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ELECTRONIC MATERIALS AND DEVICES PREPARED BY MOLECULAR
BEAM EPITAXY (U) ILLINOIS UNIV AT URBANA COORDINATED
SCIENCE LAB N MONROE 27 APR 88 AFOSR-IR-88-0083

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Electronic Materials & Devices Prepared by Holloman Beam Epitaxy

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Hadis Morkoc

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

Six Perkin Elmer 430P III-V MBE Systems and a PE Si MBE with appropriate transfer tubes for a totally interconnected MBE Complex has been purchased and installation has begun. The complex is located in the Coordinated Science Laboratory in Room 200 with the majority of administrative role being played by MRL. In this complex, two III-V MBE systems and a transfer tube (13 feet long) and the associated assortment of equipment has been paid for by funds obtained from AFOSR. These growth chambers have been termed as "Growth Reactors A & B" with the transfer tube being called "#1 Tube". The systems are presently in CSL Room 200 which has been remodeled for this purpose and we are in the process of installing them.

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FINAL REPORT FOR AFOSR

University Research Instrumentation Grant

The funds provided by the AFOSR in the amount of \$600,000.00 were used to purchase 2 Perkin Elmer 430P molecular beam epitaxy systems and a 13 feet long transfer tube. The growth reactors (both of them) are connected to the transfer tube which also houses the sample introduction chamber having a capacity of 6 x 3" wafers. In one end of the transfer tube there exist a "preparation" chamber provided for Prof. Morkoc by Perkin Elmer on a "loan" basis. This chamber is water cooled and is equipped with a high temperature stage so that Si substrates can be outgassed. Analysis equipment, such as the Auger electron spectroscopy and mass spectrum analyzer will have to be acquired later to make it useful. Si substrates and any other substrates can also be outgassed in the main body of the transfer tube itself, where a high temperature stage is also installed. This particular sample stage is also used as a working point for sample transfer from the transfer tube into the growth chamber. The other end of the transfer tube, facing the center of the room, is connected to a 4 way cross which also connects three other transfer tubes with associated MBE equipment and sample load locks.

The 430P MBE systems purchased with AFOSR funds contain 6 effusion cells, one being for As₂ source, RHEED, UTI mass spectrum analyzer up to 200 amu, 400 l/s ion pump and CTI 10" cryopump with the appropriate gate valves (VAT) for the cryopump well, ion pump well as well as for separating the growth chamber from the transfer tube, each. The transfer tube has two VAT valves, one on loan from Perkin Elmer, in either end. The gate valve (on a 10" flange) by the cross has been purchased using AFOSR funds. It should be mentioned that the transfer tube is pumped with a 300 l/s ion pump (assisted by a Titanium sublimator) and can be parted off with a VAT valve on 8" flange (6" valve).

The other transfer tubes have on them ceramics, metals, Si, one III-V machine converted to Si, and another III-V system converted to metals MBE. In addition, an ESCA with a semi spherical

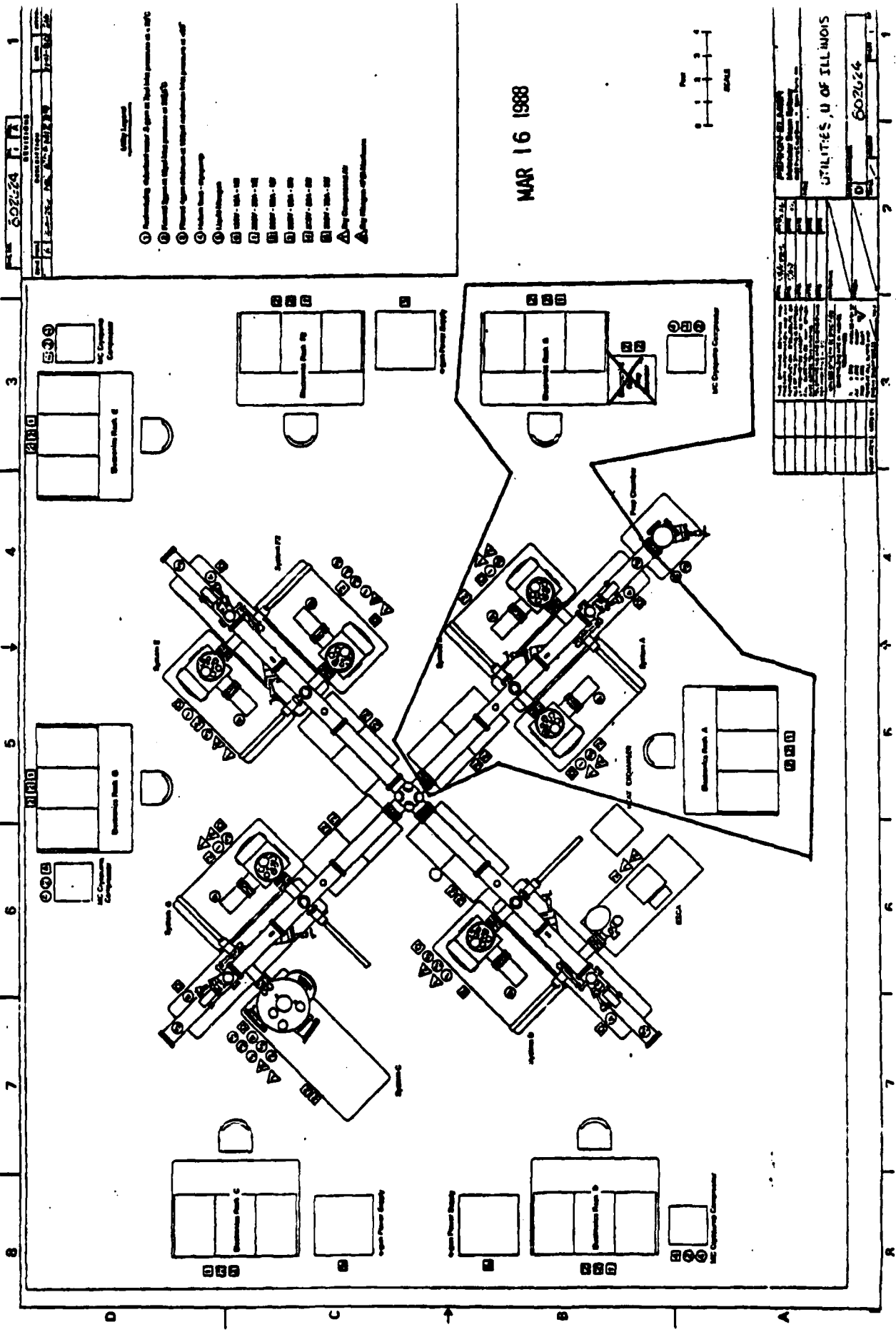
energy analyzer also exist on one of the transfer tubes, which can be accessed from the AFOSR transfer tube.

A Silicon MBE system was purchased for Morkoc by DOE through the materials research laboratory. The system is scheduled for delivery in July, 1988, and will be installed immediately thereafter.

The current status is that the room housing the 4 transfer tubes, and the growth reactors, locally named as the Epi center, is complete. The MBE systems (except the Si one) and the transfer tubes (including all the electronics) are in place and are undergoing preliminary vacuum tests on an individual basis. The plan is that once we are satisfied with the vacuum integrity, they will be connected to one another. Fig. 1 gives an schematic view of the overall system arrangement once completed. The tube pointing to the southwest and two 430P MBE systems connected to it are the ones purchased by AFOSR funds. System B, on the south side of the AFOSR transfer tubes was ordered with an additional cryopump so that gas sources for group V elements can be used by the alternate employment of two cryopumps. After careful consideration, we have decided to purchase a turbomolecular pump and a diffusion pump with appropriate cryopaneling for a state of the art gas source MBE. So far the turbomolecular pump (designed for gas source MBE environment by Balzar) and a diffusion pump have been ordered by funds obtained through DOE. Mass flow controllers and other gas manifold components are either on order or have already been received. The present plans call for the installation of a 10" Tee which will be used to install the turbo and diffusion pumps. A 10" flange valve belonging to Perkin Elmer will have to be used for the diffusion pump, which will have to be paid for at some point.

The details of what has been purchased for Systems A, B and the transfer tube is also enclosed here for the records of AFOSR. As the systems are installed Dr. G. Witt of AFOSR will be kept abreast of the developments and the final configuration.

We expect the installation of all systems to be completed by the end of June with epi growth to follow shortly afterwards.



PERKIN-ELMER SICAL ELEC. DIV.	TITLE SHEET: 1 3/30/87 U OF ILLINOIS, C00062A	DETACHED PARTS LIST 802346	ENG. DRAWING NO 2F
ITEM PART NO.	QTY	UM DESCRIPTION	DRAWING NO. REFERENCE
31 800178	2.000	EA MOD 430 BASE SYSTEM	FROM TO
32 1004389	2.000	EA CONTROL-ION PUMP, 120-500LS 60H	
03 800205	20.000	EA MOUNT, WAFER, UNBONDED, 3 INCH	
04 800595	3.000	EA KIT, CRYOPUMP OPTION CT-8	
05 801110	2.000	EA MICRISTAR OPTION	
06 802856	2.000	EA OPTION, 2CC EFFUSION CELL	
07 802858	4.000	EA OPTION, 20CC EFFUSION CELL	
08 802860	4.000	EA OPTION, 60CC EFF CELL, GRAPHITE	
09 800528	2.000	EA KIT-200CC EFFUSN CELL(DC VRN)	
10 800529	2.000	EA KIT, HEED SYSTEM	
11 800531	2.000	EA KIT, RGA SYSTEM W/DISPLAY	
12 802400	1.000	EA TRANSFER TUBE ASSY, 13 FT.	
13 800592	1.000	EA KIT, SINGLE SAMPLE ISOLATOR	
14 800783	2.000	EA TRANSFER STATION OPTION	
16 800522	1.000	EA KIT, OPTION HEATER INSTL	
17 802913	2.000	EA CROSS, FLEXLINE CONNECTOR	
19 800393	1.000	EA KIT-INSTL, UHV INTRO	
20 800532	1.000	EA KIT, OPTICAL PYROMETER	
21 800534	1.000	EA KIT, CAMERA OPTION	
22 800697	1.000	EA COMPRESSOR-WATER COOLED, CT1-MC	
23 802402	1.000	EA CHAMBER, GROWTH PORT, MODIFIED	
24 800692	8.000	EA FLEXLINE-INTCON, 10 FT LG, CT1	
25 800728	8.000	EA FLEXLINE-INTCON, 20 FT LG, CT1	
26 800693	8.000	EA CONN-FLEXLINE UNION, M/M, CT1	
27 606689	4.000	EA MOD 115-WAFER MOUNT	

6/SYS, 12 SPARES
1 SPARE

SYSTEM B

SPARE
CHAMBER A
CHAMBER A

CHAMBER A ONLY
2 SPARES
2 SPARES
2 SPARES

MAR 16 1988



END OF REPORT

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RKIN-ELMER TITLE SHEET: 1 3/30/87 DETACHED PARTS LIST ENG. DRAWING NO 2F
ICAL ELEC. DIV. U OF ILLINOIS, C00062A 802346

PART NO.	QTY	UM	DESCRIPTION	DRAWING NO.	REFERENCE	FROM	TO
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1 800205	20.000	EA	MOUNT, WAFER, UNBONDED, 3 INCH		6/SYS, 12 SPARES		
1 800595	3.000	EA	KIT, CRYOPUMP OPTION CT-8		1 SPARE		
1 801110	2.000	EA	MICRISTAR OPTION				
1 802856	2.000	EA	OPTION, 2CC EFFUSION CELL				
1 802858	4.000	EA	OPTION, 20CC EFFUSION CELL				
3 802860	4.000	EA	OPTION, 60CC EFF CELL, GRAPHITE				
3 800528	2.000	EA	KIT-200CC EFFUSN CELL(DC VRSN)				
3 800529	2.000	EA	KIT, HEED SYSTEM				
1 800531	2.000	EA	KIT, RGA SYSTEM W/DISPLAY				
2 802400	1.000	EA	TRANSFER TUBE ASSY, 13 FT.				
3 800592	1.000	EA	KIT, SINGLE SAMPLE ISOLATOR				
4 800783	2.000	EA	TRANSFER STATION OPTION				
6 800522	1.000	EA	KIT, OPTION HEATER INSTL		SYSTEM B		
7 802913	2.000	EA	CROSS, FLEXLINE CONNECTOR		SPARE		
9 800393	1.000	EA	KIT-INSTL, UHV INTRO		CHAMBER A		
0 800532	1.000	EA	KIT, OPTICAL PYROMETER		CHAMBER A		
1 800534	1.000	EA	KIT, CAMERA OPTION				
2 800697	1.000	EA	COMPRESSOR-WATER COOLED, CT1-MC		CHAMBER A ONLY		
3 802402	1.000	EA	CHAMBER, GROWTH PORT, MODIFIED		2 SPARES		
4 800692	8.000	EA	FLEXLINE-INTCON, 10 FT LG, CT1		2 SPARES		
5 800728	8.000	EA	FLEXLINE-INTCON, 20 FT LG, CT1		2 SPARES		
6 800693	8.000	EA	CONN-FLEXLINE UNION, M/M, CT1				
7 606689	4.000	EA	MOD 115-WAFER MOUNT				

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