

Preface to the Second Edition

The critical current density of superconducting RE-123 coated conductors has been improved significantly. Especially addition of artificial pinning centers has been examined, and the artificial pinning centers are now introduced to some commercial coated conductors. The introduction of pinning centers provides not only strengthening the pinning force but also enhancement of the upper critical field due to the electron scattering by the pinning centers. The latter fact greatly improves the high-field performance of the superconductor through the enhancement of the irreversibility field. Such information is newly added in Chap. 8.

In these several years the critical current density of MgB_2 has been improved appreciably, and this superconductor is now used for practical devices such as superconducting magnets for MRI. The effect of packing factor of MgB_2 on the superconducting properties such as the critical current density and irreversibility field can also be quantitatively described using the percolation theory. In addition, it was found that the flux pinning strength of grain boundaries in MgB_2 is stronger than that in Nb_3Sn at 4.2 K. These factors are needed to understand the critical current properties in MgB_2 . For this reason the content of Chap. 9 on MgB_2 is updated.

Fifty years have passed since the appearance of the first paper by C.P. Bean on the critical state model that is indispensable to describing the electromagnetic phenomena in the superconductor. Recently the force-balance equation, on which the critical state model is based, was theoretically derived from the first principle and then, generalized to irreversible cases with the aid of the summation theory. That is, the critical state model is no longer a phenomenological model, but a rigorous theory on the critical state. Since the irreversibility can be derived from the level of the first principle, this theory states that, if energy dissipation could not occur, it would be contradictory to the first law of thermodynamics. Addition of this section in Appendix is also one of important revisions of this book.

Finally the author hopes that the new edition is useful especially for young researchers who are involved in applications of superconductors.

Iizuka, Japan

Teruo Matsushita



<http://www.springer.com/978-3-642-45311-3>

Flux Pinning in Superconductors

Matsushita, T.

2014, XV, 475 p. 327 illus., Hardcover

ISBN: 978-3-642-45311-3