Preface

Modern technological applications of electron beam devices require development and creation of new electron sources with parameters that were not previously achievable.

The unique quantum mechanics phenomenon of electrons tunneling from condensed state into vacuum known as field electron emission (FEE) provides a way of creating electron sources with emission characteristics of six or seven orders of magnitude above all the previously known types of emission. This incredibly high emission current density combined with the fact that one does not require to input any additional energy for the emission process itself provides exceptional opportunities for practical applications and, first of all, for development of unprecedentedly efficient electron beam devices.

It is also important to note that nowadays the whole science of field emission goes through a period of renaissance due to the emergence of a new field of electronics—vacuum nanoelectronics.

This book aims to summarize the theoretical, experimental and technological advances in modern science of field electron emission that can help in development of new emission devices based on nanostructured materials.

This book is roughly divided into three basic topics: theoretical models and formulas for computation of electron gun elements; experimental techniques and technologies; and basics of practical applications of field cathodes in electronic devices. Particular attention was paid to the properties of field electron emission out of nanostructured carbon materials and devices based on them, as in authors' opinion these materials are the most promising for devices with field cathodes.

Working on this book, the authors did not seek to provide a full review of all works on the subject or even of a majority of them. The backbone of the book consists of theoretical, methodical and experimental results obtained by researchers and teams that the authors led or worked with at department of Vacuum Electronics of Moscow Institute of Physics and Technology and department of Electromechanical and Computer Systems Modeling of Saint Petersburg State University.

In the course of their research many original models, techniques and devices were introduced, and many of the most interesting results are presented in this book.

The authors extend their thanks to their colleagues and students whose collaboration over the years, common research and discussion of results were the principal motive behind this book.

Chapters 1, 3, 4, 7 are written by N.V. Egorov. The introduction, Chaps. 2, 5, 6, 8 are written by E.P. Sheshin. The conclusion is written by the authors with contributions from K.A. Nikiforov.

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http://www.springer.com/978-3-319-56560-6

Field Emission Electronics

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2017, XIV, 568 p. 328 illus., 21 illus. in color., Hardcover
ISBN: 978-3-319-56560-6