

PREFACE

MEM07: The 5th Annual Workshop on Mechanical and Electromagnetic Properties of Composite Superconductors (Princeton, NJ, USA, 21–24 August 2007)

Guest Editors

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MEM07 was the 5th international workshop concentrating on the mechanical and electrical properties of composite superconductors, which are the technological conductor forms from which practical superconducting devices are made. Such superconducting conductors respond to important challenges we currently face, especially those concerned with the proper management of the world's energy resources. Superconductivity provides a means to address the challenges in the generation, transmission and distribution, and use of energy.

For energy generation, the ITER Fusion Tokamak (now underway in France) provides exciting new challenges for the whole superconductivity community, due to the enormous size and strong fields of the plasma confinement superconducting magnets that will form the largest and most powerful superconducting machine yet built. Significant attention was paid at MEM07 to the modeling, characterization, testing and validation of the high-amperage Nb₃Sn cable-in-conduit conductors needed for ITER.

As for electric energy industry uses, there was much discussion of both first generation (Bi,Pb)₂Sr₂Ca₂Cu₃O_x conductors and the rapidly emerging second generation coated conductors made from YBa₂Cu₃O_{7-x}. High-performing, affordable conductors of these materials are vital for large capacity transmission cables, energy storage systems, fault current limiters, generators and motors—many prototypes of which are being pursued in technologically advanced countries.

There is a broad consensus that the prototype stage for high-current–high-field superconducting applications is nearing its end and that large scale applications are technologically feasible. However full industrialization of large-scale superconducting technologies in electric utility applications will benefit from continuous improvement in critical current, lower ac loss, higher strength and other vital conductor properties. The establishment of optimal procedures for the system design accompanying scale-up is a second vital task. As system design is dependent on material development, there is a critical need to study the key issues in developing high performance superconducting materials.

The emphases of MEM07 were

- The mechanical properties of superconductors including the influence of stress and strain on the critical current of practical conductors including YBCO and ReBCO coated conductors, BSCCO tapes, MgB₂ wires and Nb₃Sn filamentary conductors.
- The intrinsic strain effects on critical current density in Nb₃Sn, YBCO, BSCCO and MgB₂.
- Recent advances in critical current, the mechanical properties and the reduction in ac losses of HTS tapes and wires.

- The compositional and microstructural dependence of E - J characteristics and explanations based on flux pinning, grain boundary weak-links and other mechanisms.
- Standardized test-methods: international cooperative research work to establish test methods for assessing the mechano-electromagnetic properties of superconductors based on the activities of IEC/TC90 and VAMAS/TWA-16.

More than 60 researchers from more than 12 countries attended the MEM07 workshop, and about 40 presentations were made. A small selection of papers (15) from the workshop are included in this special issue of *Superconductor Science and Technology*. Taken together with papers published at earlier MEM meetings, this issue provides an updated view of some of the current state-of-the-art research in the mechano-electromagnetic properties of composite superconductors.

The workshop was organized under the activities of the NEDO Grant Project (Applied Superconductivity, 2004EA004) and VAMAS/TWA-16. The meeting was organized by a committee composed of David Larbalestier (Conference Chair) aided by MEM05 and MEM06 Conference Chairs Kozo Osamura (Research Institute for Applied Sciences, Kyoto, Japan), Damian Hampshire (Durham University, UK) and Arman Nyilas (CEME). The Program Committee was composed of Ettore Salpietro (European Fusion Development Agreement), Neil Mitchell (ITER), Kozo Osamura, Damian Hampshire and Arman Nyilas.

We express our great thanks to all those whose efforts were key in organizing the meeting, with very special thanks to our Meeting Planner Kate Liu who organized matters large and small with discretion and great efficiency.