UNCLASSIFIED

REPORT DOCUMENTATION PAGE

AD-A199 218

	1b. RESTRICTIVE MARKINGS
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION San Diego State University Foundation	6b. OFFICE SYMBOL (if applicable)
6c. ADDRESS (City, State and ZIP Code) 5300 Campanile Drive San Diego, CA 92182	7a. NAME OF MONITORING ORGANIZATION Naval Ocean Systems Center 7b. ADDRESS (City, State and ZIP Code) San Diego, CA 92152-5000
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Naval Ocean Systems Center	8b. OFFICE SYMBOL (if applicable) NOSC
8c. ADDRESS (City, State and ZIP Code) San Diego, CA 92152-5000	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER 10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	AGENCY ACCESSION NO
63220C	EE88		DN307 378

11. TITLE (include Security Classification)

COMPARISON OF HEAVY ION AND ELECTRON-BEAM UPSET DATA FOR GaAs SRAMs

12. PERSONAL AUTHOR(S)

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Presentation/speech	FROM Apr 1988 TO Apr 1988	August 1988	

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	radiation effects semiconductor devices

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Single event upsets in GaAs complementary enhancement-mode junction field-effect transistor static random access memories (C-JFET SRAMs) fabricated by the McDonnell Douglas Microelectronics Center have been studied. Two experimental approaches were used: circuit irradiation by high-energy particles, and upset mapping using focused electron-beam pulses. Data obtained by these two methods are compared, and good agreement is found.

The heavy ion data were taken at the Berkeley cyclotron by personnel of the Aerospace Corporation. These data yield upset cross-sections versus linear energy transfer (LET). From these plots one can obtain the LET thresholds at which upsets begin to occur, and the area per cell which is sensitive to particle strikes.

The use of nanosecond duration electron-beam pulses to map the sensitive areas of GaAs SRAMs has been previously described. Single 39 keV electron-beam pulses are rastered across a memory cell, and the locations at which upsets occur are mapped. The charge per pulse is varied from map to map, and in this manner the upset area versus pulse energy is obtained. The effective LET of a 39 keV electron has been estimated from literature data, and this value is combined with the upset area versus pulse charge to yield a plot of cross-section versus LET which can be compared with the heavy ion data. Good agreement in upset thresholds and cross-sectional areas is found.

In addition, the electron-beam data also shows which regions in a circuit are sensitive. The sensitive regions in a cell are dependent on circuit configuration and device geometry. Data for two different circuit designs will be presented.

Presented at the Single Event Effects Sixth Annual Symposium, 5-6 April 1988, Los Angeles, CA.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION	
☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS	UNCLASSIFIED	
22a. NAME OF RESPONSIBLE PERSON L. D. Flesner	22b. TELEPHONE (include Area Code) (619) 553-1044	22c. OFFICE SYMBOL Code 562

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Abstract for Sixth Annual Symposium on Single Event Effects

COMPARISON OF HEAVY ION AND ELECTRON-BEAM UPSET DATA FOR GaAs SRAMs *

L.D. Flesner
Naval Ocean Systems Center
Code 562
San Diego, California 92152-5000
(619) 553-1044, Electronic Mail: FLESNER@nosc.mil

R. Zuleeg, McDonnell Douglas Microelectronics Center

W.A. Kolasinski, Aerospace Corporation

ABSTRACT

Single event upsets in GaAs complementary enhancement-mode junction field-effect transistor static random access memories (C-JFET SRAMs) fabricated by the McDonnell Douglas Microelectronics Center have been studied. Two experimental approaches were used: circuit irradiation by high-energy particles, and upset mapping using focused electron-beam pulses. Data obtained by these two methods are compared, and good agreement is found.

The heavy ion data were taken at the Berkeley cyclotron by personnel of the Aerospace Corporation. These data yield upset cross-sections versus linear energy transfer (LET). From these plots one can obtain the LET thresholds at which upsets begin to occur, and the area per cell which is sensitive to particle strikes.

The use of nanosecond duration electron-beam pulses to map the sensitive areas of GaAs SRAMs has been previously described. [References 1,2,3] Single 39 keV electron-beam pulses are rastered across a memory cell, and the locations at which upsets occur are mapped. The charge per pulse is varied from map to map, and in this manner the upset area versus pulse energy is obtained. The effective LET of a 39 keV electron has been estimated from literature data, and this value is combined with the upset area versus pulse charge to yield a plot of cross-section versus LET which can be compared with the heavy ion data. Good agreement in upset thresholds and cross-sectional areas is found.

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[1] L.D. Flesner and R. Zuleeg, Fourth SEU Symposium, April 1986
[2] R. Zuleeg and L.D. Flesner, Fifth SEU Symposium, April 1987
[3] L.D. Flesner, Naval Ocean Systems Center Technical Rept. 1170, July 1987.

*Funded by the Defense Advanced Research Projects Agency and by the Air Force Space Technology Center.