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MATERIALS SCIENCE 72

Springer-Verlag Berlin Heidelberg GmbH

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J. Dabrowski E.R. Weber (Eds.)

Predictive Simulation of Semiconductor Processing

Status and Challenges

With 281 Figures

Springer

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ISSN 0933-033X

ISBN 978-3-642-05804-2 ISBN 978-3-662-09432-7 (eBook)
DOI 10.1007/978-3-662-09432-7

Library of Congress Cataloging-in-Publication Data applied for.
Bibliographic information published by Die Deutsche Bibliothek
Die Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliografie;
detailed bibliographic data is available in the Internet at http://dnb.ddb.de.

Originally published by Springer-Verlag Berlin Heidelberg New York in 2004
Softcover reprint of the hardcover 1st edition 2004

Typesetting by the editors
Cover concept: eStudio Calamar Steinen
Cover production: *design & production* GmbH, Heidelberg

Printed on acid-free paper SPIN: 10967676 57/3141/tr 5 4 3 2 1 0

Preface

Modeling and simulation has accompanied semiconductor process development in the last thirty years. Device development costs could be substantially lowered and development time shortened by simulations that accompanied the experimental process development and optimization. Those simulations were generally based on more or less phenomenological descriptions developed by fitting experimental results. Therefore they were valid only within a specific parameter range, i.e. they allowed interpolations but only rarely extrapolations. There are exceptions to this picture, such as the prediction of implantation profiles by the LSS theory that was from the beginning based on an atomistic understanding of the underlying processes. However, in many other areas such as diffusion processes we know today that the underlying physical picture considered in early process simulators was quite off reality.

The development of reliable ab-inito theory based generally on the density functional approach marked an important breakthrough towards the development of predictive theory. Simultaneously, improved experiments specifically targeted at studying specific materials and defect processes such as transient enhanced diffusion or native defect incorporation as a function of crystal growth parameters, allowed to test theory in a meaningful way.

The combination of these two research approaches results in the development of truely predictive process simulation that turns out to be a necessity for a meaningful simulation of current and future generations of Si integrated circuits. These push the critical device parameters into areas not included in most experiments and therefore require predictive simulation based on realistic models accompanied by state-of-the-art theory.

The contributions in the current volume are intended for researchers, graduate students as well process engineers interested to obtain a comprehensive picture of our current understanding of the physical basis of silicon processing and the opportunities and challenges for predictive process simulation.

Frankfurt/Oder and Berkeley,
February 2004

Jarek Dąbrowski
Eicke Weber

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