

## **MIKE D. SUMPTION**

Professor  
Materials Science and Engineering Department  
The Ohio State University

### **Education**

**1981-1986:** The Ohio State University, Columbus, Ohio, USA

B.S. Physics (1981-1986)

**1986-1992:** The Ohio University, Athens, Ohio, USA

M.S. & PhD., Condensed Matter Physics (1986-1992)

### **Qualifications**

Mike Sumption received his PhD in condensed matter physics in 1992 from Ohio University while working in Battelle's Advanced Materials Department. He then formally joined Battelle, where he worked in the advanced materials, and subsequently engineering mechanics, departments. In 1995, he joined Ohio State University's Material Science and Engineering department, where he was first Sr. Research Associate, Adjunct Professor, and then Professor, and serves as the associate director of the Center for Superconducting and Magnetic Materials, as well as the Superconducting Technology Center. Dr. Sumption's background is in materials science and solid state physics. His area of research is materials physics with a concentration in superconductive, electronic, and magnetic materials, with particular interests in (i) MgB<sub>2</sub> materials, with a focus on formation as well as dopant-induced enhancements of the upper critical fields and the related structural and transport properties, (ii) phase formation and diffusion in the A15 system, (iii) nanoscale artificial pin structures in multilayer YBCO, (iv) the current limiting mechanisms in superconducting strands, (v) flux pinning and connectivity in Nb<sub>3</sub>Sn and MgB<sub>2</sub>, (vi) the study of energy loss due to flux motion in superconducting materials and the influence of composite structure, (vii) energy related electronic materials and applications, (viii), CNT, graphene, and metal/CNT-graphene composites.

Beyond these areas, Dr. Sumption's broad range of research interests have included a variety of topics, as represented below in graduate student theses, including (i) ternary and quaternary substitutions in the A15 structure of Nb<sub>3</sub>Sn and its effects on structure and properties, (ii) determination of the Nb-Al equilibrium phase diagram in the composition range 0-30 at.%Al in the vicinity of the liquidus, and (iii) FEM modeling of the hydrostatic extrusion and deformation of multi-element composites. As described below these studies typically rely on both microstructural and microchemical studies as well as electronic and magnetic properties characterization.

Mike Sumption has studied a wide variety of materials in film, bulk, and wire form, including low  $T_c$  superconductors; NbTi, Nb<sub>3</sub>Sn, Nb<sub>3</sub>Al, NbTiTa, high  $T_c$  superconductors; YBCO, Bi, and Tl-compounds, and intermediate  $T_c$  materials; MgB<sub>2</sub> and the oxypnictides. Low temperature electronic, magnetic, and superconducting property measurements are a strong focus of the work. This, coupled with structural and compositional studies (SEM/TEM, XRD) enable vital structure-to-properties correlations. Efforts in modelling have included stability in Nb<sub>3</sub>Sn

conductors and magnets, anisotropic continuum modeling of bridging and connectivity in superconducting composite structures, field modelling in coils, synergistic pinning in composites, AC loss in various conductors, and fault current limiter design. Materials studies have included rapid quenching and mechanical alloying in Nb<sub>3</sub>Al, proximity effects in NbTi, pinning and connectivity in MgB<sub>2</sub>, and the development of a new class of Nb<sub>3</sub>Sn strands.

Dr. Sumption's research has been funded by various organizations, including the US Department of Energy, Division of High Energy Physics, NASA, the Navy, AFOSR, NIH, NRC, the Ohio Department of Development, and private industry. A number of national and international collaborations are ongoing, with universities, national labs, and industry. Dr. Sumption more than 300 publications, and serves on the editorial board of *Cryogenics*.

### **Further Areas of Study**

- The use of ohmic heating and rapid quenching to form metastable bcc phases in the Nb-Al system.
- The study of the influence of various ternary additions to Nb-Sn and Nb-Al systems on phase formation and superconducting properties.
- Development of models of stability in high performance superconductive composites
- Demonstration of increased  $B_{c2}$  in MgB<sub>2</sub> bulks using a variety of C-bearing dopants, as well as Mg-site dopants.
- The use of mechanical alloying to reach the metastable (at room temperature) stoichiometric Al<sub>5</sub> phase of Nb<sub>3</sub>Al. Here the phase transformation and the creation of an amorphous phase was studied as a function of high energy ball milling.
- Formation of the higher borides of Mg
- Pnictides and other emerging superconducting materials

### **Journals:**

- International Editorial Board, *Cryogenics*, since 2003
- Referee for APL, SST, IEEE Trans. Appl. Supercond., Adv. Cryo. Eng, *Cryogenics*

**Awards:** Dr. Sumption received the award for best student paper from the ICMC Conference in 1993, and the Lumley Research Award, 2007 and 2014.

**Societies:** Member of the MRS, IOP, and APS

### **Activities/Service**

- Served on the panel for Basic Energy Sciences "Basic Research Needs for Superconductivity," Spring 2006.
- Active in the AC loss standardization activities of VAMAS (Versailles Agreements on Measurements and Standards) related to energy loss in superconducting materials.
- Promotion of AC loss collaboration with Japanese groups as part of an NSF travel grant program. Trip in 2002 to Yokohama National University and the University of Kagoshima (Japan). Trip in 2003 to Tsukuba (US-Japan workshop) and Tokyo (US-Japan AC Loss working group).

- Served on the Department of Energy's Annual Peer Review panel for the Superconductivity Program for Electric Systems, under the Office for Electricity Delivery and Energy Reliability, 2007, 2008, 2009.

### Other Service

- Program Chairman for the 2011 International Cryogenic Materials Conference, conference chair ICMC 2015, ICMC president 2015-2017.
- Applied Superconductivity conference 2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016, Program Committee and/or Editorial Board.
- Developed and taught a short course at the applied superconductivity conference in 2008 and 2010 on low temperature superconductors.
- US Japan Workshop on High  $T_c$  Superconductors, served on organization committee, 2001, 2003, 2005.
- Served as a member of the review panel for the DOE review of the Superconducting Magnet Program at Fermilab, March 2006.
- Served on a panel which held to discuss the future of MgB<sub>2</sub> applications at the Magnet Technology workshop in 2005.
- Served on the user committee for the National High Field Magnet Laboratory, 2009- (three year term)

### Visiting Scientists:

1. **Dong Kun**, Southeast University, Nanjing, China, Dec 2016-Dec 2017, working in AC Loss and magnetization in coated conductors and coated conductor cables
2. **Xiong Li**, Southeast University, Nanjing, China, 2015-2016, working on pnictide superconductors.
3. **Y. Ding**, Southeast University, Nanjing, China, 2012-2013, working on pnictide superconductors.
4. **M. Kunachova**: Assistant Professor, Kosice University, Slovakia. Several visits collaborating in the area of oxipnictide superconductors.
5. **Z. Shi**: Assistant Professor, Department of Physics, Southeast University, Nanjing, China. Spent 9 months in the lab (2007). Collaborated on microstructure and low temperature properties of MgB<sub>2</sub>.
6. **S. Al Hossain**: Materials Science Department, Institute for Superconducting and Electronic Materials, University of Wollongong, Australia. Spent 2 months in 2007, studied MgB<sub>2</sub>.
7. **S. Kawabata**: Assistant Professor, Electrical Engineering Department, Kagoshima University, Kagoshima, Japan. Spent one year in the lab (2005), collaborated on AC losses in superconductors.
8. **S. Takacs**: Senior Research Leader, Electrotechnical Institute, Bratislava, Slovakia, Spent 3 Months in 1996 on an NRC grant written as a collaboration on flux pinning.

### Publications

**Total Journal Articles:** 230+

**Total Publications:** 310+

**Citations:** 2245 (excluding self citations)

**Publication h-factor: 27**

### **Student Theses Supervised**

1. Eunguk Lee, *AC Loss in Superconducting Composites: Continuous and Discrete Models for Round and Rectangular Cross Sections, and Comparisons to Experiments*, PhD Thesis, 2004. Three published papers.
2. Xuan Peng, *Co-Deformation and Bonding of Multi-Component Billets with Application to Nb-Sn Base Superconductor Processing*, PhD Thesis 2005. Four published papers.
3. M. Bhatia, *MgB<sub>2</sub> Superconductors: Processing, Characterization and Enhancement of Critical Fields*, PhD Thesis 2007. Eighteen published papers.
4. R. Dhaka, *Sn and Ti Diffusion, Phase Formation, Stoichiometry, and Superconducting Properties of Internal-Sn-Type Nb<sub>3</sub>Sn Conductors*, MS Thesis, 2007. Two Published papers.
5. V. Nazareth, *Characterization of the Interdiffusion Microstructure, Al<sub>5</sub> Layer Growth and Stoichiometry in Tube-Type Nb<sub>3</sub>Sn Composites*, MS Thesis, 2008. Three published papers.
9. S. Bharitya, *Al<sub>5</sub> Stoichiometry and Grain Morphology in Rod-In-Tube and Tube Type Nb<sub>3</sub>Sn Strands; Influence of Strand Design, Heat Treatments and Ternary Additions*, M.S. Thesis, 2010. Two published papers.
10. Scot David Bohnenstiehl, *Thermal Analysis, Phase Equilibria, and Superconducting Properties In MgB<sub>2</sub> And Carbon Doped MgB<sub>2</sub>*, seven published papers.
11. Ashwini Chandra, *On the Mechanism of Niobium Electropolishing*, one published paper
12. Michael Adam Susner, *Influences of Crystalline Anisotropy, Doping, Porosity, and Connectivity on the Critical Current Densities of Superconducting Magnesium Diboride Bulks, Wires, and Thin Films*, PhD Thesis, 2012. Papers = 35.
13. Gunagze Li, *Connectivity, Doping, and Anisotropy in Highly Dense Magnesium Diboride (MgB<sub>2</sub>)*, PhD Thesis, 2015, twelve published papers
14. Xingchen Xu, *Prospects to Improve the Critical Current Density of Superconducting Nb<sub>3</sub>Sn strands*, PhD Thesis, 2016, nine published papers.
15. Hyun Sung Kim, *Experimental and Numerical Analysis of Hydroformed Tubular Materials for Superconducting Radio Frequency (SRF) Cavities*, PhD Thesis, 2016, four published papers.
16. Yang, *Influence of Chemical Doping on Microstructures and Superconducting Properties of MgB<sub>2</sub> Wires and Bulk Samples*, PhD Thesis, 2016, 11 published papers.

## Courses Developed/Taught

1. Junior level Undergraduate MSE lab (581.02, 3331, 3332): Jr level labs with topics like heat diffusion, mass diffusion, electrical conductivity, superconductivity.
2. Engineering 198. *Engineering, Manufacturing and Creation of Capital*, a survey type class introducing students to various speakers working in Industry and the role of Engineering in Industry.
3. Materials Science of Superconductivity: A course on the materials science and physics of superconductivity has been developed. MSE 794X, given in Spring of 2016 as 6193, and now a permanent course as 6295, this course is aimed primarily at graduate students, but accessible to those of various backgrounds, presents an integrated picture of the materials and physics of superconductors. The focus of the course is on materials of strong interest (either practical or scientific). **Text:** Tinkham with extensive supplementary materials
4. Energy Materials (MSE 5572); Materials for energy use and application. Topics include photovoltaic, thermoelectric, LED, nuclear, superconducting, magnetic, fuel cells, and batteries.
5. Electronic Ceramics (MSE 5571); Ceramic materials, ferromagnetic, ferroelectric, thermoelectric, pyroelectric, dielectric, and optical properties.
6. Sr level Laboratory (MSE 5532) in Electronic materials: metallic semiconducting, magnetic, ionic materials.
7. Materials selection (MSE 4181). Approach to the choice of Materials, shape factors, hybrid design, and processing for various applications

## Interaction with Universities, National Labs, and Industry

Dr. Sumption has had a significant number of direct interactions with universities, national labs, and industry. A **longstanding collaboration** is in place with the low temperature group of the University of Twente, Netherlands (15 years – AC loss in cables). A similarly long collaboration is ongoing with Berkeley National Laboratory (15+ years – AC loss in cables). Interactions (15 years) with S.X. Dou from the materials department at the University of Wollongong, Australia have included Bi<sub>2</sub>Te<sub>3</sub>, and MgB<sub>2</sub> as topics. Also, there has been a strong collaboration with the Wright Patterson based AFRL group working on superconducting materials (PLD YBCO, 6 years). **Recently initiated collaborations include;** Fermilab (3 years – cable stability), the University of Cambridge (Driscoll, MgB<sub>2</sub>, Coombs, MgB<sub>2</sub>), the Institute for Superhard Materials, Ukraine (Prikhna, MgB<sub>2</sub>), the University of Birmingham, UK (Mikheenko, MgB<sub>2</sub>), the University of Manchester, UK (S. Smith, EE, Fault current limiters), and the Physics Department of the Southeast University of China (Pnictides). **Past collaborations have included:** U. Pittsburgh (USA-Bi-materials), University of Houston (USA-YBC), CSIRO (Australia-thin films), KEK National Laboratory for High Energy Physics (Japan-AC loss in cables), NIST (USA-LTSC, VAMAS standards), Argonne (USA-BSCCO), NRIM (Japan-VAMAS round robins and Nb<sub>3</sub>Al processing), the Electrotechnical Institute (Bratislava, Slovakia – Synergistic pinning effects), Yamaguchi University (Japan-Nb<sub>3</sub>Al studies), the Tsukuba Magnet Laboratory (Japan – Nb<sub>3</sub>Al), and the Atom-Institute (Austria – Nb<sub>3</sub>Al and MgB<sub>2</sub>). **Industrial collaborators have included:** IGC-Advanced Superconductors (USA-BSCCO, Nb<sub>3</sub>Al, Nb<sub>3</sub>Sn, NbTi, NbTiTa), Plastronics (USA-BSCCO), Supercon (USA-Nb<sub>3</sub>Al), Microcoating Technology (USA-Bi-materials and coatings),

Oxford Superconductors (USA -- Bi-materials and coatings) Innovare (USA-Nb<sub>3</sub>Al), Ceram Physics (YBCO), Supergenics (Nb<sub>3</sub>Sn), Supramagnetics (Nb<sub>3</sub>Sn and Bi-2212), Seimens, Rolls Royce (Fault current limiters). Dr. Sumption has had a particularly strong and effective collaboration with the locally based Hyper Tech Research (USA – Nb<sub>3</sub>Al, Nb<sub>3</sub>Sn), and was associated with its start up.

***Patents***

1. U.S. Patent Application No. 13/813,060 FAST-CYCLING, CONDUCTION-COOLED, QUASI-ISOTHERMAL, SUPERCONDUCTING FAULT CURRENT LIMITER Pub. No.: WO/2012/016202 International Application No.: PCT/US2011/045994 Publication Date: 02.02.2012 International Filing Date: 29.07.2011
2. US Patent Application 15792961.3-1354, SUPERCONDUCTING WIRES AND METHODS OD MAKING THEREOF, PCT/US2015016431

## JOURNAL PUBLICATIONS

1. E.W. Collings, K.R. Marken, Jr., and M.D. Sumption, "Interfilament and Intrafilament Magnetizations in Fine-Filament Composite Strands for Precision-Dipole Magnet Applications", *Cryogenics* **30**, 48-55, (1990).
2. M.D. Sumption, K.R. Marken, Jr., and E.W. Collings, "Hysteretic Surface Effects in Multifilamentary NbTi Wires Exposed to Transverse Applied Fields", *IEEE Trans. Appl. Magn.* **27**, 2166-2169 (1991).
3. M.D. Sumption, K.R. Marken, Jr., and E.W. Collings, "Position and Amplitude of Proximity Effect Peaks in the Magnetization Curves of NbTi/Cu and NbTi/CuMn Multifilamentary Strands, *IEEE Trans. Magn.* **27**, 1129-1132 (1991).
4. K.R. Marken, A.J. Markworth, M.D. Sumption, E.W. Collings, and R.M. Scanlan, "Eddy-Current Effects in Twisted and Wound SSC Strands, *IEEE Trans. Magn.* **27**, 1791-1795 (1991).
5. E.W. Collings, K.R. Marken, Jr., M.D. Sumption, G. Iwaki, and S. Sakai, "Design, Fabrication, and Properties of Magnetically Compensated SSC Strands, *IEEE Trans. Magn.* **27**, 1787-1790 (1991).
6. E.W. Collings and M.D. Sumption, "Advanced Strand Design for Precision DC-Field and Ramp-Field Magnets, *IEEE Trans. Magn.* **28**, 156-159 (1992).
7. E.W. Collings and M.D. Sumption, "AC Loss and Transverse Resistivity in Multifilamentary Strands with Matrices of Cu and CuMn", *Cryogenics* **32** 585-588 (1992).
8. E.W. Collings, M.D. Sumption, and W.J. Carr, Jr., "Hysteretic Method of Lower Critical Field Determination in High  $T_c$  Superconductors", *Supercond. Sci. Technol.* **5** S248-255 (1992).
9. M.D. Sumption, D.S. Pyun, and E.W. Collings, "Transverse and Longitudinal Resistivities in NbTi Multifilamentary Strands with Cu and CuMn Matrices", *IEEE Trans. Appl. Supercond.* **3** 859-862 (1993).
10. M.D. Sumption, K.R. Marken, Jr., and E.W. Collings, "Enhanced Static Magnetization and Creep in SCC-Type Strands via Cable and Twist Pitch Assisted Proximity Effects", *IEEE Trans. Appl. Supercond.* **3** 751-756, (1993).
11. M.D. Sumption and E.W. Collings, "Innovative Strand Design for Accelerator Magnets", *Int. J. Mod. Phys. A (Proc. Suppl.)* **2B**, 662-664 (1993).
12. M.D. Sumption and E.W. Collings, "Influence of Twist-Pitch and Sample Length on Proximity Effect Coupling in Multifilamentary Composites Described in Terms of a Field-Independent, Two-Current-Region Model", *Cryogenics* **34**, 491-505 (1994).
13. M.D. Sumption and E.W. Collings, "Influence of Ni Additions on the Low Temperature Magnetic Properties of A Cu-1%Ni Alloy", *J. Appl. Phys.* **76** 7461 (1994).
14. M.D. Sumption and E.W. Collings, "Creep in Superconductive Composites with Anisotropic Pinning Potentials", *J. Appl. Phys.*, **76** 4766 (1994).
15. M.D. Sumption, "Calculation of the Magnetization of Anisotropic Superconductors with Cylindrical Geometry in Transverse Fields", *Applied Superconductivity* **2** 41-46 (1994).
16. M.D. Sumption and E.W. Collings, "Chromium Diffusion into Plated NbSn Strands Deduced From Electrical Resistivity Measurement", *IEEE Trans. Appl. Supercond.* **5** 1925-1928 (1995).

17. M.D. Sumption, H.H.J. Tenkate, R.M. Scanlan, and E.W. Collings, "Contact Resistance and Cable Loss Measurement of Coated Strands and the Cables Wound From Them", *IEEE Trans. Appl. Supercond.* **5** 692-696 (1995).
18. E.W. Collings and M.D. Sumption, "Materials Selection for Ferromagnetic Compensation in Accelerator Magnets", *IEEE Trans. Appl. Supercond.* **5** 408-411 (1995).
19. M.D. Sumption and E.W. Collings, "A Comparison of AC Loss, Magnetization,  $H_r$ , and  $U_0$  for Bi:2212 Wires, Crystals, and Melt Grown Samples, *Applied Superconductivity* **3**, 521-533 (1995).
20. E.W. Collings, M.D. Sumption, K. Itoh, H. Wada, and K. Tachikawa, "Report on the Second VAMAS AC Loss Round Robin -- Magnetization Measurement of Low-Frequency Hysteretic Loss", *IEEE Trans. Appl. Supercond.* **5** 540-544 (1995).
21. E. Gregory, E.A. Gulko, T. Pyun, M.D. Sumption, and E.W. Collings, "Dual Barrier for the Suppression of Residual Resistance Degradation in Chrome-Plated Niobium-Tin Strands", *IEEE Trans. Appl. Supercond.* **5** 1921-1924 (1995).
22. E.W. Collings and M.D. Sumption, "Stability and AC Losses in HTSC/Ag Multifilamentary Strands", *Applied Superconductivity* **5** 551-557 (1995).
23. L.R. Motowidlo, G. Galinsky, G. Ozeryansky, W. Zhang, E.E. Hellstrom, M.D. Sumption, and E.W. Collings, "The Influence of Filament Size and Atmosphere on the Microstructure and  $J_c$  of Round Filament  $\text{Bi}_2\text{Sr}_2\text{Ca}_1\text{Cu}_2\text{O}_x$  Wires", *IEEE Trans. Applied Supercond.* **5** 1162 (1995).
24. M.D. Sumption and E.W. Collings, "A Model for Bridging and Coupling in Superconductors", *Physica C* **261** 245-258 (1996).
25. M.D. Sumption and E.W. Collings, "Anomalous Magnetic Properties and Proximity Effect Coupling in VAMAS Strands, *Cryogenics* **37** 165-170 (1997).
26. E.W. Collings, M.D. Sumption, K. Itoh, H. Wada, and K. Tachikawa", "Second VAMAS AC Loss Measurement Intercomparison: Magnetization Measurement of Low-Frequency (Hysteretic) AC Loss in NbTi Multifilamentary Strands", *Cryogenics* **37** 49-60 (1997).
27. E.W. Collings, M.D. Sumption, S.W. Kim, M. Wake, T. Shintomi, A. Nijhuis, H.H.J. Ten Kate, and R.M. Scanlan, "Suppression and Control of Coupling Currents in Stabrite-Coated Rutherford Cable With Cores of Various Materials and Thicknesses", *IEEE Trans. Appl. Supercond.* **7** 962-966 (1997).
28. M.D. Sumption, and E.W. Collings, "Effect Current Strengths in NbTi Multifilamentary Samples with and without Nb Barriers and Processed Under Various Conditions", *IEEE Trans. Appl. Supercond.* **7** 1117-1121 (1997).
29. M.D. Sumption, E.W. Collings, E. Gulko, T. Pyon, and E. Gregory, "Analysis of Optically and Magnetically Determined Bridging in Internal-Tin Process  $\text{Nb}_3\text{Sn}$  Strands, *IEEE Trans. Appl. Supercond.* **7** 1368-1371 (1997).
30. M.D. Sumption, L.R. Motowidlo, and E.W. Collings, "Determination of the True (or Potential) Transport- $J_c$  of a Multifilamentary Bi-HTSC/Ag Strand in the Presence of Bridging and Generalized Sausaging", *Physica C* **291** 267-273 (1997).
31. M.D. Sumption, R.M. Scanlan, and E.W. Collings, "Coupling Current Control in Rutherford Cables Wound With NbTi,  $\text{Nb}_3\text{Sn}$ , and Bi:2212/Ag", *Physica C* **310** 291-295 (1998).
32. M.D. Sumption, S. Takacs, and E.W. Collings, "Modelling of  $M-H$  Loop Anomalies in Synergistically Pinned, Heterogeneous, Composite Superconductors", *Physica C* **306**



- 300-308 (1998).
33. M.D. Sumption, R.M. Scanlan, and E.W. Collings, "AC Loss Properties of Some Bi:2212/Ag Rutherford Cables and a Comparison of Those with Cables Wound with NbTi and Nb<sub>3</sub>Sn", *Cryogenics* **38** 1225-1232 (1998).
  34. M.D. Sumption and S. Takacs, "Flux Pinning in the Weak Layers of Superconducting Heterogeneous Structures", *Physica C* **316** 129-151 (1999).
  35. M.D. Sumption, E.W. Collings, R.M. Scanlan, A. Nijhuis, H.H.J. Ten Kate, S.W. Kim, M. Wake, and T. Shintomi, "Influence of Strand Surface Condition on Interstrand Contact Resistance and Coupling Loss in NbTi-Wound Rutherford Cables", *Cryogenics* **39** 197-208 (1999).
  36. F. Buta, M.D. Sumption, E.W. Collings, N. Harada, E. Gregory, and M. Tomsic, "Short Sample Quenching of Nb<sub>3</sub>Al Precursor Strand in Support of Reel-To-Reel Process Development", *IEEE Trans. Appl. Supercond* **9** 1433-1436 (1999).
  37. E. Gregory, M. Tomsic, F. Buta, M.D. Sumption, and E.W. Collings, "Process Development and Microstructures of Nb<sub>3</sub>Al Precursor Strand for Reel-To-Reel Production", *IEEE Trans. Appl. Supercond.* **9** 2692-2695 (1999).
  38. E.W. Collings, M.D. Sumption, R.M. Scanlan, D.R. Dietderich, and L.R. Motowidlo, "Low Coupling Loss Core-Strengthened Bi:2212/Ag Rutherford Cables", *IEEE Trans. Appl. Supercond.* **9** 758-761 (1999).
  39. M.D. Sumption, E.W. Collings, and E. Gregory, "Low Field Flux Jumping in High Performance Multifilamentary Nb<sub>3</sub>Al and Nb<sub>3</sub>Sn Composite Strands", *IEEE Trans. Appl. Supercond.* **9** 1455-1458 (1999).
  40. M.D. Sumption, E.W. Collings, R.M. Scanlan, A. Nijhuis, and H.H.J. Tenkate, "Core Suppressed AC Loss and Strand-Moderated Contact Resistance in a Nb<sub>3</sub>Sn Rutherford Cable", *Cryogenics* **39** 1-12 (1999).
  41. E.W. Collings, M.D. Sumption, R.M. Scanlan, D.R. Dietderich, L.R. Motowidlo, R.S. Sokolowski, Y. Aoki, and T. Hasegawa, "Bi:2212/Ag-Based Rutherford Cables: Production, Processing, and Properties", *Supercond. Sci. Technol.* **12** 87-96 (1999).
  42. M.D. Sumption, E. Lee, and E.W. Collings, "Influence of Filamentary and Strand Aspect Ratios on AC Loss in Short, Untwisted Samples of HTSC and LTSC Superconducting Multifilamentary Composites", *Physica C* **337** 187-194 (2000).
  43. M.D. Sumption, E.W. Collings, A. Nijhuis, and R.M. Scanlan, "Coupling Current Control in Stabrite-Coated NbTi Rutherford Cables by Varying the Width of a Stainless Steel Core", *Adv. Cryo. Eng.* **46** 1043-1049 (2000).
  44. M.D. Sumption, R.M. Scanlan, A. Nijhuis, and E.W. Collings, "AC Loss and Contact Resistance in Copper Stabilized Nb<sub>3</sub>Al Rutherford Cables with and without a Stainless Steel Core", *IEEE Trans Appl. Supercond.* **10** 1196-1199 (2000).
  45. M.D. Sumption, E. Lee, S.X. Dou, and E.W. Collings, "Extraction of Matrix Resistivity from Short Samples of Superconducting Multifilamentary Composite Tapes: Influence of Strand Twist Pitch and Internal Structure", *Physica C* **335** 164-169 (2000).
  46. N. Harada, T. Nakano, M. Tsuda, T. Hamajima, F. Buta, E. Lee, M.D. Sumption, E.W. Collings, K. Tagawa, H. Moriai, T. Takeuchi, H. Wada, and K. Watanabe, "Superconducting Properties and Rapid Heating Condition in Transformed Jelly-Roll Nb<sub>3</sub>Al Multifilamentary Wires as a Function of Maximum Ohmic-Heating Temperature", *IEEE Trans. Appl. Supercond.* **11** 3611-3614 (2001).

47. F. Buta, M.D. Sumption, and E.W. Collings, "Studies for Processing Nb<sub>3</sub>Al Using a Rapid Ohmic-Heating and Quenching Method", IEEE Trans. Appl. Supercond. **11** 3980-3983 (2001).
48. E.W. Collings, M.D. Sumption, and E. Lee, "Magnetization as a Critical Defining Parameter for Strand in Precision Dipole Applications -- Implications for Field Error and F-J Stability", IEEE Trans. Appl. Supercond. **11** 2567-2570 (2001).
49. S.X. Dou, X.L. Wang, J. Horvat, D. Milliken, A.H. Li, K. Konstinov, E.W. Collings, M.D. Sumption, and H.K. Liu, "Flux Jumping and a Bulk-To-Granular Transition in the Magnetization of a Compacted and Sintered MgB<sub>2</sub> Superconductor", Physica C **361** 79-83 (2001).
50. M.D. Sumption, E. Lee, and E.W. Collings, "Analysis of Eddy Current AC Loss for Untwisted, Multifilamentary Superconducting Composites with Various Aspect Ratios", IEEE Trans. Appl. Supercond. **11** 2963-2966 (2001).
51. E.W. Collings and M.D. Sumption, "Transverse Resistivities an Untwisted HTSC Tapes at 4.2, 30, and 60 K", Physica C **357-360** 1153-1159 (2001).
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### BOOK CHAPTERS

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76. S. Bhartiya, M.D. Sumption, X. Peng, E. Gregory, M.J. Tomsic, D. Doll, and E. W. Collings, "Comparison of A15 Stoichiometry and Grain Morphology in Internal Sn and Tube Type Strands; Influence of Strand Design, HTs and Alloying", *Adv. Cryog. Eng.* **56** (2010) 175.
77. E.W. Collings, M.D. Sumption, M.A. Susner, D.R. Dietderich, E. Barzi, A.V. Zlobin, and A. Nijhuis, "Coupling-Current and Persistent-Current Magnetizations in Nb<sub>3</sub>Sn Rutherford Cables And Strands", *Adv. Cryog. Eng.* **56** (2010) 191.
78. M. D. Sumption, "Stability in Nb<sub>3</sub>Sn Conductors; Magnetic and Self-Field Instability Considerations at 4 K And 2 K", *Adv. Cryog. Eng.* **56** (2010) 199.
79. J. V. Marzik, R. C. Lewis, M. R. Nickles, D. K. Finnemore, J. Yue, M. Tomsic, M. Rindfleisch, M. D. Sumption, "Plasma Synthesized Boron Nano-Sized Powder For MgB<sub>2</sub> Wires", *Adv. Cryog. Eng.* **56** (2010) 295.
80. C. V. Varanasi, J. Reichart, J. Burke, H. Wang, M. Susner, M. Sumption, P.N. Barnes, "Second Phase (BaGeO<sub>3</sub>, BaSiO<sub>3</sub>) Nanocolumns in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> Films", *Adv. Cryog.*

- Eng. **56** (2010) 362.
81. M.G.T. Mentink, M.M.J. Dhalle, D.R. Dietderich, A. Godeke, W. Goldacker, F. Hellman, H.H.J. ten Kate, M.D. Sumption, M.A. Susner, “The effect of Ta and Ti additions on the strain sensitivity of bulk Niobium-Tin”, *Physics Procedia* 36 ( 2012 ) 491 – 496.

## CONFERENCE PROCEEDINGS

1. E.W. Collings, K.R. Marken, Jr., and M.D. Sumption, "Magnetization Studies of Multifilamentary Strands for Superconducting Supercollider (SSC) Applications -- Methods of Controlling Proximity-Effect Coupling and Residual Magnetization", Proceedings of the International Atomic Energy (IAEA) Symposium on Materials for Fusion and High Energy Physics 1989 -- IAEA-TECDOC-594 (1991).
2. M.D. Sumption and E.W. Collings, "Stability, Mechanical Considerations, and AC Loss in HTSC Monoliths, Coils, and Wires", Proc. of the 4<sup>th</sup> World Congress on Superconductivity, NASA , pp. 138 (1994).
3. M.D. Sumption, T.S. Luhman, M. Strasik, and E.W. Collings, "Magnetic and Microstructural Properties of Melt Grown YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>", Proceeding of the Sixth US-Japan Workshop on Superconductivity, Houston, Dec 6-7, (1993).
4. E.W. Collings and M.D. Sumption, "A Study of AC Losses in HTSC/Ag Multifilamentary Strands", Proc. 7<sup>th</sup> Us-Japan Workshop on High- $T_c$  Superconductors, Tsukuba, Japan, Oct 24-25, 1995.
5. M. D. Sumption, E. W. Collings, N.V. Vo, and S. X. Dou, "Eddy Current and Creep-Based Losses in CTFF-Type Bi:2223/Ag Multifilamentary Tapes", Proc. 16<sup>th</sup> ICEC/ICMC Conference, Ed. By T. Haruyama, T. Mitsui, and K. Yamafuji, (Elsevier Science Japan) pp. 1609-1612, (1997).
6. M.D. Sumption, E.W. Collings, M.V. Parish, W. Jingrong, and W.J. Carr, Jr., "Lower Critical Field Determination in Thick Rods of High- $J_c$  Melt-Processed YBCO", AIP Conf. Proc. on Superconductivity and its Applications **251**, 547-556 Ed. By Y.H. Kao, A.E. Kaloyeros, and H.S. Kwok, (1991).
7. E.W. Collings, F. Buta, M.D. Sumption, E. Gregory, and M. Tomsic, "Melt Quenched Nb<sub>3</sub>Al Processing and Properties", Proc. Workshop on Nb<sub>3</sub>Al Superconductor and its Applications, Tsukuba-Shi, Ibaraki, Japan, April 27, (1998).
8. M.D. Sumption and E.W. Collings, "Bridging in Superconductors", in Critical State in Superconductors, Ed. K. Tachikawa, K. Kitazawa, H. Maeda, T. Matsushita, World Scientific, Singapore, pp. 122-129, (1995).
9. H. Liu, S.X. Dou, M.D. Sumption and E.W. Collings, "Microstructure Development and Phase Transformation of Ag-Sheathed Bi:2223 Tapes", in Superconductivity and Superconducting Materials Technologies Ed. By P. Vincenzini (Techna Srl) pp. 287-292, (1995).
10. E.W. Collings, M.D. Sumption, S. Kim, M. Wake, and T. Shintomi, "Suppression of Eddy Current Loss in Bare-Copper Rutherford Cables Using Stainless Steel Cores of Various Thicknesses", Proc. 16<sup>th</sup> ICEC/ICMC Conference, Ed. by T. Haruyama, T. Mitsui, and K. Yamafuji, Elsevier Science Japan, pp. 1767-1770, (1997).
11. A. Chandra, G. S. Frankel and M. D. Sumption, "Electropolishing of Niobium to Obtain Defect Free Surfaces", Proceedings of SRF2011, Chicago, IL USA TUPO068.
12. D. Loder, R. Sanchez, M. Feddersen, K. Haran, M. Sumption, M.Tomsic, J. Yue, D. Doll, "A conduction cooled Nb<sub>3</sub>Sn racetrack coil: Design, Construction and Testing", 2016 IEEE Power and Energy Conference at Illinois (PECI) (IL USA Urbana 2016 Feb. 19 - 2016 Feb. 20).
13. M.D. Sumption, AC Loss of Superconducting Materials in Motors and Generators for Very High Density Motors and Generators for Hybrid-Electric Aircraft", 2018 AIAA/IEEE Electric

Aircraft Technologies Symposium, <https://doi.org/10.2514/6.2018-5001>

## PRESENTATIONS

Listed here are selected presentations at venues with no direct publications (e.g., workshops) from 2001.

1. M.D. Sumption, F. Buta, E.W. Collings, "Progress on Nb-Al in the US", the Low Temperature Superconductor Workshop, Nov 2001.
2. M.D. Sumption, X. Peng, and E.W. Collings "A Mechanical Alloying Route for Nb-Sn and Nb-Al Superconductors", the Low Temperature Workshop, Nov. 2001.
3. M.D. Sumption, F. Buta, E.W. Collings, "Progress in Nb-Al in the US", the Low Temperature Superconductor Workshop Nov., 2002
4. M.D. Sumption, X. Peng, E.W. Collings, "A15 Superconductors via a Mechanical Alloying Route", The Low Temperature Superconductor Workshop Nov., 2002
5. M.D. Sumption, E. Lee, E. Gregory, and E.W. Collings, "Magnetization Measurements of HEP Nb<sub>3</sub>Sn Strands", the Low Temperature Superconductor Workshop Nov., 2002.
6. M.D. Sumption, F. Buta, M. Tomsic, and E.W. Collings, "NbAl and MgB<sub>2</sub> Development in the US", *Invited Presentation* made to the Conference on New Materials, Tsukuba, Japan, Jan 2002.
7. M.D. Sumption and E.W. Collings, " $d_{eff}$  in Nb<sub>3</sub>Sn Strands", the Low Temperature Superconductor Workshop, Nov 2003.
8. M.D. Sumption, E.W. Collings, "Stabilities and Instabilities in High Current A15 strands", the Low Temperature Superconductor Workshop, Nov. 2003.
9. M.D. Sumption, E. Lee, E.W. Collings, "AC Losses in YBCO Conductors: a High Frequency Perspective, the US-Japan Workshop on High  $T_c$  Superconductors, Oct 2003.
10. M.D. Sumption and E.W. Collings, "Proposal for a Round Robin for AC Loss Measurements in YBCO Coated Conductors", at the VAMAS Versilles Agreement on Measurements and Standards, held in Tsukuba, Oct 2003.
11. M.D. Sumption, M. Tomsic, M. Bhatia, Y. Hascicek, S.X. Dou, E. W. Collings, "Magnesium Diboride Conductor Development at Hyper Tech Research", The US-Japan Workshop on High  $T_c$  Superconductors, Oct 2003.
12. M.D. Sumption, *Keynote*, "MgB<sub>2</sub> Applications in the US", SCEnet, Netherlands, 2004.
13. M.D. Sumption, and E.W. Collings, "Instability Measurements in High Performance Nb<sub>3</sub>Sn", Low Temperature Workshop, Nov 2004.
14. M.D. Sumption, "YBCO at High Frequencies for Air Force Applications", Workshop for Coated Conductors and Applications", NM, Nov. 2005.
15. M.D. Sumption, and E.W. Collings, M. Tomsic, "MgB<sub>2</sub>; Niche Application or New Conductor", *Panel Discussion*, Genoa, MT19, 2005.
16. M.D. Sumption, E.W. Collings, M. Tomsic, "MgB<sub>2</sub> at High Fields", The Low temperature Superconductor Workshop 2005.
17. M.D. Sumption, and E.W. Collings, "Stability and Instability in Nb<sub>3</sub>Sn Conductors", The Low Temperature Workshop 2005.
18. M.D. Sumption, and E.W. Collings, "Losses in YBCO Conductors", the US-Japan Workshop Madison WI, 2005.
19. M.D. Sumption, and E.W. Collings, "MgB<sub>2</sub> Conductor Development", the US-Japan Workshop Madison WI, 2005.
20. M.D. Sumption, and E.W. Collings, "Stability in High Performance Nb<sub>3</sub>Sn", Low



- Temperature Superconductor Workshop, Nov 2006.
21. M.D. Sumption, and E.W. Collings, "Phase formation in Tube-Type Nb<sub>3</sub>Sn Conductors", Low Temperature Superconductor Workshop, Nov 2006.
  22. M.D. Sumption, and E.W. Collings, "YBCO at High Frequencies for Air Force Applications", AFOSR Workshop Feb 2006
  23. M.D. Sumption, "AC Loss For YBCO Coated Conductor In Utility Power Applications", The Electric Power Research Institute Workshop, Sixth Annual EPRI Superconductivity Conference and Task Force Meeting, Columbus OH Sept 2006
  24. M.D. Sumption, "AC Loss in YBCO and MgB<sub>2</sub> Conductors: External Field loss, Transport losses, Influence of Magnetic Elements and Dynamic Resistance", *Invited Presentation, MRS Spring Meeting, 2007.*
  25. M.D. Sumption, "MgB<sub>2</sub> Superconducting Strands:  $B_{c2}$ ,  $B_{irr}$ , Doping, Connectivity, Phase Formation, Flux Pinning", MRS Spring Meeting, 2007.
  26. M.D. Sumption, "AC Loss for YBCO and MgB<sub>2</sub>", The US-Japan Workshop, Gifu, Japan, 2007.
  27. M.D. Sumption, "AC Loss For YBCO and MgB<sub>2</sub> for Various Applications – i.e. How bad is YBCO? When is (round) MgB<sub>2</sub> needed?", *Invited talk at the International Symposium on Superconductivity, Tsukuba, Japan*, Nov 2007.
  28. M.D. Sumption, "AC Loss for YBCO and MgB<sub>2</sub> for Various Applications – i.e. How bad is YBCO? When is (round) MgB<sub>2</sub> needed?", The European Applied Superconductivity Conference, Belgium, Sept 2007.
  29. M.D. Sumption, "YBCO Loss Measurements and Analysis for AFRL needs", AFRL Review, San Francisco, CA, April 15-16, 200
  30. M.D. Sumption, "Stability in Nb<sub>3</sub>Sn -- Explicit Functional Dependence of  $J_s$  on  $d_{eff}$  and RRR, Local RRR Degradation, Adiabatic considerations", The Low Temperature Superconductor Workshop, Lake Tahoe, 2007.
  31. M.D. Sumption, "Phase Formation and Performance Potential in Tube-Type Nb<sub>3</sub>Sn", The Low Temperature Superconductor Workshop, Lake Tahoe, 2007
  32. M.D. Sumption, "Effects of Simultaneous Titanium and Tantalum Additions on The Properties of Internal - Tin Type Nb<sub>3</sub>Sn Strands", The 20<sup>th</sup> International Conference on Magnet Technology, Philadelphia PA, 2007.
  33. M.D. Sumption, "MgB<sub>2</sub> Superconducting Strands:  $B_{c2}$ ,  $B_{irr}$ , Doping, Connectivity, Phase Formation, Flux Pinning", APS March meeting, New Orleans, 2008.
  34. M.D. Sumption, "Thermal diffusion and Quench Propagation in YBCO Coils with ZnO-Based Insulations", AFRL Review, San Francisco, CA, April, 2008
  35. M.D. Sumption, "Stability in Nb<sub>3</sub>Sn -- Explicit Functional Dependence of  $J_s$  on  $d_{eff}$  and RRR, Local RRR Degradation, Adiabatic considerations", Presentation at the Workshop on Accelerator Magnet Design and Optimization, CERN, Geneva, Switzerland, 200
  36. M.D. Sumption, "Transport, flux pinning, and connectivity in MgB<sub>2</sub>", *Invited Presentation, NIMS Week, Tsukuba, Japan*, June 2008
  37. M.D. Sumption, "Homogeneity and Connectivity of Doped MgB<sub>2</sub> Bulks and Strands as Probed by  $C_p$  and Current Transport", APS March meeting, Pittsburgh, 2009.
  38. M.D. Sumption, "MgB<sub>2</sub> Materials and Applications", Southeast University, Nanjing, China, Oct, 2009
  39. M.D. Sumption, "Losses in YBCO Strands/Cables and Quench in YBCO Coils", Shanghai University, Oct 2009.

40. M.D. Sumption, "Losses in YBCO Strands/Cables and Quench in YBCO Coils", 9<sup>th</sup> European Applied Superconductivity Conference, Dresden, Germany, Sept 2009.
41. M.D. Sumption, M. Susner, S. Bhonenstiel, E.W. Collings, "Flux Pinning, Homogeneity, and Connectivity of Doped MgB<sub>2</sub> Bulks and Strands", The International Cryogenic Materials Conference, Tuscon , AZ, Aug 2009.
42. M.D. Sumption, "Stability in Nb<sub>3</sub>Sn Conductors; Magnetic and Self Field Instability Considerations at 4 K And 2 K", The International Cryogenic Materials Conference, Tuscon , AZ, Aug 2009.
43. M.D. Sumption, "Stability in Nb<sub>3</sub>Sn Conductors; Magnetic and Self Field Instability Considerations at 4 K And 2 K", The Low Temperature Superconductor Workshop, Nov, 2009.
44. M.D. Sumption, "Flux Pinning, Homogeneity, and Connectivity of Doped MgB<sub>2</sub> Bulks and Strands", The Materials Research Society Meeting, San Francisco, April 2009.
45. M.D. Sumption, T. J. Haugan, P. N. Barnes, T. A. Campbell, N. A. Pierce, C. Varanasi, M. Susner, "Influence of Artificial Nanostructure Pinning on the Critical Current Density in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> Thin Films", The Materials Research Society Meeting, San Francisco, April 2009
46. M.D. Sumption, "Model Superconducting Helical Undulators Wound from Wind and React MgB<sub>2</sub> and Nb<sub>3</sub>Sn Conductors", The 21<sup>st</sup> International Magnet Technology Conference, Heifei, China, Oct 2009.
47. **Invited:** M.D. Sumption, "Loss and Stability Issues for YBCO and MgB<sub>2</sub> in Motors/Generators -- a Simplified Look", NASA Workshop on Distributed Turboelectric Propulsion for Large Transport Aircraft, Cleveland OH, February 10-11, 2009
48. M.D. Sumption, "Superconductivity, Superconductors, and Energy Needs", ENCOMM, The Ohio State University, Spring 09.
49. M.D. Sumption, "OSU-FNAL Collaboration Presentation", Fermilab, Summer 09.
50. M.D. Sumption. S. Bhartiya, E.W. Collings, "Comparisons of Sn-Stoichiometry and Performance in RIT and Tube Conductors, Influence of Sn Level and Ti", The Low Temperature Superconductor Workshop, Nov, 2009.
51. M. D. Sumption, M. Kanuchova, M. Majoros, M. Susner, C. Myers, E.W. Collings, "Properties of SmFeAsO<sub>1-x</sub> F<sub>x</sub> Type Oxypnictide Bulks and Wires Made via Several Routes", APS March meeting, Portland, Oregon, 2010.
52. M.D. Sumption, M. Majoros, and E.W. Collings, "Essential Considerations and Basic Estimations for MgB<sub>2</sub> Based Fault Current Limiters", Applied Superconductivity Conference, Washington DC, Aug 2010.
53. M.D. Sumption, "Stability in Nb<sub>3</sub>Sn Conductors; Magnetic and Self Field Instability Considerations at 4 K And 2 K", Applied Superconductivity Conference, Washington DC, Aug 2010.
54. M.D. Sumption, M. Majoros, and E.W. Collings, "System Optimization Calculations for a AC, Pulse, or Ramp DC YBCO Cable with Conduction or Gas Cooling", Applied Superconductivity Conference, Washington DC, Aug 2010.
55. M.D. Sumption, M. Susner, C. Kovacs, M. Border, D. Putnam, and E.W. Collings, "Transport, Magnetic, and Microstructure Studies for Rod-In-Tube and Tube Type Nb<sub>3</sub>Sn Strands Optimized for Different Operational Regimes", Applied Superconductivity Conference, Washington DC, Aug 2010.

56. M.D. Sumption, D. Putnam, M. Susner, C. Kovacs, M. Border, and E.W. Collings, "Stoichiometry and Morphology studies of the microstructures of Tube Type Nb<sub>3</sub>Sn Strands", Applied Superconductivity Conference, Washington DC, Aug 2010.
57. M.D. Sumption, M. Susner, S. D. Bohnenstiehl, Y. Yang, S. Dregia, "Phase Formation in MgB<sub>2</sub>, and the Influence of Density and Connectivity on a Transport--Magnetic Measurement Bifurcation", CIMTEC 2010, Montecatini Terme, Italy, July 2010.
58. **Invited:** M.D. Sumption, "Superconducting Materials for Application", The University of Houston and the TcSUH center, July 2010.
59. M.D. Sumption, "Anisotropic Connectivity and its Influence on Critical Current Densities, Irreversibility Fields, and Flux Creep in in-situ Processed MgB<sub>2</sub> Strands", The Materials Research Society Meeting, San Francisco, April 2010
60. **Invited:** M.D. Sumption, "M. D. Sumption, M. Majoros, and E.W. Collings"YBCO Conductors for HEP applications", MS&T, Oct 17-21, Houston TX.
61. M.D. Sumption, MgB<sub>2</sub> for Accelerator Applications, LTSW 2010
62. M.D. Sumption, "Quench Aspects of YBCO at 4 K" Post LTSW 2010 Program".
63. M.D. Sumption, "Superconducting Materials for Application – Focus Nb<sub>3</sub>Sn Undulators", Argonne Advanced Photon Source, Dec 2011.
64. M.D. Sumption, Contact Resistance, Current Sharing, Coupling Currents, and Magnetization for Coated Conductor Roebel Cables for HEP Applications, The Low Temperature Superconductor Workshop, Providence RI, Nov 7-9, 2011.
65. M.D. Sumption, "Current Sharing and AC Losses in Coated Conductor Roebel Cables – HEP Applications", European Applied Superconductivity Conference, Den Haag, Netherlands, Sept 2011.
66. M.D. Sumption, "Evidence of the Presence of Surface Film while Niobium Electropolishing", International Cryogenic Materials Conference, Spokane, WA, June 13-17, 2011.
67. M.D. Sumption, "Materials, Strands, and Cables for Superconducting Accelerator Magnets", 2011 General Accelerator Development Peer Review, Argonne, IL, Jan 2011.
68. M.D. Sumption, M. Majoros, and E.W. Collings, "FEM Studies of AC Loss During Charge and Discharge of a SMES Coil made with CORC (YBCO based) cable", 2012 Applied Superconductivity Conference, Portland, Oregon
69. M.D. Sumption, M. Majoros, and E.W. Collings, "Contact Resistance, Current Sharing, Coupling Currents, and Magnetization for Coated Conductor Roebel Cables and CORC cables for HEP Applications", 2012 Applied Superconductivity Conference, Portland, Oregon
70. M.D. Sumption, X. Xu, and E.W. Collings, "Studies of Sn limits in Nb<sub>3</sub>Sn Conductors of Several Types", Low Temperature Superconductor Workshop, Napa Valley, CA, Nov 5-7, 2012
71. M.D. Sumption, M. Majoros, E.W. Collings, "Contact Resistance, Current Sharing, Coupling Currents, and Magnetization for Coated Conductor Roebel Cables and CORC cables for HEP Applications", Low Temperature Superconductor Workshop, Napa Valley, CA, Nov 5-7, 2012
72. M.D. Sumption, E.W. Collings, A. Chandra, G.S. Frankel, "On the Mechanism of Niobium Electropolishing: Some effects of Gravity and Geometry", 7th SRF Materials Workshop July 16-17, 2012 Thomas Jefferson National Accelerator Facility Newport News, VA
73. M.D. Sumption, Cables for HEP Applications, MAP Meeting, Fermilab, May 2012.
74. M.D. Sumption, M. Susner, S. Bohnenstiehl, and E.W. Collings, "Multilayer Structures in MgB<sub>2</sub> Superconducting thin Films; Doping Pinning, Connectivity", The 2012 APS March

- Meeting, Boston MA.
75. M.D. Sumption, A. Chandra, G. Frankel, E.W. Collings, "On the Mechanism of Niobium Electropolishing: Some effects of Gravity and Geometry, 2013 International Cryogenic Materials Conference, Anchorage, Alaska
  76. M.D. Sumption, X. Xu, C. Kovacs, X. Peng, and E.W. Collings, "Influences of heat treatment and Ti addition on high performance Rod-in-Tube (Nb,Ta)<sub>3</sub>Sn Strands", 2013 International Cryogenic Materials Conference, Anchorage, Alaska
  77. M. D. Sumption, H. Kim, M. A. Susner, and E. W. Collings, "Mechanical properties of niobium tube with tube bulge test for SRF cavities", 2013 International Cryogenic Materials Conference, Anchorage, Alaska
  78. M.D. Sumption, M.A. Susner, Y. Yang, S.D. Bohnenstiehl, and E.W. Collings, "Zr- and C-doping in MgB<sub>2</sub> Bulks and thin Films", 2013 International Cryogenic Materials Conference, Anchorage, Alaska
  79. M.D. Sumption, G Li, Y Yang, M. Susner, C. Myers, C. Kovacs, E.W. Collings, "Advances in AIMI "Second Generation" MgB<sub>2</sub> Wires, *n*-values, and Coils", 2013 International Cryogenic Materials Conference, Anchorage, Alaska
  80. M.D. Sumption, G Li, Y Yang, M. Susner, E.W. Collings, "Critical Current Density of Multifilamentary Second Generation MgB<sub>2</sub> Wires", Electronic Materials and Applications, Jan 2013, Orlando, Florida
  81. M.D. Sumption, G Li, Y Yang, M. Susner, E.W. Collings "Influences of Doping, Porosity, and Anisotropy on the Critical Currents of Magnesium Diboride Wires", 2013 International Cryogenic Materials Conference, Anchorage, Alaska
  82. M.D. Sumption, "Magnetization and decay effects in Nb<sub>3</sub>Sn, Bi:2212, and YBCO relevant to field errors", The Low Temperature Workshop, St. Petersburg, Florida, Nov 2013
  83. M.D. Sumption, G Li, Y Yang, M. Susner, E.W. Collings, "Advances in AIMI "Second Generation" MgB<sub>2</sub> Wires, and *n*-value advances in conductors", For the US-Japan Workshop Dayton OH July 10-12 2013
  84. M.D. Sumption, M. Majoros, Y Yang, M. Susner, C. Myers, C. Kovacs, E.W. Collings, "Superconducting Coils for Application", For the US-Japan Workshop Dayton OH July 10-12 2013
  85. M.D. Sumption, "The Introduction of substitutional and non-substitutional dopants into MgB<sub>2</sub> in high pressure/Temperature or non-equilibrium", APS March Meeting, Baltimore MA, March 2013.
  86. M.D. Sumption, "Critical Current Density of Multifilamentary Second Generation MgB<sub>2</sub> Wires", The MRS Spring Meeting, San Fran. 2013
  87. M. D. Sumption, C. Myers, M. Majoros, E. W. Collings, "Magnetization and decay effects in Nb<sub>3</sub>Sn, Bi:2212, and YBCO relevant to field errors", Applied Superconductivity Conference, Charlotte, NC, Aug 2014.
  88. M.D. Sumption, M. Majoros, Y Yang, M. Susner, C. Myers, C. Kovacs, E.W. Collings, "Cooling and Test of Large Diameter MgB<sub>2</sub>-based Cryocooled Coils for MRI and Nuclear Physics Applications", Applied Superconductivity Conference, Charlotte, NC, Aug 2014.
  89. Invited Talk (Paid visit to Fukuoka and NIMS): M.D. Sumption, G Li, Y Yang, M. Susner, C. Myers, C. Kovacs, M. Majoros, and E.W. Collings, "Advances in MgB<sub>2</sub> Strands, Bulks, Thin Films, Cables, and Coils", Prepared for a Visit to Fukuoka University and NIMS, Japan, March 9-14, 2014.
  90. Development of Superconducting Materials, Conductors, Coils, and Magnets for Conduction-

- Cooled MRI Magnets, TEC Workshop, The Ohio State Workshop, April 2014.
91. M. Sumption, Presentation at the General Accelerator Research and Development Meeting, July 2015, Bethesda Maryland.
  92. M. Sumption, "Development of Superconducting Materials, Conductors, Coils, and Magnets for Conduction-Cooled MRI Magnets", Presentation at OSU-TEC workshop, April 2015.
  93. M.D. Sumption, "Magnetization, Decay, and Influence on Error Fields in HTS accelerator magnets", The ICMC, Tuscon, Arizona, June 2015.
  94. M.D. Sumption, "The Development of Persistent Joints for MgB<sub>2</sub>-based Conductors", The ICMC, Tuscon Arizona, June 2015.
  95. M.D. Sumption, "Effects of Core Type, Placement, and Width, on ICR of Nb<sub>3</sub>Sn Rutherford Cables", The ICMC, Tuscon Arizona, June 2015.
  96. M.D. Sumption, "What are the Limits of  $J_c$  in Nb<sub>3</sub>Sn Strands?", Low Temperature Superconductor Workshop Feb 16-18, 2015 Napa Valley, 2015.
  97. M.D. Sumption, "Magnetization, Decay, and Influence on Error Fields in HTS accelerator magnets", Low Temperature Superconductor Workshop Feb 16-18, 2015 Napa Valley, 2015.
  98. M.D. Sumption, OSU GARD Presentation, GARD High Field Magnet Workshop, Bethesda Maryland, July 28, 2015
  99. M.D. Sumption, Development of Superconducting Materials, Conductors, Coils, and Magnets for Conduction-Cooled MRI Magnets, OSU, Fischer College of Business, TEC Meeting, April, 2015.
  100. M.D. Sumption, Measurements of YBCO Pancake Coils: Stability, Quench, and NZP at 4.2 K and 10 T – and CORC Cable Quenching at 77 K/SF", International Conference on Magnet Technology, MT24, Seoul, Korea, Oct 18-23, 2015.
  101. M.D. Sumption, "Modelling and Measurement of Magnetization of YBCO CORC and Roebel Cables for Accelerators", International Conference on Magnet Technology, MT24, Seoul, Korea, Oct 18-23, 2015.
  102. M.D. Sumption, "Demonstration of Conduction Cooled MgB<sub>2</sub> and Nb<sub>3</sub>Sn Coil Segments for Magnet Applications", International Conference on Magnet Technology, MT24, Seoul, Korea, Oct 18-23, 2015.
  103. M.D. Sumption, "Magnetization, Decay, and Influence on Error Fields in HTS accelerator magnets", International Cryogenic Materials Conference, Tuscon, Arizona, June 28-July 2, 2015.
  104. M.D. Sumption, "Effects of Core Type, Placement, and Width, on ICR of Nb<sub>3</sub>Sn Rutherford Cables", International Cryogenic Materials Conference, Tuscon, Arizona, June 28-July 2, 2015.
  105. M.D. Sumption, "The development of persistent joints for MgB<sub>2</sub>-based conductors", International Cryogenic Materials Conference, Tuscon, Arizona, June 28-July 2, 2015.
  106. M.D. Sumption, "What are the Limits of  $J_c$  in Nb<sub>3</sub>Sn Strands?", The Low Temperature Workshop, Napa, Valley, CA, Feb 16-18, 2015.
  107. M.D. Sumption, Influence of Zr, Ti, Nb, and Dy<sub>2</sub>O<sub>3</sub> on MgB<sub>2</sub> Bulks Fabricated by High Temperature and Pressure Reaction, APS March Meeting, Baltimore Maryland, March 2016.
  108. M.D. Sumption, "AC Loss Measurements of MgB<sub>2</sub> Strands Designed for Motor and Generator Applications", Applied Superconductivity Conference, Denver Colorado, September 2016.
  109. M.D. Sumption, "The development of persistent joints for MgB<sub>2</sub>-based conductors", Applied Superconductivity Conference, Denver Colorado, September 2016.

110. M.D. Sumption, "Magnetization and Stability in Coated Conductor Cables for HEP applications", Coated Conductors for Applications Workshop, Aspen Colorado, Sept 11-16, 2016
111. M.D. Sumption, Prospects of Nb<sub>3</sub>Sn performance enhancement for high field fcc applications", FCC conference, Rome Italy, April 11-15, 2016.
112. M.D. Sumption, "Modelling and Measurement of Magnetization of YBCO CORC and Roebel Cables for Accelerators", Low Temperature Superconductor Workshop, Santa Fe, New Mexico, Feb 8-10 (2016).
113. M.D. Sumption, "Modelling and Measurement of Magnetization of YBCO CORC and Roebel Cables for Accelerators", Navy Applied Superconductivity Workshop, Philadelphia PA, April (2016).
114. M.D. Sumption, "Modelling and Testing of MgB<sub>2</sub> Segmented Coils and Persistent joints for MgB<sub>2</sub> Magnets", Electronic Materials and Application, Orlando Florida, Jan 18-20, 2017
115. M.D. Sumption, "Development and Measurement of Carbon Nanotube-metal Composite Conductors", Electronic Materials and Application, Orlando Florida, Jan 18-20, 2017
116. M.D. Sumption, "Stability, quench, and current sharing in Roebel and CORC cables for HEP magnets", EUCAS, Geneva Switzerland, Sept 2017
117. M.D. Sumption, "Development of APC (ZrO<sub>2</sub>) Nb<sub>3</sub>Sn Multifilamentary and Ternary Conductor", The future Circular collider week, May 29, 2017
118. M.D. Sumption, "Measurements of YBCO cable at High  $dB/dt$  for Various HTS Cables", International Cryogenic Materials Conference, July 9-13, 2017
119. M.D. Sumption, "Calorimetric Measurements of Varied Architecture YBCO Conductors and Cables at High  $dB/dt$  in a Stator Environment", July 9-13, 2017
120. M.D. Sumption, "Analysis of Magnetization effects for HTS conductors for HEP magnets", The Low Temperature Workshop, Santa Fe, NM, Feb 27-March 1, 2017
121. M.D. Sumption, "Magnetization and Analysis of CORC, TWST, and Roebel Cables for HEP applications and Associated Error fields", Magnet Technology Conference 25, Amsterdam, Netherland, Aug 27-Sept 1, 2017
122. M.D. Sumption, "React and wind type MgB<sub>2</sub> based MRI segment Coil: Development, Instrumentation, and Initial Cool down", Magnet Technology Conference 25, Amsterdam Aug 27-Sept 1, 2017
123. M.D. Sumption, "Influence of field cycle on coated conductor magnetization and decay for accelerator applications", Magnet Technology Conference 25, Amsterdam Aug 27-Sept 1, 2017
124. M.D. Sumption, "AC Loss of Superconducting Materials for Very High Density Motors and Generators of Hybrid-Electric Aircraft", American Institute of Aeronautics and Astronautics (AIAA) Electric Aircraft Technologies symposium in Cincinnati Ohio July 9-11, 2018
125. M.D. Sumption, AC Loss of Superconducting Materials for Very High Density Motors and Generators of Hybrid-Electric Aircraft", Presented at the Applied Superconductivity Conference Seattle WA, Oct 26-Nov 2, 2018
126. M.D. Sumption, "Magnetization and Flux Penetration of YBCO CORC Cable Segments at the Injection fields of Accelerator Magnets", Presented at the Applied Superconductivity Conference Seattle WA, Oct 26-Nov 2, 2018
127. M.D. Sumption, "Magnetization and Loss of Superconducting Cables with Helical (CORC) and Twisted Stacked Geometries -- FEM and Analytical Modelling for Accelerator Magnets", Presented at the Applied Superconductivity Conference Seattle WA, Oct 26-Nov 2, 2018

128. M.D. Sumption, "Magnetization and Loss Measurements of YBCO CORC and Roebel Cables for Accelerators using 3 T dipole Susceptometer", Presented at the Applied Superconductivity Conference Seattle WA, Oct 26-Nov 2, 2018
129. M.D. Sumption, "Development and Measurement of Carbon Nanotube-metal Composite Conductors", Nanotechnology Materials and Devices Workshop, Cincinnati OH May 21-22, 2018. M.D. Sumption, "The Development of Artificial Pinning Structures in Superconducting Ternary Nb<sub>3</sub>Sn; Microstructure, Pinning, and Critical Fields", Miami University Colloquium, Oxford Ohio, Nov 7, 2018
130. M.D. Sumption, "Effects of Dy<sub>2</sub>O<sub>3</sub> doping on the Anisotropy and Transport of MgB<sub>2</sub> Wires", CIMTEC 2018, Perugia Italy, June 4-14, 2018
131. M.D. Sumption, "Unravelling the Magnetization of CORC Cables", The Low Temperature Superconductor Workshop, Jacksonville, Florida, Feb 2018

### Current Grants and Contracts

1. *A novel way to dope Ti in Nb<sub>3</sub>Sn conductor to reduce A15 grain size and non-cu critical current at high Fields* (180 k\$) 2019-2020 (DOE) **Synopsis:** Development of advanced Nb<sub>3</sub>Sn Conductors for particle accelerators.
2. *Conductors, joints, and coils for cryogen free whole body 3 T MRI systems* (290 k\$/year) 01/01/2015 - 12/31/2018 (NIH) **Synopsis:** Development of conductors, joints, and magnetic, thermal, and mechanical designs for 3 T MgB<sub>2</sub> MRI.
3. *Conductors, cables, and coils for superconducting accelerator magnets* (180 k\$ per year, 2014-2019) (DOE) **Synopsis:** Measurement and Analysis of HTS and LTS cables and conductors for HEP applications
4. *Additive manufacturing of scalable 3D resonators* (80 k\$, 2019) (DOE) **Synopsis:** Development of superconducting cavities for quantum computers using 3-D printing
5. *YBCO superconductors and coils for NASA applications* (25 k\$) (2019) (NASA) **Synopsis:** Development of YBCO coils for NASA Superconducting motors.
6. *Phase II: Low AC-loss superconducting cable technology for electric aircraft propulsion* (150 k\$) (NASA) 2019-2020
7. *Advanced Superconducting Rotor* (25 k\$) (2019) **Synopsis:** MgB<sub>2</sub> for superconducting rotors
8. *Development of MgB<sub>2</sub> for Fusion Applications* (30 k\$) (DOE) (2018-2019) **Synopsis:** Gen 2 MgB<sub>2</sub> for fusion reactors
9. *Development of APC Nb<sub>3</sub>Sn for fusion applications* (25 k\$) (DOE) (2018-2019) **Synopsis:** Nb<sub>3</sub>Sn APC for fusion applications