Reference No: FY99 #32
Product Title: Compound Semiconductor Reliability
Product Description: Investigate reliability concerns and failure mechanisms of compound semiconductor devices (GaAs, InP, SiGe, other).
Performance Period: FY97 - FYOO
Center: Jet Propulsion Laboratory
Point of Contact:
Thrust Area: Microelectronics Reliability
Status: New x Ongoing -
Benefit: Understanding of reliability failure mechanisms relating to compound semiconductors is critical for infusion of this technology into NASA applications. Benefits ranging from combining digital, analog, and RF circuitry on one chip (SiGe) to operation at high frequency and the related increase in the communication data rate. These benefit are applied to all NASA applications. The information collected is essential in establishing reliable future high data rate and optical communication links

Beneficiaries
Mars Exploration Program endorsement (Code S & M) EOS-MLS (Code Y & S)
Code R applications at GRC and LaRC

Program Objective: The objectives of this task include the following:

- Provide a solution and useful recommendations for the hydrogen problem affecting GaAs devices.
- Demonstrate the effectiveness of a non-destructive optical technique for measurement of the channel temperature of compound semiconductor devices under normal operating conditions.
- Investigate the reliability and maturity level of SiGe technology for application in space systems.

Product Alignment:

- Development of optical non-destructive channel temperature measurement technique as a reliability screen.
  Provide an infusion path for the application of SiGe technology in future space applications
- All data, test reports, and publications will be disseminated to the NASA and industrial community via suitable technical publications, NASA technology reports, and made available on the NPPP homepage.

Technical Approach: Investigate possible solutions to hydrogen effects on GaAs devices and conduct experiments to verify the suitability and reliability issues. Construct a 2dimensional-hydrogen failure model and investigate TaSiN as a suitable barrier material. Conduct experimentation to demonstrate the effectiveness of a nondestructive optical technique for channel temperature measurements. Transfer the technology to commercial industry partners. Investigate the reliability status and maturity of SiGe technology via partnership with major manufacturers and university research centers. Conduct reliability workshops and participate in industry forums to facilitate the collection and exchange of information.

Deliverables and Milestones :
The following results will be included-.

- Development of a 2-dimensional hydrogen failure model of GaAs devices.
- Hydrogen Effects report.
- TaSiN test samples evaluation reports.
- Characterization data and system setup for non-destructive channel temperature measurements.

- SiGe technology evaluation reports
- Technical papers and publications

1Q99 2-dimensional hydrogen effects model
3Q99 TaSiN evaluation report

4Q99 Transfer of channel temperature measurement system technology to industry
2Q00 SiGetechnology evaluation report
4Q00 Publish evaluation results and final report

Partners/Collaborators: Partnership with TRW, Triquint Semiconductor, University of Michigan, University of Massachusetts, Texas Instruments, Raytheon, IBM Research Laboratory, TNP, other