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13. ABSTRACT (Maximum 200 words) An FEI Company 610 series, Focussed Ion Beam (FIB) instrumentation facility has been installed. This ultrahigh resolution nanoscale technology system can remove/deposit material on submicron lateral and vertical scales, and allows precise lateral and vertical etch/deposition and cross sections of device features and structural defects that are either impossible or impractical by conventional cleaving or lapping techniques. Using gallium LMI technology, computer controlled positioning and ultrafine machining deposition, the FIB system can perform multiple cross sections on the same sample, expose subsurface nodes, form probe pads for electrical analysis, and prepare ultra precise samples for high resolution TEM/STEM. The research supported by this instrumentation concentrates on but is not limited to advanced electronic device manufacturing development. Additional, more general research areas include analysis of ceramic materials, titanium aluminide composites, ultra low temperature brazing alloy development, and molten metal-ceramic interactions.				
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STATEMENT OF PROBLEM STUDIED

The focussed ion beam workstation has been used to prepare precisely positioned cross sections of interfaces for TEM analysis. Materials and systems studied include buried defects in GaAs devices, failure analysis in active matrix electroluminescent conventional displays on glass, micro-displays directly on silicon, gate oxide interfaces in silicon based devices, and multilayered microjoining interfaces between glass-metallization-solder systems. Precise cross sectioning of these interfaces is essential for TEM analysis of the interface. The focussed ion beam has been used to develop cross sectioning techniques without mechanical sectioning, lapping, electrochemical thinning or even bulk ion beam machining. Current efforts are directed at removal of FIB produced electron transparent thin areas from the device such that they can be directly inserted in the TEM/STEM.

SUMMARY OF MOST IMPORTANT RESULTS

The use of the FIB workstation has allowed identification of buried micron size contaminants in shorted micro-capacitors on GaAs devices. The FIB was able to precisely remove layers and to isolate by micro machining around the contaminant for subsequent TEM analysis. Similar analysis has been carried out to identify failure mechanisms of active matrix electroluminescent micro-displays built directly on Silicon and on more conventional electroluminescent display thin film stacks on glass. The micro "rewiring" capability of the FIB has been used to rewire microelectronic devices to test redesigns of the device without the time and expense of fabrication system changes.

The FIB has been used to prepare TEM cross sections of SiGe nanostructures deposited onto Silicon by Pulsed U.V. Laser induced epitaxy and to determine the high resolution microstructures developed during metallization and heat treatment of thin gate oxide materials for use in submicron MOSFETS.

LIST OF PUBLICATIONS AND TECHNICAL REPORTS

- ◆ Process Development for Si Based Nanostructures using Pulsed U.V. Laser Induced Epitaxy, Chaodan Deng, Ph.D. Thesis, OGI, Oct 1995.
- ◆ The Microstructural Effects of Metallization and Heat Treatment on Thin Gate Oxide for Use in Sub-micron MOSFETS, John McCarthy, Ph.D. thesis, OGI, November 1995.
- ◆ Microstructural Characterization of Al-5Cu and Al-1Si on 0.6nm TCA SiO₂/Si Following Heat Treatment at 400°C in N₂, Jack McCarthy, MRS Symposium Proc V382, Apr 95, Structure and Properties of Multilayered Thin Films.

LIST OF PARTICIPATING SCIENTIFIC PERSONNEL

Name	Position	Degree obtained
Jack McCarthy	Professor, OGI	Ph.D. Degree
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Daya Sing	Post-Doctoral Fellow	
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REPORT OF INVENTIONS

None

BIBLIOGRAPHY

See List of Publications/ Presentations/ Reports

APPENDIXES

None

TITLE

FOCUSSED ION BEAM WORKSTATION FACILITY

FINAL PROGRESS REPORT

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U.S. ARMY RESEARCH OFFICE

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THE REPORT IS TO INCLUDE:

1. FOREWORD (OPTIONAL)
2. TABLE OF CONTENTS (IF MORE THAN 10 PAGES)
3. LIST OF APPENDIXES, ILLUSTRATIONS AND TABLES (IF APPLICABLE)
4. BODY OF REPORT WHICH SHOULD INCLUDE THE FOLLOWING:
 - A. STATEMENT OF THE PROBLEM STUDIED
 - B. SUMMARY OF THE MOST IMPORTANT RESULTS
 - C. LIST OF ALL PUBLICATIONS AND TECHNICAL REPORTS
 - D. LIST OF ALL PARTICIPATING SCIENTIFIC PERSONNEL SHOWING ANY ADVANCED DEGREES EARNED BY THEM WHILE EMPLOYED ON THE PROJECT*
5. REPORT OF INVENTIONS (BY TITLE ONLY)*
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7. APPENDIXES

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