Ion Beam Processes in Advanced Electronic Materials and Device Technology

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Ion Beam Processes in Advanced Electronic Materials and Device Technology

Symposium held April 15-18, 1985, San Francisco, California, U.S.A.

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Preface

These proceedings are a refereed account of the Symposium on Ion Beam Processes in Advanced Electronic Materials and Device Technology presented at the 1985 Spring Meeting of the Materials Research Society, April 15-18, 1985, in San Francisco, California. Over the years, ion implantation has become one of the premiere processing techniques in the semiconductor industry. As device fabrication has become more intricate and complex the demands made on the use of ion implantation have become more stringent. Also, ion beams have become the base technology for a number of other vital processing steps in semiconductor device fabrication. The intent of this symposium was to re-examine these new uses of ion beams in device technology and to address the materials problems and ion-induced materials alterations associated with their use. The program was structured to address the fundamental origins of these phenomena as well as problems arising in actual applications. This format provided an interactive forum which brought nearly equal numbers of industry and academic participants together and included a substantial number of international participants.

The capabilities of ion implantation are being pressed at both high and low energies. The demand for low energy implants arises from the need to fabricate shallower and shallower junctions as the lateral dimensions of advanced devices shrink. This has forced a more exact examination of orientation effects such as ion channeling of the consequences of pre-amorphization steps before implantation, and of anomalous dopant redistribution effects associated with rapid annealing of these shallow junctions. Higher energy implants are being used to form buried contacts in CMOS devices. This brings a need to predict implantation and damage profiles through multilayer structures as well as enhanced diffusion and mixing effects initiated by the energetic ions penetrating the multilayer materials. Fabrication of buried insulating layers for future three dimensional device structure by implanting oxygen or nitrogen ions requires similar information. These new thrust areas also require implantation accelerators with new capabilities of higher energies and/or higher currents. All these areas were addressed in the symposium.

Numerous new uses of ion beams were also considered. Submicron focused ion beams are being studied for use in maskless ion implantation, ion beam lithography, and for dry etching. This in turn requires understanding high dose rate implantation effects, ion beam induced annealing, ion beam assisted etching and deposition. Ion beam effects in photoresist material and polymers must be understood. Ion beams are showing great promise in the areas of electronic packaging for inducing beneficial materials interactions between metal/insulator and metal/semiconductor systems at low temperatures, for increasing adhesion, and for selective patterning and alloying. Implantation doping of III-V heterostructures and superlattices have already been utilized to fabricate devices but much work remains to understand enhanced diffusion and ion mixing effects observed in the implantation and annealing processes. The entire field of rapid thermal annealing is proving most beneficial for annealing implanted III-V compounds as well as silicon device structures.

These are a few of the forefront areas covered by the papers presented at this symposium. The greater-than-expected attendance, the remarkably high quality of the papers presented, and the stimulating and inter-disciplinary nature of the discussions were most gratifying to us as organizers. These observations suggest that this was a symposium that met a need and should be reconvened in the future.

B. R. Appleton F. W. Eisen T. W. Sigmon

June 1985

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Finally, we gratefully acknowledge Ms. Lynne Hinton who served as Symposium Secretary. It is largely through her efforts that these proceedings are possible.