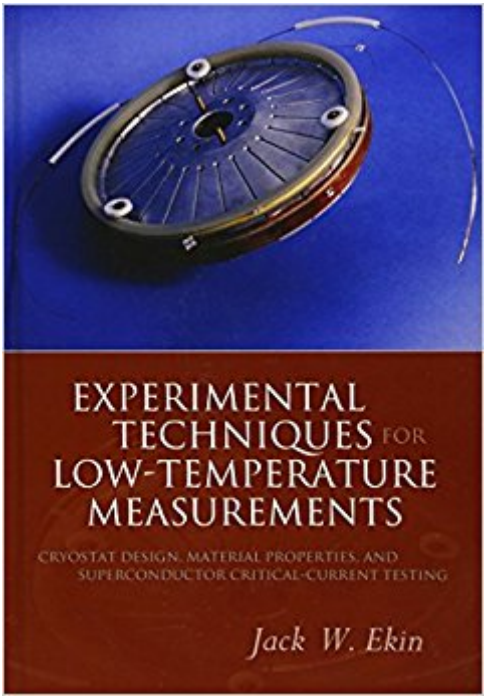
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Experimental Techniques: Cryostat Design, Material Properties And Superconductor Critical-Current Testing



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Synopsis

This book presents a highly integrated, step-by-step approach to the design and construction of low-temperature measurement apparatus. It is effectively two books in one: A textbook on cryostat design techniques and an appendix data handbook that provides materials-property data for carrying out that design. The main text encompasses a wide range of information, written for specialists, without leaving beginning students behind. After summarizing cooling methods, Part I provides core information in an accessible style on techniques for cryostat design and fabrication - including heat-transfer design, selection of materials, construction, wiring, and thermometry, accompanied by many graphs, data, and clear examples. Part II gives a practical user's perspective of sample mounting techniques and contact technology. Part III applies the information from Parts I and II to the measurement and analysis of superconductor critical currents, including in-depth measurement techniques and the latest developments in data analysis and scaling theory. The appendix is a ready reference handbook for cryostat design, encompassing seventy tables compiled from the contributions of experts and over fifty years of literature.

Book Information

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"At last a new book, not a collection of technical papers, has been published on the techniques of low-tempurature measurements. ... I highly recommend Ekin's book. It is informative and well written, for beginners who are starting research at low temperatures and for veterans who will

benefit from the author’s experience."-- Physics Today"I could not wait for this book to appear in print. I will make it required reading for anyone designing cryogenic probes for use in our laboratory."--Bruce Brandt, U.S. National High Magnetic"I am very impressed with the mixture of rigour and practicality that the book offers. [...] The charts are a treasure trove of practical information."--Mark Colclough, University of Birmingham"... an invaluable resource to interested scientists and engineers. "--Adam Gromko, University of Colorado, Boulder

Jack EkinNISTDiv. 818.03325 Broadway St.Boulder, CO 80305, USA Jack Ekin is a Research Physicist at the National Institute of Standards and Technology in Boulder, where his contributions have spanned a wide range of topics in low-temperature physics, including studies of fundamental conduction processes in normal metals, electro-mechanical properties of both high- and low-Tc superconductors, and interface conduction in thin films and nanostructures. He completed a B.S. degree at the University of Michigan, conducted his early graduate work in physics at the University of Heidelberg as a Fulbright Scholar, and received M.S. and Ph.D. degrees from Cornell University. Currently, he also holds an appointment as Lecturer at the University of Colorado. He is a member of the Institute of Electrical and Electronics Engineers and a Fellow of the American Physical Society. He has published over 150 cryogenic research articles, textbook chapters, and patents, and has lectured and consulted internationally in the field of low-temperature measurements.

Part I of this book is a broad-reaching and up-to-date (2006) introduction to experimental techniques for the graduate student who is about to get his hands wet with liquid helium (just kidding)for the first time. In fact, the temperature range addressed by the book is from pumped helium (~1.5 K) to helium’s boiling point (4.2 K): there’s nothing about He3 cryostats or dilution, adiabatic demagnetization, or Pomeranchuk refrigerators or about exotic thermometry in the mK range. It’s also not a recipe book for how to build a cryostat...its figures are are too schematic for that...but it does give the reader an overview of almost everything that he or she will encounter when designing and/or using liquid helium cryostats, including the tricks to build the cryostat probe to which the experiment is to be attached.For the novice and cryogenic professional alike, the book includes numerous graphs of material properties covering the temperature range 4-300 K. However, what makes this book so extraordinary useful for me is the 134-page appendix in which the author has assembled a wellspring of sometimes hard-to-find data..thermal conductivity, specific heat, and thermal contraction, to name a few...for the commercial materials that one actually uses when designing sophisticated low temperature apparatus. Just how useful this appendix is was brought

home to me when I wanted to compare the thermal conductivity of Be-Cu to that of stainless steel at 4 K. After giving Google a reasonable chance, I wasn't optimistic that I'd find the data in the book, but there it was in Table A6.7.Part III, 136 pages long, is dedicated to critical-current measurements in superconductors. This is quite a specialized subject that will probabaly be of interest to a considerably smaller number of readers than Part II, which deals with the general field of electrical transport measurements. However, for one who needs to enter this field, the same practical approach that the author used in the first two parts of the book, with its numerous graphs and figures, should enable the newcomer to start characterizing superconductors in the shortest time, from Nb3Sn to MgB2 to the high Tc's. Appendix 10 is a detailed review of critical-current analysis parameters.In addition to the compilation of extremely useful 'cold' data, the author introduces the chapters with a collection of 'warm' quotes, my favorite being "Measure twice, cut once or Cut twice and it's still too short." Even before you get started reading the chapter, you know it's going to be fun.

Extremely useful book with lab techniques and details. It contains information valuable even for non-superconducting research. Books like this are real treasures.

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