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POINT DEFECTS LINE DEFECTS AND INTERFACES IN
SEMICONDUCTORS(U) GORDON RESEARCH CONFERENCES INC
P M PETROFF 1983 N00014-83-G-0026

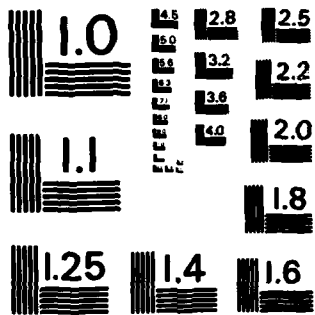
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FINAL REPORT

POINT DEFECTS, LINE DEFECTS
AND INTERFACES IN SEMICONDUCTORS

JULY 11-15, 1983

PLYMOUTH STATE COLLEGE (S)
PLYMOUTH, NEW HAMPSHIRE

ONR Grant No. : N00014-83-G-0026

CHAIRMAN

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FINAL REPORT

Introduction

The 1983 Gordon Conference on Point Defects, Line Defects and Interfaces in Semiconductors was held at Plymouth State College, Plymouth, New Hampshire on July 11-15, 1983. There is a great deal of activity in this field, since the science is pertinent to both micro-electronics (in all its facets) and to photo-voltaic solar cells, and both these technologies are science-limited. It is worth noting that the Europeans have copied this meeting in the so-called "Lund" conferences, and now the Eastern bloc nations have been holding frequent similar meetings, e.g., the Matrafured (1982) and Eger (1983) conferences in Hungary, and the Sczcyrcck (1985) conference in Poland; there are frequent similar meetings in Japan.

As the conference title indicates, the conference covered point defects, line defects (both precipitates and dislocations) and interfaces. The semiconductors treated included silicon and III-V compounds, although the Banquet speaker discussed optoelectronic research in Japan in its broadest aspects.

Organizational

The conference consisted of twenty-one invited talks in ten sessions, each headed by a Session Chair. [A copy of the conference program is included in this report.] In addition there were forty contributed (poster) papers divided into two groups, with special times for the participants to consider these papers.

There were 107 participants. [The list of participants is included in this report.] Of these 78 were from the US: 40 from industry, 30 from universities, and 8 from government laboratories. The 29 participants from abroad were distributed as follows: 11 - West Germany; 7 - France; 5 - Japan; 4 - United Kingdom; and one each from Canada and the Netherlands.



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Technical

The essence of the Gordon Research Conferences is discussion, and the topics treated were selected with that in mind. There was vigorous and fruitful discussion on every topic, and on many of the poster papers.

Three point defects topics had whole sessions devoted to them: Oxygen in Silicon, Point Defects in III-V Compounds and Transition Elements in Semiconductors. Much of the first topic focused on the thermal donor problem, a problem almost thirty years old in 1983, but one that received a great impetus by its treatment at the Conference; indeed subsequent work promises to complete the understanding of this problem. The anti-site defects dominated the discussion of point defects in the III-V compounds, with the increasing recognition that the EL2 defect is in fact a family of defects with similar properties, a family based on anti-site defects. The transition elements, in particular the simple interstitial and substitutional iron series elements, were covered theoretical and experimental reviews; there remains to be studied the important problem of what happens to these mobile elements in real crystals.

The review of Hydrogen in Silicon summarized the recent reconciliation of many conflicting results, so that there is now a consistent working model for hydrogen in silicon; the paper also treated the need for confirming work on this topic, which is important both scientifically and technologically, since hydrogen is a passivating agent for many defects. The paper on Quenched in Defects in Silicon covered exciting results of the defects trapped upon the laser-quenching of silicon, which results go directly to the long-standing question of the native high-temperature defects in silicon; the problem is not solved, because some of the defects observed in the DLTS studies have not been identified, but some vacancy-related defects were observed, indicating that the vacancy, at least is a high temperature defect in silicon. That in itself is progress, because the interstitial-only model is ruled out; it is still possible that interstitials coexist with the vacancies as native high-temperature defects in silicon.

Surfaces were discussed in several papers: Silicon-Metal Interfaces (treated both by TEM and by ion-channeling techniques), Silicon-Silicide interfaces, and Schottky Barrier Formation. All these talks presented new insight into these interfaces, and high-lighted remaining challenges.

Ionization-enhanced and recombination-enhanced processes received broad treatment theoretically and experimentally. A new mechanism of recombination-enhanced migration was discussed and shown to be important in the motion of the aluminum interstitial in silicon. The role of these enhancements in dislocation processes and the degradation of semiconductors was also treated in several papers, but much remains to be understood concerning the microscopic mechanisms involved.

In summary the conference was very successful, and plans for the next conference are already underway.

GORDON RESEARCH CONFERENCES

POINT AND LINE DEFECTS IN SEMICONDUCTORS

Plymouth State College, Plymouth NH
July 11-15, 1983

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GOBDUN RESEARCH CONFERENCE

Point Defects, Line Defects
and Interfaces in Semiconductors

P. M. Petroff - Chairman
J. W. Corbett - Co-Chairman
Plymouth State College (SI), Plymouth, New Hampshire

July 11th through 15th, 1963

	Monday, July 11	Wednesday, July 13	Thursday, July 14	Friday, July 15
	Structures of Extended Defects and Interfaces 9 a.m. - 12:15 p.m. (J. Spence - Discussion Leader)			Point Defects in Compound Semiconductors (Bulk and Interfaces) 9 a.m. - 12:15 p.m. (U. Schneider - Discussion Leader)
- M. Gibson	"Structure of Interfaces and Interfacial Dislocations in Silicon-Metal Systems" (35 minutes)	- E. Weber		"EPR and PL Studies of Antisite Defects in GaAs" (35 minutes)
- W. Gibson	"Ion Channeling Studies of Metal-Semiconductor Interfaces" (35 minutes)	- G. Beckel		"Theory of Antisite Defects in GaAs and GaP" (35 minutes)
- D. Chrus	"Dislocation Climb Processes in Semiconductors" (35 minutes)	- T. Kennedy		"EPR Studies in GaP" (35 minutes)
	Point Defects and Complexes in Bulk Si and GaAs 7:30 - 9:30 p.m. (S. Penolaba - Discussion Leader)			Defects in Semiconductor Interfaces 7:30 - 9:30 p.m. (T. McGill - Discussion Leader)
- A. Zenger	"Theory of Transition Elements in Si and III-V Compounds" (35 minutes)	- C. Rubloff		"Bonds and Structure at Silicon-Silicide Interfaces" (35 minutes)
- C. A. Zimmerman	"New Experimental Results on Transition Elements in Si" (35 minutes)	- R. H. Williams		"Schottky Barrier Formation and Interfacial Reactions in Metal III-V Interfaces" (35 minutes)
	Point Defects and Complexes (Bulk and Interfaces) 9 a.m. - 12:15 p.m. (C. Watkins - Discussion Leader)		Thursday, July 14	Electron-Lattice Interactions 9 a.m. to 12:15 p.m. (H. Queisser - Discussion Leader)
- T. S. Shi	"Hydrogen in Si" (35 minutes)		- M. Schlier	"Migration Mechanisms and Recombination Enhanced Processes in Semiconductors" (35 minutes)
- A. Chavre	"Quenched in Defects in Laser Assesed 'Si'" (35 minutes)		- K. Masuda	"Recombination Enhanced Glide of Dislocation in III-V Compounds Semiconductors"
- D. V. Lang	"Studies of Dangling Bonds at Interface. Using Spin Dependent DLTS" (35 minutes)		- H. Alexander	"Photoplastic Effects in Si" (35 minutes)
	Oxygen in Si 7:30 - 9:30 p.m. (U. B. Paul - Discussion Leader)		- I. Hayashi	After Banquet Speaker 7:30 to 8:30 p.m. "The Status of Integrated Optoelectronic Research in Japan"
- M. Stavola	"Oxygen Diffusion in Si" (30 minutes)			Degradation Mechanisms 9 a.m. - 11:15 p.m. (T. Ikoma - Discussion Leader)
- P. Wagner and B. Oeder	"Evolution of Oxygen Related Complexes in Si" (30 minutes)			"Optically Induced Degradation in Quaternary Compounds" (35 minutes)
- A. Barret	"Early Stages of Oxygen Precipitation in Si" (30 minutes)			"Gradual Degradation and Deep Levels in III-V Compound Semiconductor Devices" (35 minutes)

POSTER SESSION: A poster session is also planned for participants who wish to present recent work. To reserve space, please give the poster title and an outline of the contents in the application. A selection will be made if there are too many posters.

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