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Materials Reliability in Microelectronics II

Editors: C. V. Thompson and J. R. Lloyd

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Materials Reliability in Microelectronics II

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Preface

Design constraints imposed by concerns with device and interconnect reliability currently limit further evolution to faster and more complex integrated circuits. While the reliability of materials in integrated circuits is related to their performance in electronic systems, and has therefore been dealt with primarily by electrical engineers, the study and understanding of the physical mechanisms of failure, and the design of processes and structures to avoid failure, present classical challenges in materials science and engineering. For example, the mechanical and chemical stability of metals in integrated circuits is affected by the relationships in the way they have been processed, their microstructures, and their properties, just as in large-scale structures, such as bridges and automobiles. However, the interesting challenges come in when the macrostructures and microstructures are shrunk to micrometer and submicrometer sizes, and also when metals are encapsulated in rigid oxides and then subjected to stresses considerably higher than their bulk yield stresses, and when they are subjected to current densities several orders of magnitude higher than those allowed in house wiring. These unusual dimensions and physical conditions lead to new behavior, which can be studied and understood using the methods developed for bulk materials in other applications.

This symposium and its predecessor have provided forums for materials scientists and engineers to meet with other scientists and engineers to discuss, in detail, the physical phenomena that lead to failure of materials in microelectronics. From these symposia new perspectives on reliability issues have emerged. In this volume, for example, considerable progress is seen in the merging of the understanding of the mechanical deformation and electromigration-induced damage of metallic interconnects. Also, new tools for characterizing thin film microstructure have been described, along with the insights into failure processes that they have lead to. Progress in modelling and design for circuit reliability has also been reported.

We thank the participants for lively discussions, and the speakers, especially the invited speakers, for thoughtful and informative presentations. We also thank Sienna Technologies, Inc. and Digital Equipment Corporation for financial support of the symposium, and Peter Heron for his efforts in preparing these proceedings for publication.

Carl V. Thompson
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