

Reid Franklin Cooper

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Research Interests: Experimental geophysics (seismic attenuation; transient and steady-state flow of minerals and rock); experimental petrology (structure and dynamics of silicate melts and glasses; phase equilibria; solid-state reactions; non-equilibrium thermodynamics); application of petrology/geochemistry to the design and analysis of engineering materials

Education: Cornell University, Ithaca, New York
Ph.D. in Materials Science and Engineering – 1983
M.S. in Materials Science and Engineering – 1980
Minor Fields: Geophysics and Structural Geology/Tectonics

The George Washington University, Washington, D.C.
B.S. in Civil Engineering – 1977

Professional Experience: Brown University, Providence, Rhode Island
2003-present Professor, Earth, Environmental and Planetary Sciences

University of Wisconsin–Madison
1994-2003 Professor, Materials Science and Engineering
Professor, Geology and Geophysics
1990-1994 Associate Professor, Materials Science and Engineering
Associate Professor, Geology and Geophysics.
1986-1990 Assistant Professor, Materials Science and Engineering.

California Institute of Technology, Pasadena California
Autumn 1994 Visiting Professor, Division of Geological and Planetary Sciences

Los Alamos National Laboratory, Los Alamos, New Mexico
1995 Visiting Scientist, Center for Materials Science

Corning Glass Works (now Corning, Inc.), Corning, New York
1983-1985 Senior Research Scientist, Research and Development Division,
Glass-Ceramics and Composites Research

Cornell University, Ithaca, New York
1977-1983 Graduate Research Assistant, Department of Materials Science and Engineering

Teaching/ Education Experience: 2003– Brown University
Chemical and Mechanical Kinetics (Graduate level)
Thermodynamics/Phase Equilibria (Graduate level)
Mineralogy (Junior/Senior level)
Geochemistry/Earth Materials (Sophomore level)
Introductory Physical Geology (First-Year level)
Seminar on Thermodynamics & Natural Philosophy (Baccalaureate)
First-Year and Sophomore Advisor (2005–)
Ad hoc University Committee on Race/Gender Issues in Science Education (2004–2005)
University Faculty Executive Committee (2010-2013); Officer (Past Chair *pro tempore*, 2011-2012)
Brown University Community Council (2014–2017)
University Academic Priorities Committee (2018–2021)

Teaching/
Education
Experience:
(continued)

1986-2003 University of Wisconsin-Madison
 Introduction to Ceramic Materials (Senior/Graduate level)
 Materials Systems and Design Project (Senior level)
 Kinetics of Solid-State Reactions (Graduate level)
 Mechanical Behavior of Materials (Senior/Graduate level)
 Thermodynamics of Materials (Junior level)
 Baccalaureate Major Advisor, Materials Science/Metallurgy
 (1987-2003)
 College of Engineering Academic Programs, Curriculum and
 Regulations Committee (1988-1990)
 College of Engineering Committee on Education (1992-1997)
 College of Engineering Industrial Liaison Council (1998-2003)
 University Physical Sciences Divisional Executive Committee
 (1997-2000); Chair (1999-2000)

1978 Director, Camp Bowman, Goshen Scout Camps, Goshen, VA.
 1977 National Capital Area Council, Boy Scouts of America.
 (Summers) Total responsibility for operation and program of 250 boys/week
 summer camp. Hired, trained and supervised staff of 35 men
 and women for two nine-week seasons.

Professional
Societies and
Activities:

Member of: American Geophysical Union (Fellow); Mineralogical Society of America
 (Fellow); American Ceramic Society (Fellow); American Association for the
 Advancement of Science

American Geophysical Union, Mineral and Rock Physics Focus Group Executive
 Committee, 2002-2019; Fellows Committee (Chair) 2009-2019; Secretary 2008-2013.
 Physical Properties of Earth Materials Committee, Chair, 2002-2004; Steering
 Committee/Membership Chair, 1991-1995.

Associate Editor, *Journal of Geophysical Research-Solid Earth* 2007-2016.

American Ceramic Society, ACerS/NIST Committee on Phase Equilibria Publications
 2002-2006 (Chair, 2005-2006); Publications Committee, 2002-2006; Basic Science
 Division, Nominating Committee Chair, 1997.

Associate Editor, *Journal of the American Ceramic Society*, 1999-2005

Mineralogical Society of America, Nominating Committee, 1977; Benefactors Committee
 1999-2007; Dana Medal Committee 2010-2014.

Science Doctoral Programs External Review Committee, Tulane University, New Orleans,
 LA (2013)

NSF Review Panels: SBIR, 1989; Mech. & Mat'ls., 1996; Ceramics, 1999, 2003;
 Graduate Research Fellowship Program (Geosciences), 2015-16, 2017-18, 2019-20.

NASA Planetary Geosciences Review Panels (Geophysics): 1989-1991; 2017.

Symposium Organizer:
Workshop on the Status and Future of Experimental Rock Deformation; Southern
 California Earthquake Center (sponsor), Summer 2004
Structure and Dynamics of Silicate Melts and Glasses: Natural and Synthetic; American
 Ceramic Society, Pacific Rim Conference, Autumn 2001.
Chemical Processing of Electronic Ceramics; Materials Research Society, Fall Meeting
 1999.
Experimental Techniques in Rock Mechanics; 34th National Symposium on Rock
 Mechanics, Summer 1993.
Mechanisms of Deformation and Failure in Rocks and Ceramics; Materials Research
 Society, Spring Meeting 1993.

Advisory Committee Member, Marsh Chapel, School of Theology, Boston University,
 2019-2023.

Honors and Fellowships:Brown University (2003-present)

President's Award for Excellence in Faculty Governance 2016
 Fellow, American Ceramic Society – elected 2014
 Fellow, American Geophysical Union – elected 2005
 Master of Arts *ad eundem gradum* 2004

University of Wisconsin–Madison (1986-2003)

Fellow, Mineralogical Society of America – elected 1996
 H.I. Romnes Faculty Research Fellowship – UW–Madison 1994-1999
 Presidential Young Investigator Award – National Science Foundation 1987-1992
 Polygon Engineering Council Outstanding Instructor Award – UW–Madison 1987, 1993, 1994, 1997, 2002
 University of Wisconsin Regents Undergraduate Teaching Award 1992

Corning Glass Works (1983-1985)

Sigma Xi – elected 1985

Cornell University (1977-1983)

Corning Glass Works Foundation Fellowship 1978-79, 1979-80, 1980-81
 Tau Beta Pi (National Engineering Honor Society) National Fellowship 1977-78

The George Washington University (1973-1977)

Bachelor Degree conferred "With Distinction" (University Highest Honors)
 Tau Beta Pi Engineering Honor Society – Chapter President 1976-77 – elected 1976
 G.W. University Award in Materials Testing 1977
 American Society for Testing and Materials Student Award 1977
 American Society for Metals (D.C. Chapter) Student Research Award 1977
 American Society of Civil Engineers (Nat'l Capital Section) Student Award 1976

Publications:

1. Cooper, R.F., M.A. Imam and C.M. Gilmore (1977). A comparison of microstructure and properties of small diameter rod and thick plate Ti-6Al-4V. Naval Air Systems Command, Technical Report No.IV.
2. Weathers, M.S., J.M. Bird, R.F. Cooper and D.L. Kohlstedt (1979). Differential stress determined from deformation-induced microstructures of the Moine Thrust Zone. *J. Geophys. Res.*, **84**, 7495-7509.
3. Kohlstedt, D.L., R.F. Cooper, M.S. Weathers and J.M. Bird (1979). Paleostress analysis of deformation-induced microstructures: Moine Thrust Zone and Ikertoq Shear Zone. In: *Proceedings of Conference VIII: Analysis of Actual Fault Zones in Bedrock*, USGS Report #79-1239, Menlo Park, pp. 394-425.
4. Weathers, M.S., J.M. Bird, R.F. Cooper and D.L. Kohlstedt (1979). Microstructure and stress analysis of the Mullen Creek-Nash Fork Shear Zone, Wyoming. In: *Proceedings of Conference VIII: Analysis of Actual Fault Zones in Bedrock*, USGS Report #79-1239, Menlo Park, pp. 426-447.
5. Turcotte, D.L., P.H. Tag and R.F. Cooper (1980). A steady state model for the distribution of stress and temperature on the San Andreas Fault. *J. Geophys. Res.*, **85**, 6224-6230.
6. Cooper, R.F. and D.L. Kohlstedt (1982). Interfacial energies in the olivine-basalt system. *Adv. Earth Planet. Sci.*, **12**, 217-228.
7. Cooper, R.F. and D.L. Kohlstedt (1984). Sintering of olivine and olivine-basalt aggregates. *Phys. Chem. Minerals*, **11**, 5-16.
8. Cooper, R.F. and D.L. Kohlstedt (1984). Solution-precipitation enhanced diffusional creep of partially molten olivine-basalt aggregates during hot-pressing. *Tectonophysics*, **107**, 207-233.
9. Cooper, R.F. and D.L. Kohlstedt (1986). Rheology and structure of olivine-basalt partial melts. *J. Geophys. Res.*, **91**, 9315-9323.

Publications (continued):

10. Stewart, R.L., K. Chyung, M.P. Taylor and R.F. Cooper (1986). Fracture of SiC fiber/glass-ceramic composites as a function of temperature. In: *Fracture Mechanics of Ceramics*, Vol. 7, edited by R.C. Bradt, A.G. Evans, D.P.H. Hasselman and F.F. Lange, Plenum Press, New York, pp. 33-51.
11. Cooper, R.F. and K. Chyung (1987). Structure and chemistry of fiber-matrix interfaces in silicon carbide fiber-reinforced glass-ceramic composites: an electron microscopy study. *J. Mater. Sci.*, **22**, 3148-3160.
12. Cooper, R.F., D.L. Kohlstedt and K. Chyung (1989). Solution-precipitation enhanced creep in solid-liquid aggregates which display a non-zero dihedral angle. *Acta Metall.*, **37**, 1759-1771.
13. Feinman, G.M., S. Banker, R.F. Cooper, G.B. Cook and L.M. Nicholas (1989). A technological perspective on changes in the ancient Oaxacan grayware ceramic tradition: preliminary results. *J. Field Archaeol.*, **16**, 331-344.
14. Cooper, R.F., D.H. Green and D.K. Bidner (1990). Reciprocating four-point flexure testing at high temperature with application to attenuation in partial melts. In: *The Brittle-Ductile Transition in Rocks; The Heard Volume, Geophys. Monogr. Ser.*, Vol. 56, edited by A.G. Duba, W.B. Durham, J.W. Handin and H.F. Wang, Am. Geophys. Union, Washington, DC, pp. 201-206.
15. Cooper, R.F. (1990). Differential stress-induced melt migration: an experimental approach. *J. Geophys. Res.*, **95**, 6979-6992.
16. Cook, G.B., R.F. Cooper and T. Wu (1990). Chemical diffusion and crystalline nucleation during oxidation of ferrous iron-bearing magnesium aluminosilicate glass. *J. Non-Crys. Solids*, **120**, 207-222.
17. Allen, W.P., J.C. Foley, R.F. Cooper and J.H. Perepezko (1990). Decomposition reactions and toughening in NiAl-Cu alloys. *Mater. Res. Soc. Symp. Proc.*, **194**, 405-412.
18. Bonney, L.A. and R.F. Cooper (1990). Reaction-layer interfaces in SiC fiber-reinforced glass-ceramics: a high-resolution scanning transmission electron microscopy analysis. *J. Am. Ceram. Soc.*, **73**, 2916-2921.
19. Green, D.H., R.F. Cooper and S. Zhang (1990). Attenuation spectra of olivine/basalt partial melts: transformation of Newtonian creep response. *Geophys. Res. Lett.*, **17**, 2097-2100.
20. Cooper, R.F., W. Yoon and J.H. Perepezko (1991). Internal nucleation of highly undercooled magnesium metasilicate melts. *J. Am. Ceram. Soc.*, **74**, 1312-1319.
21. Meyer, D.W., R.F. Cooper and M.E. Plesha (1991). Analytical rheology simulation and interface mechanics in ceramic composites. *Ceram. Trans.*, **19**, 593-600.
22. Hall, P.C. and R.F. Cooper (1991). Phyllosilicate-oxide reactions: an approach to oxidation-resistant ceramic composites. *Ceram. Trans.*, **19**, 237-243.
23. Zhang, S. and R.F. Cooper (1991). Differential stress-induced melt migration in cobalt-magnesium orthosilicate-basalt partial melts. In: *Proc. Int'l. Conf. Mech. Solids and Structures*, edited by D.T. Lwin and F.W. Travis, World Scientific Publishing, Singapore, pp. 361-371.
24. Booske, J.H., R.F. Cooper, I. Dobson and L. McCaughan (1991). Models of nonthermal effects on ionic mobility during microwave processing of crystalline solids. *Ceram. Trans.*, **21**, 185-192.
25. Booske, J.H., R.F. Cooper and I. Dobson (1992). Mechanisms for nonthermal effects on ionic mobility during microwave processing of crystalline solids. *J. Mater. Res.*, **7**, 495-501.
26. Meyer, D.W., R.F. Cooper and M.E. Plesha (1992). Rheological modeling of ceramic composites: an indirect method of interfacial mechanical properties measurements. *Int. J. Solids Structures*, **29**, 2563-2582.
27. Meyer, D.W., M.E. Plesha and R.F. Cooper (1992). A contact friction algorithm including nonlinear viscoelasticity and a singular yield surface provision. *Computers and Structures*, **42**, 913-925.
28. Booske, J.H., R.F. Cooper, L. McCaughan, S. Freeman and B. Meng (1992). Studies of nonthermal effects during intense microwave heating of crystalline solids. *Mater. Res. Soc. Symp. Proc.*, **269**, 137-143.

Publications (continued):

29. Meyer, D.W., R.F. Cooper and M.E. Plesha (1993). High-temperature creep and the interfacial mechanical response of a ceramic matrix composite. *Acta Metall. Mater.*, **41**, 3157-3170.
30. Cooper, R.F. and P.C. Hall (1993). Reactions between synthetic mica and simple oxide compounds with application to oxidation-resistant ceramic composites. *J. Am. Ceram. Soc.*, **76**, 1265-1273.
31. Green, D.H. and R.F. Cooper (1993). Dilatational anelasticity in partial melts: viscosity, attenuation and velocity dispersion. *J. Geophys. Res.*, **98**, 19,807-19,817.
32. Reardon, B.J., J. Kieffer, J.H. Booske and R.F. Cooper (1993). Analysis of the microwave sintering effect in NaCl using molecular dynamics simulations. *Ceram. Trans.*, **36**, 239-246.
33. Freeman, S.A., J.H. Booske, R.F. Cooper, B. Meng, J. Kieffer and B.J. Reardon (1993). Studies of microwave field effects on ionic transport in ionic crystalline solids. *Ceram. Trans.*, **36**, 213-220.
34. Gribb, T.T., S. Zhang and R.F. Cooper (1994). Melt migration and related attenuation in equilibrated partial melts. In: *Magmatic Systems*, edited by M.P. Ryan, Academic Press, pp. 19-36.
35. King, T.T. and R.F. Cooper (1994). Ambient-temperature mechanical response of alumina-fluoromica laminates. *J. Am. Ceram. Soc.*, **77**, 1699-1705.
36. Freeman, S.A., J.H. Booske, R.F. Cooper and B. Meng (1994). Microwave radiation effects on ionic current in ionic crystalline solids. *Mat. Res. Soc. Symp. Proc.*, **347**, 479-485.
37. Meng, B., J.H. Booske, R.F. Cooper and S.A. Freeman (1994). Microwave absorption in NaCl crystals with various controlled defect conditions. *Mat. Res. Soc. Symp. Proc.*, **347**, 467-472.
38. Zhang, L., J.H. Booske, R.F. Cooper, J.L. Shohet, J.R. Jacobs, F.S.B. Anderson, M.J. Goeckner, E.J. Wicksberg and G. Was (1994). Plasma-immersed oxygen ion implantation of iron-doped glass for nonmetallic magnetic hard disks. *J. Vac. Sci. Technol.*, **B12**, 3342-3346.
39. Freeman, S.A., J.H. Booske and R.F. Cooper (1995). Microwave field enhancement of charge transport in sodium chloride. *Phys. Rev. Lett.*, **74**, 2042-2045.
40. Meng, B., J.H. Booske and R.F. Cooper (1995). A system to measure complex permittivity of low-loss ceramics at microwave frequencies and over large temperature ranges. *Rev. Sci. Instrum.*, **66**, 1068-1071.
41. Nair, B.G., R.F. Cooper, J.N. Almquist and M.E. Plesha (1995). High-temperature flow of SiC continuous fiber-glass ceramic matrix composites: The effect of interface/interphase ductility. *Mat. Res. Soc. Symp. Proc.*, **365**, 469-474.
42. Gribb, T.T. and R.F. Cooper (1995). Anelastic behavior of silicate glass-ceramics and partial melts: Migration of the amorphous phase, in *Plastic Deformation of Ceramics*, edited by R.C. Bradt, J.L. Routbort and C.A. Brookes, Plenum Press, New York, pp. 87-97.
43. Freeman, S.A., J.H. Booske and R.F. Cooper (1995). A novel method for measuring intense microwave radiation effects on ionic transport in ceramic materials. *Rev. Sci. Instrum.*, **66**, 3606-3609.
44. Meng, B., J.H. Booske and R.F. Cooper (1995). Extended cavity perturbation technique to determine the complex permittivity of dielectric materials, *IEEE Microwave Theory Tech.*, **43**, 2633-2636.
45. Freeman, S.A., J.H. Booske and R.F. Cooper (1995). Ionic transport in sodium chloride and silver chloride during microwave irradiation. *Ceram. Trans.*, **59**, 185-192.
46. Meng, B., J.H. Booske, R.F. Cooper and B. Klein (1995). Measurements of the complex permittivity of low-loss ceramics at microwave frequencies and over large temperature ranges. *Ceram. Trans.*, **59**, 251-258.
47. Meng, B., J.H. Booske, R.F. Cooper and B. Klein (1995). Microwave absorption in NaCl crystals with various concentrations of point defects. *Ceram. Trans.*, **59**, 177-184.

Publications (continued):

48. Grellinger, D.J., J.H. Booske, S.A. Freeman and R.F. Cooper (1995). Processing parameters influencing the sintering of alumina in a conventional and 14-GHz microwave furnace. *Ceram Trans.*, **59**, 465-472.
49. Cooper, R.F., J.B. Fanselow and D.B. Poker (1996). The mechanism of oxidation of a basaltic glass: Chemical diffusion of network-modifying cations. *Geochim. Cosmochim. Acta*, **60**, 3253-3265 (erratum: **61**, 3275, 1997).
50. Meng, B., B.D.B. Klein, J.H. Booske and R.F. Cooper (1996). Microwave absorption in insulating dielectric ionic crystals including the role of point defects. *Phys. Rev. B*, **53**, 12,777-12,785.
51. Cooper, R.F., J.B. Fanselow, J.K.R. Weber, D.R. Merkley and D.B. Poker (1996). Dynamics of oxidation of a Fe²⁺-bearing aluminosilicate (basaltic) melt. *Science*, **274**, 1173-1176.
52. Cooper, R.F. (1996). Dynamic redox reactions and the formation of fine-grained, polycrystalline ceramics from inviscid melts. In: *Space Processing of Materials*, edited by N Ramachandran, *Proc. SPIE*, **2809**, 69-77.
53. Klein, B.D.B., B. Meng, S.A. Freeman, J.H. Booske and R.F. Cooper (1996). Investigations of microwave absorption in insulating dielectric ionic crystals including the role of point defects and dislocations. *Mater. Res. Soc. Symp. Proc.*, **430**, 397-402.
54. Freeman, S.A., J.H. Booske and R.F. Cooper (1996). High-frequency field effects on ionic defect concentration and solid-state diffusion processes. *Mater. Res. Soc. Symp. Proc.*, **430**, 417-422.
55. Binger, K.R., S.A. Freeman, D.J. Grellinger, R.F. Cooper and J.H. Booske (1996). Statistical comparative analyses of engineering properties of microwave and conventionally sintered alumina. *Mater. Res. Soc. Symp. Proc.*, **430**, 453-458.
56. Rybakov, K.I., V.E. Semenov, S.A. Freeman, J.H. Booske and R.F. Cooper (1996). Study of microwave-driven currents in ionic crystals. *Mater. Res. Soc. Symp. Proc.*, **430**, 459-464.
57. Rybakov, K.I., V.E. Semenov, S.A. Freeman, J.H. Booske and R.F. Cooper (1997). Dynamics of microwave-induced currents in ionic crystals. *Phys. Rev. B.*, **55**, 3559-3567.
58. Booske, J.H., S.A. Freeman and R.F. Cooper (1997). Experimental and numerical studies of microwave heating of ceramics. In: *Strong Microwaves in Plasmas*, edited by A.G. Litvak, Nizhny Novgorod Univ. Press, Moscow, pp. 291-309.
59. Lee, J.A. and R.F. Cooper (1997). Internal friction/attenuation in a β -Spodumene glass-ceramic. *J. Am. Ceram. Soc.*, **80**, 2917-2928.
60. Booske, J.H., R.F. Cooper and S.A. Freeman (1997). Microwave enhanced reaction kinetics in ceramics. *Mater. Res. Innov.*, **1**, 77-84.
61. Cooper, R.F., D.R. Smith and G.B. Cook (1997). Dynamic oxidation and the structure and crystalline nucleation of aluminosilicate glasses and melts, in: *High-Temperature Materials Chemistry IX* (PV 97-39), edited by K.E. Spear, The Electrochemical Society, Pennington, NJ, pp. 389-396.
62. Booske, J.H., R.F. Cooper, S.A. Freeman, B. Meng, K.I. Rybakov and V.E. Semenov (1997). Thermal and nonthermal interactions between microwave fields and ceramics. *Ceram. Trans.*, **80**, 143-151.
63. Gribb, T.T. and R.F. Cooper (1998). A high-temperature torsion apparatus for the high-resolution characterization of internal friction and creep in refractory metals and ceramics: Application to the seismic-frequency, dynamic response of Earth's upper mantle. *Rev. Sci. Instrum.*, **69**, 559-564.
64. Gribb, T.T. and R.F. Cooper (1998). Low frequency shear attenuation in polycrystalline olivine: Grain boundary diffusion and the physical significance of the Andrade model for viscoelastic rheology. *J. Geophys. Res.*, **103**, 27,267-27,279.
65. Freeman, S.A., J.H. Booske and R.F. Cooper (1998). Modeling and numerical simulations of microwave-induced ionic transport. *J. Appl. Phys.*, **83**, 5761-5772.

Publications (continued):

66. Booske, J.H., R.F. Cooper, S.A. Freeman, K.I. Rybakov and V.E. Semenov (1998). Microwave ponderomotive forces in solid-state ionic plasmas. *Phys. Plasmas*, **5**, 1664-1670.
67. Booske, J.H., R.F. Cooper, S.A. Freeman and K.R. Binger (1998). Enhancement of ionic diffusion by microwave-field-induced ponderomotive forces at physical interfaces. *Mater. Res. Soc. Symp. Proc.*, **527**, 525-532.
68. Booske, J.H., R.F. Cooper and K.R. Binger (1998). Measuring temperature profiles in microwave-heated ceramic powder compacts. *Proc. 1998 IEEE Int'l. Conf. Plasma Sci.*, IEEE, Piscataway, NJ, pp.291-297.
69. Cook, G.B. and R.F. Cooper (1999). Redox dynamics in the float-processing of glasses I: Reaction between undoped and iron-doped borosilicate glassmelts and a gold-tin alloy. *J. Non-Crys. Solids*, **249**, 210-227.
70. Booske, J.H., R.F. Cooper, K. Ruffer and S.A. Freeman (1999). Measurements of internal temperature profiles in microwave-sintered ceramics using localized spinel-formation reactions. *Proc. 7th Int'l. Conf. on Microwave and RF Heating*, edited by J.M. Catala-Civera *et al.*, Servicio de Publicaciones UVP, Valencia, Spain, pp. 407-410.
71. Cook, G.B. and R.F. Cooper (2000). Iron concentration and the physical processes of dynamic oxidation in an alkaline earth aluminosilicate glass. *Am. Mineral.*, **85**, 397-406.
72. Liu, H.L., S.S. Gearhart, J.H. Booske and R.F. Cooper (2000). Recoil implantation method for ultrashallow p(+)/n junction formation. *J. Appl. Phys.*, **87**, 1957-1962.
73. King, T.T., W. Grayeski and R.F. Cooper (2000). Thermochemical reactions and equilibria between fluoromicas and silicate matrices: A petromimetic perspective on structural ceramic composites. *J. Am. Ceram. Soc.*, **83**, 2287-2296.
74. Gribb, T.T. and R.F. Cooper (2000). The effect of an equilibrated melt phase on the shear creep and attenuation behavior of polycrystalline olivine. *Geophys. Res. Lett.*, **27**, 2341-2344.
75. Smith, D.R., and R.F. Cooper (2000). Dynamic oxidation of a Fe²⁺-bearing calcium-magnesium-aluminosilicate glass: The effect of molecular structure on chemical diffusion and reaction-morphology. *J. Non-Crys. Solids*, **278**, 145-163.
76. Nair, B.G., R.F. Cooper, J.N. Almquist and M.E. Plesha (2001). Off-axis creep of a ceramic-matrix/continuous-ceramic-fiber composite: Experimental Evaluation. *J. Mater. Sci.*, **36**, 2133-2144.
77. Nair, B.G., R.F. Cooper and M.E. Plesha (2001). High-temperature creep of a bi-directional, continuous-SiC-fiber-reinforced glass-ceramic composite. *Mater. Sci. Engr. A*, **A300**, 68-79.
78. Thompson, K., J.H. Booske, Y.B. Gianchandani, R.F. Cooper, Y. Bykov, A. Ereemeev and I. Plotnikov (2001). Electromagnetic induction heating for cold wall rapid thermal processing, in: *Proc. 9th Int'l. Conf. on Adv. Thermal Process. Semiconductors—RTP 2001*, IEEE Publications, New York, 190-196.
79. Cook, G.B. and R.F. Cooper (2001). Redox dynamics in the high-temperature float-processing of glasses II: Reaction between undoped and iron-doped aluminoborosilicate glassmelts and a gold-germanium alloy. *J. Non-Crys. Solids*, **283**, 34-46.
80. Nair, B.G., R.F. Cooper, D.F. Bruhn and D.L. Kohlstedt (2001). High-temperature rheology of calcium aluminosilicate (anorthite) glass-ceramics under uniaxial and triaxial loading. *J. Am. Ceram. Soc.*, **84**, 2617-2624.
81. Thompson, K., J.H. Booske, D.F. Downey, Y.B. Gianchandani and R.F. Cooper (2001). RF and microwave annealing for ultra-shallow junction formation, in: *Rapid Thermal and Other Short-Time Processing Technologies II* (PV 2001-9), edited by D. L. Kwong *et al.*, The Electrochemical Society, Pennington, NJ, pp. 121-128.

Publications (continued):

82. Thompson, K., J.H. Booske, R.F. Cooper and Y.B. Gianchandani (2001). Temperature measurement in microwave-heated silicon wafers. *Ceram. Trans.* **111**, 391-398.
83. Thompson, K., Y.B. Gianchandani, J.H. Booske and R.F. Cooper (2001). Si-Si bonding using RF and microwave radiation, in *Proceedings of the 11th International Conference on Solid-State Sensors and Actuators*, Munich, FRG.
84. Mendybaev, R.A., J.R. Beckett, L. Grossman, E. Stolper, R.F. Cooper and J.P. Bradley (2002). Volatilization kinetics of silicon carbide in reducing gases: An experimental study with applications to the survival of presolar grains in the solar nebula. *Geochim. Cosmochim. Acta.*, **66**, 661-682.
85. Thompson, K., Y.B. Gianchandani, J.H. Booske and R.F. Cooper (2002). Direct Si-Si bonding by electromagnetic induction heating. *J. MEMS.*, **11**, 285-292.
86. Thompson, K., J.H. Booske, Y.B. Gianchandani and R.F. Cooper (2002). Electromagnetic annealing for the 100-nm technology node. *Elect. Device Lett.*, **23**, 127-129.
87. Thompson, K., J.H. Booske, R.F. Cooper and Y.B. Gianchandani (2002). Electromagnetic induction heating for the 70-nm node. *Mater. Res. Soc. Symp. Proc.*, **717**, 15-20.
88. Cooper, R.F. (2002). Seismic wave attenuation: Energy dissipation in viscoelastic crystalline solids, in: *Plastic Deformation of Mineral and Rocks; Reviews in Mineralogy and Geochemistry Vol. 51*, edited by S.-i. Karato and H.-R. Wenk, Mineralogical Society of America, Washington, pp. 253-290.
89. O'Keefe, R.R., R.W. Carpick, R.F. Cooper, W.J. Drugan and D.S. Stone (2002). Oxide nanocomposites for MEMS applications, in *Proceedings of the VIII International Congress on Experimental and Applied Mechanics (Society for Experimental Mechanics)* (Milwaukee, WI), pp. 160-164.
90. McMillan, K.M., R.S. Lakes, R.F. Cooper and T. Lee (2003). The viscoelastic behavior of β -In₃Sn and the nature of the high-temperature background. *J. Mater. Sci.*, **38**, 2747-2754.
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Ningli Zhao, Ph.D. Geophysics (2021), Dissertation: *The Role of Phase and Grain Boundaries on the Rheological Properties of Peridotite* (jointly supervised with Prof. J.G. Hirth)

Funded Research (2018-2023):

Grain and Phase Boundaries in Mantle Assemblages: Atom Probe and Electron Microscopy/Diffraction Approaches

National Science Foundation, Division of Earth Sciences, Program in Petrology and Geochemistry (EAR-1947439)

R.F. Cooper, Principal Investigator; S.W. Parman, Co-Investigator
01/01/2020–12/31/2023; \$514,000

An experimental (rock-deformation), observational (natural olivine-basalt clots) and theoretical analysis of chemical segregation to grain and phase boundaries and the impact of boundary structure on composition profiles, employing specialized transmission electron microscopy and atom probe tomography.

Attenuation and Flow/Relaxation in Ice-I and its Effect on Thermochemical Evolution of the Icy Satellites

NASA Program in Solar Systems Workings

R.F. Cooper, Principal Investigator
09/01/2016–08/31/2023; \$360,597

An experimental and theoretical study of the effect(s) of persistent plastic deformation on the attenuation and transient creep responses in polycrystalline ice and ice/salt-hydrate aggregates.

Funded Research (2018-2023)(continued):*Transient Creep in Peridotite with Application to Postseismic Relaxation*

National Science Foundation, Division of Earth Sciences, Program in Geophysics (EAR-1620474)

R.F. Cooper, Principal Investigator

09/01/2016–08/31/2019; \$244,198

An experimental and theoretical study of transient flow in both constant stress (creep) and stress-relaxation modes, with application to upper mantle relaxation following earthquakes as measured by geodetic techniques.

Rock Weathering on Venus: Experimental Constraints on Products and Kinetics of Basalt-Atmosphere Interactions

NASA Program in Solar Systems Workings

A.H. Treiman, University Space Research Association–Houston, Principal Investigator; R.F. Cooper, Co-Investigator (one of six)

02/01/18–09/30/21; \$73,500 (Brown Univ. Subcontract)

An experimental and analytical study of the reaction thermodynamics and kinetics of basaltic (and analog) magmas with sulfur- and carbon-rich gasses.

Collaborative Research: Community Facility Support: Facilitating Access and Innovation through a Collaborative Organization for Rock Deformation (CORD)

National Science Foundation, Division of Earth Sciences, Program in Instrumentation and Facilities (EAR-1833496; EAR-2054439)

G. Hirth, Principal Investigator; R.F. Cooper and T. Tullis, Co-Investigators (Brown University)

M. Peč, Principal Investigator; J.B. Evans, Co-Investigator (Massachusetts Institute of Technology)

09/01/2018-08/31/2020; \$271,164; Renewed 07/01/2021-06/30/2024; \$175,626 (Brown University portion)

Support for two technician-educators—one at Brown, one at MIT—to facilitate rock deformation experimentation, particularly in training/support of laboratory visitors, in apparatus maintenance, and in laboratory collaboration.

Experimental Constraints on Surface Weathering on Venus

NASA Program in Solar Systems Workings (80NSSC23K0561)

M. McCanta, Univ. Tennessee-Knoxville, Principal Investigator; R.F. Cooper, Co-Investigator (one of six)

02/06/2023-02/05/2026; \$165,957 (Brown University portion)

An experimental, analytical and theoretical study of the reaction thermodynamics and kinetics of basaltic (and analog) magmas with high-pressure/-temperature sulfur- and carbon-rich gasses.