“Physics in Canada” Book Review
“La Physique au Canada” Critique de livre

“Helium Cryogenics” by Steven W. Van Sciver, Springer, 2012, pp: 470, ISBN: 978-1-4419-9978-8 (pbk), price: 225.83

Steven W Van Sciver's “Helium Cryogenics” is used as a textbook in a graduate level mechanical engineering course. It assumes the reader is familiar with thermodynamics, statistical physics, heat transfer, fluid mechanics and solid-state physics. As a reference this book on the cryogenic properties of He is very useful, it includes several problems at the end of each chapter, and has an extensive set of references to the original research papers. The writing is rather formal and deadpan, as might be expected in an engineering textbook. It goes into fine details of some of the complexities of heat transfer and flow of various states and mixtures of states of He.

The introductory chapters include a review of thermodynamics, and properties of various materials at low temperatures. The review of thermodynamics is fairly complete, but terse. It is adequate for a quick review if the reader is already familiar with the material, but it would likely not be useful to a novice.

Each chapter following the second one progressively spirals deeper into the complexities of the thermodynamic properties of He. The third chapter is a breeze, as it describes how well He, in its gas form, follows the ideal gas law. The fourth chapter goes into the fluid dynamics of He, including the continuity equation and Navier-Stokes equations. The various dimensionless quantities such as Reynolds number are then introduced as they help describe when the flow is laminar or turbulent.

Eventually there are chapters on the quantum properties of He-II, giving rise to phonons, rotons, and maxons. The strange viscosity properties of the superfluid He are discussed in some detail. The Kapitza conductance between He liquid and vapour is discussed. The ^{3}He-^{4}He dilution refrigerator used to bring He to even lower temperatures is described in Chapter 9 near the end of the book.

In short, this is a treatise on He cryogenics, and will take any reader a long investment of time to fully digest. For those interested in the cryogenic properties of ^{3}He and ^{4}He this book is an invaluable reference, as it has an account of all the current knowledge on the subject.

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