Semiconductor Defect Engineering—Materials, Synthetic Structures and Devices

Symposium held March 28–April 1, 2005, San Francisco, California, U.S.A.

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PREFACE

This volume results from Symposium E, "Semiconductor Defect Engineering—Materials, Synthetic Structures and Devices," held March 28–April 1 at the 2005 MRS Spring Meeting in San Francisco, California. It follows on highly successful earlier symposia held approximately triannually since the inaugural one in 1992. The intent of this gathering has been to explore deliberate introduction and manipulation of defects and impurities in order to engineer some desired properties in semiconductor materials and devices. Reflecting the maturing of the theme, the response from the research community has again been very positive, with over 150 abstracts submitted from around the world.

The organization of this proceedings volume closely follows the topics around which the sessions were built. The papers are grouped around distinct topics covering materials, processing and devices. The papers on grown-in defects in bulk crystals deal with overviews of intrinsic and impurity-related defects, their influence on electrical, optical and mechanical properties, as well as the use of impurities to arrest certain types of defects during growth and defects to control growth. In the case of epitaxial films, additional issues concerning stoichiometry and defects caused by plasmas and electron/ion irradiation are included. In view of the current exciting developments in widegap semiconductors like GaN, ZnO and SiC for blue light emitting devices and high-temperature electronics, most of the papers dealt with dopant and defect issues relevant to these materials.

Defect reaction problems pertaining to impurity gettering, precipitation and hydrogen passivation are indeed specific examples of defect engineering that improve the electronic quality of the material. An interesting recent example in this area is mutual passivation of dopant and alloy element in dilute III-V alloys. A number of invited and contributed papers also dealt with sophisticated new characterization techniques needed to study, identify and image these defects—even at individual levels—in materials and device structures.

The scope of defect and impurity engineering is far-ranging as exemplified by phase and morphological stability of silicides, interface control and passivation, and application of ion implantation, plasma treatment and rapid thermal processing for creating/activating/suppressing trap levels. A good complement of papers in these areas is also found in this volume.

The symposium lasted the entire four days of the MRS Meeting, with eight oral sessions and two evening poster sessions. In addition, the symposium sponsored a half-day tutorial entitled "Semiconductor Heterojunctions—Properties and Photoelectronic Characterization," given by Y.N. Mohapatra of the Indian Institute of Technology, Kanpur. There were in all 16 invited talks, 50 contributed oral presentations and 78 posters. All the papers were peer-reviewed following the conference and revised. We are most grateful to the referees for their steadfastness in attending to their task. The quality of the symposium proceedings critically depends on this voluntary endeavor on top of the care exercised by the authors. The short turn-around time with e-communications has made possible the completion of the editing process within 8 weeks of the end of the Meeting. Subject to the limitations of what is possible under the publication deadline, efforts were made to reduce errors, but the reader is urged to bear with the inevitable shortcomings in the spirit of the symposium title!

A majority of papers presented at the symposium are included in this volume.

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May 2005
ACKNOWLEDGMENTS

We would like to acknowledge the support received from the following sponsors:

Eastman Kodak Co., Kodak Research Labs
Freescale Semiconductor, Inc.
HORIBA Jobin Yvon, Inc.
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