloy, American Nuclear Society, June 2022

2. M. deJong, R. Schoell, S. Saptarshi, S. Timmins, E. White, I. Anderson, D. Kaoumi, C. Rock, T. Horn, Oxide-Dispersion-Strengthened steel processing by Additive Manufacturing of Gas Atomization Reaction Synthesis (GARS) powders, TMS conference 2022 (Anaheim CA), Feb 2022

3. A. Lopez; R. Schoell; T. Kaspar; B. Derby; N. Li; D. Schreiber; D. Kaoumi; In Situ Observation of the Amorphization Behavior of Fe2O3, Cr2O3, and Al2O3 under Ion Irradiation, TMS Conference 2022, Anaheim CA), Feb 2022

4. P. Hosemann, J. Qiu, F. Schmied, J. Scully, Y. Wang, B. Uberuaga, D. Kaoumi, F. Selim, R. Auguste, J. Han, In-situ measurement and analysis of structural alloy corrosion in liquid metals, TMS conference 2022 (Anaheim CA), Feb 2022 (**invited**)

5. F. Tsai; R. Schoell; K. Hattar; D. Kaoumi; Effects of Ion Irradiation on the Corrosion of 304SS in PWR Simulated Water Chemistry, TMS Conference 2022 (Anaheim CA), Feb 2022

6. H. Gardner, R. Schoell, J. Qiu, F. Fehri, M. Moody, P. Hosemann, D. Kaoumi, D. Armstrong, Effect of ion irradiated microstructure on molten salt corrosion of Hastelloy N, TMS conference 2022 (Anaheim CA), Feb 2022

7. M. Short; W. Zhou; N. AlMousa; K. Woller; D. Kaoumi; R. Schoell; F. Helix; M. Lapington; M. Zhang; M. Moody; A. Wilkinson; Investigating Radiation-Altered Corrosion in Liquid Lead, TMS Conference 2022 (Anaheim CA), Feb 2022

8. R. Schoell; F. Tsai; P. Baldo; Y. Wang; D. Kaoumi; Effects of Pre-Irradiation on the Corrosion Behavior of I600 in Hydrogenated Water, TMS Conference 2022 (Anaheim CA), Feb 2022

9. M Short, W. Zhou, N. AlMousa, K. Woller, G. Zheng, Y. Yang, M. Lastovich, R. Schoell, P. Stahle, A. Wilkinson, M. Moody, A. Minor, T. Lapington, F. Hofmann, D. Kaoumi, Radiation-Decelerated Corrosion of Nuclear Structural Materials in Gen IV Reactor Environments, Materials in Nuclear Energy Systems (MiNES) 2021, Oct 2021(**invited**)

10. R. Schoell; J. Kabel; S. Lam; A. Sharma; P. Laszlo; P. Hosemann; D. Kaoumi; Combinatorial PVD Coatings on SiC-SiC for Boiling Water Reactor Conditions, MS&T 2021, Columbus OH, Oct 2021

11. P. Hosemann, R. Auguste, F. Selim, O. Linke, M. Butterling, H. Chan, J. Han, J. Qiu, J. Scully, R. Schoell, D. Kaoumi, Characterization of Materials Exposed to Coupled Nuclear Environments Using Positron Annihilation Spectroscopy and Electrical Impedance Spectroscopy MS&T 202, Columbus OH, Oct 2021 (**Invited**)

12. F. Tsai; R. Schoell; K. Hattar; D. Kaoumi; Effect of ion Irradiation on the Corrosion of 304SS in PWR Simulated Water Chemistry, MS&T 2021, Columbus OH, Oct 2021

13. H. Gardner, R. Schoell, J. Qiu, F. Fehri, M. Moody, P. Hosemann, D. Kaoumi, D. Armstrong, Effect of Ion Irradiation on Microstructural Evolution of Hastelloy N for use in Molten Salt Reactors, Atom Probe Tomography & Microscopy 2021 (Virtual Conference), Sept 2021

14. H. Gardner; R. Schoell; D. Kaoumi; P. Hosemann; M. Moody; D. Armstrong; Towards Development of a Nickel-Based Oxide Dispersion Strengthened Alloy for Use in Molten Salt Reactors, Microscopy and Microanalysis, Aug 2021

15. A. Lopez Morales, M. Owusu-Mensah, K. Yano, D. K. Schreiber, D. Kaoumi, In situ TEM investigation of irradiation-induced amorphization of Fe3O4 and γ -Fe2O3, Microscopy and Microanalysis conference 2021 (online), Aug 2021

16. B. Derby; J. Baldwin; D. Kaoumi; D. Edwards; D. Schreiber; T. Lach; B. Uberuaga; N. Li; Synthesis and Irradiation Response of Hetero FeCr - Fe_2O_3 Interfaces, TMS conference March 2021 (online)

17. R. Schoell, L. Xi, H. West, Z. Shayer, D. Kaoumi, Investigation of the Fatigue Crack Behavior of 304 Stainless Steels Using Synchrotron X-ray Tomography; TMS conference March 2021 (online)

18. B. Derby; J. Baldwin; D. Kaoumi; D. Edwards; D. Schreiber; T. Lach; B. Uberuaga; N. Li; Understanding Defect Recovery and Accommodation and their Implications on Mechanical Performance in Irradiated Nanocomposite Materials, TMS Conference 2021

19. Y. Zhao, R. Schoell, M. Frost, D. Kaoumi, Creep Behavior of Advanced Austenitic (Fe-25Ni-20Cr) Alloy 709 through In-situ Neutron Diffraction Characterization and Transmission Electron Microscopy Characterization, TMS conference 2021 (online)

20. R. Schoell; J. Kabel; S. Lam; K. Shapovalov; P. Hosemann; D. Kaoumi, Corrosion and TEM Analysis of CVD and PVD Coatings for BWR Accident Tolerant Fuel Cladding, TMS conference 2021 (online)

21. M. Owusu-Mensah, J. Cooper, A. Lopez Morales, K. Yano, S. Taylor, D. Schreiber, B. Uberuaga, D. Kaoumi, Radiation-induced defect mobility in Fe/Fe3O4 heterostructures through in situ irradiation in a Transmission Electron Microscope, The Nuclear Materials Conference, Belgium, 2020 (online meeting)

22. M. Owusu-Mensah, J. Cooper, A. Lopez Morales, D. Kaoumi, In situ TEM investigation of irradiation-induced amorphization of Fe_3O_4, *Microscopy and Microanalysis*, Milwaukee (online meeting), 2020

23. R. Schoell, D. Frazer, P. Hosemann, D. Kaoumi, Stainless Steel 304 Micro-Pillar Mechanical Response to Ion Irradiation and Helium Implantation under Transmission Electron Microscopy Observation, *Microscopy and Microanalysis, Milwaukee (online meeting)*, 2020

24. R. Schoell, C. Zheng, K. Hattar, D. Kaoumi, Mechanical Properties of Ion Irradiated and Helium Implanted HT9 Micropillars, TMS 2020 annual meeting, San Diego, CA, USA, Feb 2020

25. S. Jublot-Leclerc, M. Owusu-Mensah, J. Ribis, Vladimir A. Borodin, R. Schoell, C. Zheng, D. Kaoumi, A. Gentils, Ion beam synthesis of nano-metallic oxide particles in high purity FeCr, TMS 2020 annual meeting, San Diego, CA, USA, Feb 2020

26. R. Schoell, C. Zheng, C. Baumier, A. Gentils, D. Kaoumi, In-situ dual-beam irradiation of ferritic/martensitic steel HT9 in a transmission electron microscope: effects of helium implantation, TMS 2020 annual meeting, San Diego, CA, USA, Feb 2020

27. R. Schoell, C. Zheng, D. Frazer, P. Hosemann, D. Kaoumi, Combined use of in-situ ion irradiation and in-situ nanomechanical testing for characterizing helium pre-implanted 304 stainless steel, TMS 2020 annual meeting, San Diego, CA, USA, Feb 2020

28. F. Selim, S. Agarwal , A. Kohnert, J. Cooper, N. Li, Y. Wang, D. Kaoumi, D. Edwards, L. Capolungo, P. Hosemann, B. Uberuaga, Quantitative Analysis of Atomic Scale Defects in Irradiated Materials, TMS 2020 annual meeting, San Diego, CA, USA, Feb 2020 (**invited**)

29. D. Kaoumi, Y.C. Zhao, M. Cinbiz, M. Forest, J-S. Park, J. Almer, Investigation of the Microstructure and Mechanical Properties in Alloy 709 at Different Temperatures Using In Situ Diffraction Measurements, EUROMAT 2019, Stockholm, Sweden, Sept 2019 (Symposium on Advanced Steels)

30. D. Kaoumi, Y.C. Zhao, M. Forest, J-S. Park, J. Almer, Study of Deformation-Induced Austenite-Martensite Transformation in 304 Stainless Steel Using In Situ Synchrotron and Neutron Diffraction Methods, EUROMAT 2019, Stockholm, Sweden, Sept 2019 (symposium on Advanced Steels)

31. D. Kaoumi, C. Zheng, E. R. Reese, K. G. Field, E. Marquis, Microstructure Characterization of neutron irradiated Ferritic/Martensitic steel HT9, EUROMAT 2019, Stockholm, Sweden, Sept 2019 (Symposium on Qualification, Development and Modelling of Structural and Fuel Materials for Sustainable Nuclear Reactors)

32. D. Kaoumi, C. Zheng, Insights on Dislocation dynamics in an Advanced Austenitic Alloys through In-situ TEM Deformation Experiments, EUROMAT 2019, Stockholm, Sweden, Sept 2019 (symposium on Advanced Steels)

33. J. Kabel, P. Hosemann, R. Schoell, D. Kaoumi, T. Koyanagi, Y. Katoh, Interface characterization of candidate dual-purpose barrier coatings for SiC/SiC accident tolerate fuel cladding, Environmental Degradation of Materials in Nuclear Power Systems – Water Reactors, Boston, MA, 2019

34. D. Kaoumi, V. Jammot, Unveiling microstructural processes governing the plasticity of irradiated metals through In-situ TEM deformation experiments, Physical Metallurgy Gordon Research Conference, July 2019, Manchester, NH, USA

35. D. Kaoumi, F-L. Paul, M. Kirk, Deformation-Induced Martensitic Transformation in 304 Stainless Steel using In-situ TEM characterization: Effect of Ion Irradiation, TMS annual meeting 2019, San Antonio, USA, March 2019

36. R. Schoell, L. Xi, P. Kenesei, J. Almer, D. Kaoumi, In-situ Synchrotron X-Ray MicroTomography of Stress Corrosion Cracking in 304 SS under humid air environment, San Antonio, USA, March 2019

37. R. Schoell, C. Zheng, P. Hosemann, D. Kaoumi, Ion irradiation induced segregation and precipitation in PH 13-8 Mo steel, TMS annual meeting 2019, San Antonio, USA, March 2019

38. Y. Zhao, J-Sang Park, J. Almer, D. Kaoumi, Mechanical Behavior of Austenitic Alloy 709: Synchrotron X-Ray vs. Neutron Diffraction Characterization, San Antonio, USA, March 2019

39. D. Kaoumi, C. Zheng, S. Maloy, “Irradiation induced loop density and burgers vector in F/M steels T91 and HT9”, MMM2018, Osaka, Japan

40. D. Kaoumi, C. Zheng, “Dose effect on the irradiation induced loop density and burgers vector in Ion irradiated F/M steel HT9”, EMRS Spring meeting 2018, Strasbourg, France

41. D. Kaoumi, Use of in-situ TEM to study the dose effect on the irradiation induced loop density and burgers vector in an ion-irradiated F/M steel for nuclear applications, The 5th Workshop On TEM With In Situ Irradiation (WOTWISI-5), Huddersfield, UK, April 2018

42. C. Zheng, D. Kaoumi, Neutron irradiation induced microstructures in Ferritic/Martensitic steel HT9, TMS 2018, Phoenix AZ

43. C. Zheng, D. Kaoumi, Void swelling evolution and radiation-induced segregation & precipitation in dual-ion irradiated Ferritic/Martensitic HT9 steel, TMS 2018, Phoenix AZ

44. R. T. Smith, M. N. Cinbiz, J.S. Park, J. Almer, and D. Kaoumi, In-situ Synchrotron diffraction of a high-temperature creep-enhanced stainless steel, TMS 2018, Phoenix AZ

45. L. Xi, D. Kaoumi, D. G. Enos, J. Almer, and P. Kenesei, Characterization of Stress Corrosion Cracking of 304 Stainless Steels Using High-energy Synchrotron X-ray Microtomography, TMS 2018, Phoenix AZ

46. C. Zheng, E. Anderson, E. Marquis, D. Kaoumi, Neutron irradiation induced microstructures in Ferritic/Martensitic steel HT9, symposium on Materials for Fusion and Fission, EUROMAT 2017, Greece

47. D. Kaoumi, C. Zheng, Comparison of in-situ and bulk ion irradiation induced microstructure evolution in Ferritic/Martensitic steel HT9, EUROMAT 2017, Greece

48. D. Kaoumi, C. Marsh, Stress serrations during tensile tests of Nickel based alloy X750: effect of vacuum, EUROMAT 2017, Greece

49. D. Kaoumi, J. Liu, in-situ TEM characterization of deformation induced martensitic transformation in Stainless Steel 304, EUROMAT 2017, Greece

50. R. T. Smith, M. N. Cinbiz, J.S. Park, J. Almer, and D. Kaoumi, In-situ X-ray Diffraction Tensile Testing of an Austenitic Creep-enhanced Stainless Steel, EUROMAT 2017, Greece

51. D. Kaoumi, DOE ART meeting, DOE sponsor meeting, Germantown, MD, June 2017

52. D. Kaoumi, C. Zheng, In-situ ion irradiation induced microstructure evolution in ferritic/martensitic steel T91, *Symposium on Microstructural Processes in Irradiated Materials at the 2017 TMS Annual Meeting and Exhibition,* San Diego, CA, March 2017

53. C. Zheng, M. A. Auger, D. Kaoumi, Ion irradiation induced segregation and precipitation in F/M steel HT9, *Symposium on Microstructural Processes in Irradiated Materials at the 2017 TMS Annual Meeting and Exhibition,* San Diego, CA, March 2017

54. C. Marsh, S. Depinoy, D. Kaoumi, Temperature Dependence of the Fracture Behavior of X-750 alloy and Effect of Heat Treatment, *the 2017 TMS Annual Meeting and Exhibition,* San Diego, CA, March 2017

55. C. Marsh, D. Kaoumi, "Tensile Behavior of X750: Heat Treatment Effect", *the 2017 TMS Annual Meeting and Exhibition,* San Diego, CA, March 2017

56. D. Kaoumi, J. Liu, F-L. Paul, “Deformation-Induced Martensitic Transformation in 304 Stainless Steel using In-situ and Ex-situ TEM characterization”, The Nuclear Materials Conference, Nov. 7-10, 2016.

57. C. Zheng, M. A. Auger, D. Kaoumi, “Phase stability behavior in heavy ion-irradiated F/M steel HT9”, The Nuclear Materials Conference, Nov. 7-10, 2016.

58. C. Marsh, S. Depinoy, D. Kaoumi, “Effect of Heat Treatment on the Temperature Dependence of the Fracture Behavior of X-750 alloy”, The Nuclear Materials Conference, Nov. 7-10, 2016.

59. D. Kaoumi, J. Adamson, “Self-ordering of defect structures under ion beam irradiation”, 20th International Conference on Ion Beam Modification of Materials, Oct. 2016, Wellington, New Zealand.

60. D. Kaoumi, J. Liu, F-L Paul, “Deformation-induced martensitic transformation in 304 Stainless Steel”, International Conference on Solid-Solid Phase Transformation in Inorganic Materials, Whistler, BC, Canada, June 28-July 3 2015.

61. D. Kaoumi, T. Gautier, “Observations of deformation mechanisms in Ni-based alloys In-Situ in a Transmission Electron Microscope”, 17th International Conference on the Strength of Materials, Brno, Czech republic, Aug. 2015.

62. D. Kaoumi, K. Hrutkay, "Hot tensile deformation behavior and microstructural evolution of Haynes 230", The *2014 TMS Annual Meeting and Exhibition*, San Diego, CA, Feb 16-20, 2014.

63. D. Kaoumi, T. Gautier, M. Kirk, “In-situ deformation of Inconel 617 structural alloy in a transmission electron microscope”, The Nuclear Materials Conference NuMat2012, Osaka, Japan, Oct 2012.

64. D. Kaoumi, K. Hrutkay, “Microstructure-Mechanical Behaviour Relationship in Two Ni-based Superalloys”, The Nuclear Materials Conference NuMat2012, Osaka, Japan, Oct 2012

65. D. Kaoumi, M. Kirk, “Self-Ordered Defect Structures in Two Model F/M Steels Under In-situ Ion Irradiation”, The Nuclear Materials Conference NuMat2012, Osaka, Japan, Oct 2012

66. D. Kaoumi, J. Adamson, M. Kirk, T. Faney, B. Wirth, “Microstructure Evolution of Two Model F/M Steels Ion-Irradiated In-Situ in a TEM: Effect of temperature”, *Symposium on Microstructural Processes in Irradiated Materials at the 2011 TMS Annual Meeting and Exhibition*, San Diego, CA, Feb 27 – March 3, 2011.

67. D. Kaoumi, J. Adamson, M. Kirk, T. Faney, B. Wirth, “Microstructure Evolution of Two Model F/M Steels Ion-Irradiated In-Situ in a TEM”, *Nuclear Materials 2010,* Karlsruhe, Germany October 4-7 2010.

68. D. Kaoumi, M. Kirk, T. Faney, B. Wirth, “Microstructure Evolution of a Model F/M Steel Irradiated with Ions In-Situ in a TEM: Experiment vs. Modeling”, *Electron Microscopy and Multiscale Modelling,* Oct 27 -30 2009, Zurich, Switzerland.

69. D. Kaoumi, A. T. Motta, M. Kirk, J. Bentley, “Characterization and Ion-Irradiation of Three Oxide-Dispersion-Strengthened Steels up to 100 dpa: Stability of the Precipitates”, *International Conference on Fusion Reactor Materials,* Sept 7-12 2009, Sapporo, Japan.

70. D. Kaoumi, A. Motta, “Corrosion and Hydriding in Nuclear Alloys Studied with Synchrotron Radiation”, INL Workshop on Synchrotron radiation, Advanced Test Reactor National Scientific User Facility, June 1-5, 2009, Idaho Falls, ID, USA (presentation on behalf of A. Motta).

71. D. Kaoumi, A. T. Motta and M. Kirk, “Microstructure Evolution of Fe-9Cr-0.1C and Fe-12Cr-0.1C Model Martensitic Steels Ion-irradiated in-Situ in a TEM”, *Symposium on Microstructural Processes in Irradiated Materials at the 2009 TMS Annual Meeting and Exhibition,* Feb. 15-19, 2009, San Francisco, CA, USA

72. D. Kaoumi, A. T. Motta and M. Kirk, "Phase Stability in Oxide Dispersion Strengthened Steels under In-situ Ion Irradiation", *Materials Research Society Fall Meeting*, Dec. 2008, Boston, MA, USA.

73. D. Kaoumi, A. T. Motta, and M. Kirk, “Characterization and In-Situ Ion-Irradiation of MA957 ODS Steel”, Embedded Topical Meeting on Nuclear Fuels and Structural Materials for the Next Generation Nuclear Reactors, *The American Nuclear Society annual meeting*, June 2008, Anaheim, CA.

74. D. Kaoumi, A. T. Motta, and M. Kirk, "Characterization and in-situ Fe ion irradiation of four MA-ODS steels of interest for structural applications in GEN-IV nuclear reactors", *NATO Advanced Study Institute on Materials for Generation IV Nuclear Reactors*, September 24-October 6, 2007, Cargese, Corsica, France.

75. D. Kaoumi, A. T. Motta and R. C. Birtcher, “Grain Growth in Nanocrystalline Metal Thin Films under *In Situ* Ion-Beam Irradiation viewed as a thermal spike phenomenon: experiment vs. theory”, *Symposium on Microstructural Processes in Irradiated Materials at the 2007 TMS Annual Meeting and Exhibition,* Feb. 2007, Orlando, FL, USA.

76. D. Kaoumi, A. T. Motta and R. C. Birtcher, "Grain Growth in Nanocrystalline Metal Thin Films under In Situ Ion-Beam Irradiation", *ASTM Int. 23rd Symposium on Effects of Radiation on Materials*, June 2006, San Jose, CA, USA.

77. D. Kaoumi, A. T. Motta and R. C. Birtcher, "Irradiation-Enhanced Second-Phase Precipitation in Zr-Fe Nanocrystalline Thin-Films", *Materials Research Society Fall Meeting*, Nov. 2005, Boston, MA, USA.

78. D. Kaoumi, A. T. Motta and R. C. Birtcher, "Microstructure Evolution in Zr-Fe Thin Films During In-situ Ion Irradiation in a TEM", *14th International Meeting on Ion Beam Modification of Materials*, September Sept. 2004, CA, USA.

***Professional Workshops (by invitation)*:**

1. Workshop for Applied Nuclear Data Activities (WANDA), Washington, DC, Jan 22-24, 2019

2. Tour of French Nuclear Facilities for US Professors of Nuclear Engineering organized by the French section of the American Nuclear Society, June 29 - July 5 2014 (by invitation)

3. Workshop on UO2 and MOX fuel performance (2012)

4. Workshop on Stress Corrosion Cracking (2011) organized by the Fuels and Materials Center of Research and Education (CORE) of the Idaho National Laboratory's Institute for Nuclear Engineering Science, and Technology (INEST)

5. Workshop on the Use of In-Situ TEM-Ion Accelerator Techniques in the Study of Radiation Damage in Solids, June 2008, the University of Salford, UK.

Synergistic Activity and Awards:

- **2019 Mid-Career NCSU Faculty Initiative Award**
- **2013 recipient of the ANS MSTD Student Literary Award** for the paper entitled: "Tensile Behavior of Inconel 617 vs. Haynes 230: Effects of Temperature and Strain Rate", Transactions of the American Nuclear Society, 109, 2013.
- Member of the **National Engineering Honor Society Tau Beta Pi**.
- Member of the **National Nuclear Engineering Honor Society Alpha Nu Sigma**.
- **Fellowship of the Dean of College of Engineering (**Penn State) (2002, 2003, 2004).
- Member of the American Nuclear Society.
- Member of the Material Research Society;
- Member of the Minerals, Metals & Materials Society;

- Member of the executive committee of the MSTD division of the American Nuclear Society (2022-2025)

- **Lead-organizer** of the Symposium on Synergistic Irradiation, Corrosion, and Microstructural Evolution in Nuclear Materials for the 2022 TMS Annual Meeting and Exhibition, Anaheim, CA, Feb 2020: (42 abstracts)

- **Co-organizer** of the *Symposium on In-situ TEM at the extremes*, Microscopy & Microanalysis annual meeting M&M 2020, Milwaukee, WI, Aug 2020: 62 abstracts

- **Member of the Administrative Board of the Graduate School** of NC State University, representing the College of Engineering, 2019-2020

- **Editorial Review Board member for Materials Research Letters (2018 -)**

- **Lead-organizer** of the *Symposium on Radiation Effects in Metals and Ceramics for the 2020 TMS Annual Meeting and Exhibition*, San Diego, CA, Feb 2020: 130 abstracts. Chair for 2 sessions (132 abstracts, largest symposium of the TMS conference).

- **Session Chair** of the *Symposium on Radiation Effects in Metals and Ceramics for the 2020 TMS Annual Meeting and Exhibition, ,* San Diego, CA, Feb 2020.

- **International Advisory Committee member** for the 2019 International Corrosion Engineering Conference (ICEC 2019), Incheon, Korea, October 2019

- **Session Chair** of the *Symposium on Nuclear Materials,* Materials Science & Technology annual meeting, Portland, Sept 2019

- **Technical Program Committee Member** for the International Congress on Advances in Nuclear Power Plants (ICAPP), Juan-les-Pins, France, May 2019

- **Reviewer** for the International Congress on Advances in Nuclear Power Plants (ICAPP), Juan-les-Pins, France, May 2018 (17 abstracts, 5 full papers)

- **Analytical Instrumentation Facility Steering Committee, NCSU, 2016-2019**

- **Co-organizer of the 8th symposium on Microstructural Progresses in Irradiated Materials (MPIM),** part of the TMS 2017 146 th Annual Meeting and Exhibition, San Diego, California, USA, February 26–March 2, 2017

- **Session co-chair at the 8th symposium on Microstructural Progresses in Irradiated Materials (MPIM),** part of the TMS 2017 146 th Annual Meeting and Exhibition, San Diego, California, USA, February 26–March 2, 2017

- **Guest Editor for *Journal of Materials Research*** for Special issue on "Radiation damage and Effects Characterization: State of the Art, Challenges, and Protocols" (2014-2015) (**37 papers**) (**Publication date: May 2015**)

- **Editorial Board** (**Review Editor**) of ***Nuclear Energy*** (specialty section of ***Frontiers in Energy Research***) (since 2014)

- Member of **executive committee** of the **Materials Science and Technology Division (MSTD)** of the American Nuclear Society (2011-2013).

- Technical Program Committee Member and Track Leader: Symposium on Materials and Structural Issues, (2014, 2012), International Congress on Advances in Nuclear Power Plants (ICAPP '14, Charlotte, NC, USA, and ICAPP '12, Chicago, IL, USA)

- Session Organizer and Chair for four symposia at the International Congress on Advances in Nuclear Power Plants (ICAPP meetings 2010, 2011, 2012),

- Session chair at the International Conference on Nuclear Materials, 2012, Osaka, Japan.

Current Funded Research Projects:

1/ Nuclear Science and Security Consortium (2021-2026)
Sponsor: Department of Energy's National Nuclear Security Administration (DOE/NNSA)
Award Period: 09/01/2021 – 08/31/2026
Collaborators: UC-Berkeley (leading university); Air Force Institute of Technology; George Washington University; Michigan State University; North Carolina State University; Texas A&M University; University of California, Davis; University of Illinois, Urbana-Champaign; University of Nevada, Las Vegas; University of New Mexico; University of Tennessee.

The mission of this consortium is to train the next generation of nuclear scientists and engineers, while engaging in R&D spanning basic aspects of new technology and methods to programmatic work directly supporting the NNSA's nuclear security and nonproliferation missions; more details to be found at: https://www.energy.gov/nnsa/articles/nnsa-renews-university-consortium-grant-research-and-development-nuclear-science

2/ Bridging the atomic scale and the mesoscale in the characterization of defect production and evolution in high entropy alloys (2020-2023)

Funding Agency: National Science Fondation (NSF); Collaborators: Bowling Green State University (BGSU) (2020-2023- extended to 2024)

High entropy alloys (HEAs) are emerging as an outstanding class of materials due to their excellent mechanical properties and high radiation tolerance as a result of their unique electronic structure. Chemical disorder and compositional fluctuations in these alloys have large effects on energy dissipation and response to irradiation. Thus this project focuses on understanding defect formation and buildup in these alloys through experimental characterization. The proposed research is expected to reveal the effects of chemical disorder on defect formation, migration and evolution in a radiation environment and reveal the damage and annealing mechanisms in Single -Phase Concentrated Solid Solution alloys (SP-CSAs) and HEAs through the study of defect production from collision cascades on an atomic and mesoscale level in alloys with increasing chemical complexity from one to five constituents.

3/ Microstructure Optimization and Novel Processing Development of ODS Steels for Fusion Environments (2020 – 2023)

Funding Agency: US Department of Energy through the Advanced Research Projects Agency – Energy; Consortium led by Pacific Northwest National Laboratory; Collaborators: NCSU, Ames Laboratory, Pacific Northwest National Laboratory.

This project's objective is scalable, cost-effective fabrication of high-performance, oxide-dispersion strengthened (ODS) steel with advanced-manufacturing methods for fusion blanket-breeding applications. Gas atomization reaction synthesis (GARS) enables the synthesis of precursor ODS steel powders without prolonged mechanical alloying. This process creates a chromium (Cr)-enriched surface oxide with yttrium/titanium (Y/Ti)-enriched intermetallics in powder interiors. The goal will be to consolidate and extrude GARS powder in one step using first-of-a-kind shear assisted processing and extrusion (ShAPE) and laser-based AM processes. Such scalable, cost-effective fabrication of ODS steels may enable efficient power conversion cycles (≥40%) at operating temperatures beyond 900 K in future fusion power plants.

4/ Ni-based ODS alloys for Molten Salt Reactors (2019-2023 – planned extension to 2024)

Funding Agency: DOE NEUP; Collaborators: University of California, University of Idaho, Idaho National Laboratory, Oxford University (United Kingdom), Kyung Hee University (South Korea) through INERI awarded in 2021

The objective of this work is to (i) propose and develop a new Ni-based ODS alloy that can be used for structural applications in Molten Salt Reactors as the primary material facing the fuel (ii) demonstrate that its high temperature mechanical properties are adequate for MSR operating temperatures, (iii) Demonstrate its enhanced resistance to radiation damage compared to regular nickel alloys as a result of its inherent multi-interface character through "rapid" ion irradiation testing and (iv) demonstrate its improved corrosion resistance in MSR environment through appropriate experiments.

5/ Passive Strain Measurements for Experiments in Radiation Environments (2020-2023)
Funding Agency: US Department of Energy through LDRD led by Idaho National Laboratory; Collaborators: Idaho National Laboratory, Massachusetts Institute of Technology

Understanding the mechanical response of materials under radiation is essential to qualifying any material for use within a nuclear reactor. In a radiation environment, such as in a reactor core, the radiation damage degrades many instruments thus it limiting the instrumentation options. Furthermore, the use of active instrumentation for in situ monitoring increases the cost of experiments. On the other hand, passive instrumentation can be developed and used to evaluate critical parameters for fast and reliable screening tests prior to the extended irradiation campaigns. The accuracy of passive instruments can be significantly improved when coupled with state-of-the-art computational methods. In this project, we propose to develop passive instrumentation for the determination of permanent strains induced by irradiation and extract

critical parameters using computational methods. The model used to interpret the experiment will utilize existing crystal plasticity models developed within Nuclear Energy Advanced Modelling and Simulation (NEAMS) as well as machine learning algorithms to be developed at Idaho National Laboratory (INL) and the Massachusetts Institute of Technology (MIT). An experiment will also be designed at INL for irradiation at the MIT test reactor (MITR). The experiment will benefit from engineered anisotropic materials and characterize the directional deformation in response to neutron radiation. The results of the experiment will be incorporated into the model so that the material response can be predicted for future uses as a probe material. This will enable materials research to more quickly and effectively separate radiation and thermal contributions to mechanical deformation

6/ Corrosion Sensitivity of Stainless Steels in Pressurized Water Reactor Water Chemistry: Can KOH replace LiOH in PWRs? (2020-2023);
Funding Agency: DOE NEUP; Collaborators: University of California Berkeley (UCB); Pacific Northwest National Laboratory (PNNL); Electric Power Research Institute (EPRI)
The objective of this work is to determine if switching from LiOH to KOH to control the pH in nuclear reactors is possible without worsening the corrosion behavior of the structural alloys used in PWR core internal components. The impacts of such a change and the consequent water chemistry alterations on the corrosion processes and NPP core-internal component service-life will be assessed and better understood.

7/ Synergy of radiation damage with corrosion processes through a separate effect investigation approach (2020-2023)
Funding Agency: DOE; Collaborators: Los Alamos National Laboratory (LANL)
This project focuses on investigating the synergy of radiation damage with corrosion processes through a series of separate effect experiments which will look at the effect of irradiation on Fe-based systems and Ni-Based systems and how radiation damage affect corrosion processes. Fe-based systems are of interest for Liquid Metal Cooled Reactors and Ni-Based systems are of interest for Molten Salt Reactors. We will investigate the effects of ion irradiation on metal and effects of ion irradiation on Metal/Oxide interfaces and post irradiation Atom Probe Tomography.

8/ Simultaneous Corrosion/Irradiation Testing in Lead and Lead-Bismuth Eutectic: The Radiation Decelerated Corrosion Hypothesis (2020 – 2023)
Funding Agency: DOE NEUP; Collaborators: Massachusetts Institute of Technology (MIT); Oxford University (UK)
Liquid lead and lead-bismuth eutectic (LBE) cooled fast reactors promise the best power density and economics for fission reactors, should they actually be deployed. For decades, the issues of corrosion and how it will change with irradiation have been the bottleneck in lead fast reactor (LFR) and LBE fast reactor (LBEFR) deployment, restricting outlet temperatures below 550°C1 . Without precise knowledge of corrosion and irradiation performance of LFR/LBEFR materials, these reactors will never be deployed, stuck forever in a Catch 22. A far faster, yet reactor-accurate, method of combined corrosion/irradiation testing is required. To break this bottleneck,

we will test candidate materials from previous studies in a new, simultaneous corrosion/radiation facility. Rather than rely on separate long-term corrosion and neutron irradiation, simultaneous exposure followed by microstructural characterization, mechanical testing, and comparison to existing data will rapidly down-select potential alloy candidates and assess how irradiation affects corrosion. In addition, we will explore a controversial, yet massively impactful scientific hypothesis, that radiation slows corrosion in the LFR/LBEFR based on molten salt testing.

9/ "Fundamental Understanding of Transport Under Reactor Extremes" (2018-2022)
(Sponsor: Department of Energy – Energy Frontier Research Centers)
Participants: Los Alamos National Laboratory (Lead), University of California, Berkeley, Bowling Green State University, North Carolina State University, Pacific Northwest National Laboratory, University of California, Berkeley, University of Virginia, and University of Wisconsin, Madison.
The center works on "Fundamental Understanding of Transport Under Reactor Extremes (FUTURE)" with the goal to understand the coupling between radiation damage and corrosion and predict irradiation-assisted corrosion in passivating and non-passivating environments for materials in nuclear energy systems. More info on the dedicated website https://www.lanl.gov/projects/future/index.php .

10/ Understanding of degradation of SiC/SiC materials in nuclear systems and development of mitigation strategies (2018-2021)
Funding Agency: DOE; Collaborators: University of California, General Atomics
The objective of this work is to develop the best possible coating composition via rapid throughput processing and testing techniques and conduct a thorough material analysis of the resulting SiC-SiC/coating structure and transfer the obtained knowledge to engineering scalable coating systems. Furthermore, this proposal targets to develop a comprehensive understanding of the effect of true reactor conditions (in terms of chemistry and radiation) and aims to evaluate the best structure/coating system in this environment. We will deliver the best coating possible for deployment on SiC-SiC substrates for LWR environment while providing an avenue for cost effective mass production of cladding tubes.

Past projects:

1. Mechanistic and Validated Creep/Fatigue Predictions for Alloy 709 from Accelerated Experiments and Simulations (2015-2018)
Sponsor: Department of Energy – Nuclear Energy University Program
Collaborators: NCSU, ANL

2. Innovative Approach to SCC Inspection and Evaluation of Canister in Dry Storage (2015-2019)
Sponsor: Department of Energy – Nuclear Energy University Program, IRP Consortium
Collaborators: Colorado School of Mines (leading university), NCSU, ANL, LANL, SNL, CB&I

3. Developing ultra-small scale mechanical testing methods and microstructural investigation procedures for irradiated materials. (2014-2017)
Agency: **DOE NEUP**
Collaborators: University of California at Berkeley

4. High Fidelity Ion Beam Simulation of High Dose Neutron Irradiation (2014 – 2017)
Agency: **DOE NEUP IRP**
Collaborators: University of Michigan (leading institution), U. Tennessee; Penn State U.; U. Wisconsin; U. C. Berkeley; U. C. Santa Barbara; ORNL; LANL; LLNL; ANL; INL, TerraPower LLC; EPRI; U. Manchester; U. Oxford; Areva; U. Queens; CEA

5. Investigation of the fundamental mechanisms of deformation and crack propagation of Ni-based superalloys
Agency: **DOE NEUP – Infrastructure / NRC faculty development**

6. Microstructure and Property Evolution in Advanced Cladding and Duct Materials Under Long-Term and Elevated Temperature Irradiation: Modeling and Experimental investigation
Agency: **DOE NE-UP (2010-2013)**
Collaborators: University of Tennessee, Knoxville, Pennsylvania State University, University of Wisconsin.

7. Irradiation induced precipitation in corrax maraging steels.
Agency: **LANL, UCB** (2013)
Collaborators: University of California Berkeley

8. Friction consolidation and extrusion of ODS steel powders
Agency: **Pacific Northwest National Laboratory** (2011-2013)
Collaborators: (University of South Carolina)

Classes taught:

Introduction to Nuclear Materials (400/500 level class open to undergraduate and graduate students cross listed in MSE and NE course catalog): 9 years
In this course, most of the materials issues encountered in the operation of nuclear power reactors are discussed. The objective of the course is to give students a background in materials for nuclear power reactors and to discuss the unique changes that occur in these materials under the reactor environment, so that students understand the limitations put on reactor operations and reactor design by materials performance. In the first part of the course we review basic concepts of physical metallurgy to develop an understanding of the relationship between microstructure and material properties outside of irradiation. In the second part of the course, we describe the process of radiation-material interaction, present the methods to calculate atomic displacement damage produced by exposure to irradiation, and describe the changes in material properties that results from irradiation exposure. In the third part of the course, special attention is given to

property changes affecting the fuel and cladding performance and operational safety such as corrosion of the cladding, hydriding, fuel expansion, Pellet-Cladding Interactions, stress corrosion-cracking. Both mathematical methods and experimental techniques are emphasized

Radiation damage (700 level class cross listed in MSE and NE course catalog): 10 years
In this course, the focus is put on the materials issues encountered in the operation of nuclear power reactors as a result of radiation damage. The objective of the course is to discuss the unique changes that occur in materials under irradiation by review the basics of the science of radiation damage. In the first part of the course we review basic concepts of physical metallurgy to develop an understanding of the relationship between microstructure and material properties outside of irradiation. In the second part of the course, we describe the process of radiation-material interaction (primary damage production, point defect cascade, thermal spike concept). We present the methods to calculate atomic displacements (K-P model, Lindhard model, NRT model), and describe the microstructural evolution that results from irradiation exposure (depleted zones, dislocation loops etc). The aim is to show how irradiation-induced changes in the microstructure can evolve into changes in macroscopic behavior of the material. We review the dimensional instabilities resulting from irradiation (swelling, irradiation creep, and irradiation growth). Special attention is given to mechanical property changes that affect fuel/cladding performance and operational safety (hardening and embrittlement). Both mathematical methods and experimental techniques are emphasized. Students quantitatively evaluate radiation damage, and learn simple analytical models that describe microstructural evolution and property changes under irradiation.

Radiation Detection and Measurement (open to senior undergraduates and graduate students): 5 years
The course objectives are to (i) Understand atomic and nuclear physics concepts such as nuclear structure and radioactive decay, and radiation sources in general; (ii) Understand the principles of radiation interaction with matter; (iii) Understand the principles of radiation detection and measurement, by reviewing different type of detectors (gas filled detectors, Scintillation detectors, Semiconductor detectors, and neutron detectors)