CHAPTER - V

SUMMARY & CONCLUSION

CHAPTER - FIVE

SUMMARY AND CONCLUSION

The Research Laboratory of the Physics Department conducting several experiments. The scientific data of all these experiments are recorded manually on the paper with time. Such type of recording is lengthy and it has certain drawbacks. For example, some experiments in the ferroelectricity lab are very long. It requires two to three hours. This becomes tiresome, time consuming work and there may be a possibility of errors. If the data is recorded digitally, then there will be no such limitations.

This present work has been proposed out for designing the data acquisition system using computer for interfacing the different types of sensors. With the help of this system attempt has been made to work out four applications: i) Temperature measurement, ii) Electrical field for d.c conductivity measurement, iii) Thermoelectric power measurement, and iv) Semiconductor device (Diode) characteristics measurement ; for acquiring the data, preparing data files and from the data files plot the graph of different parameters. This data acquisition system consists of a analog input circuitry, mV/mA input interfacing card and PC-XT. The interfacing card consists of Protection and filter circuit, Multiplexer, Amplifier, A/D converter, Opto isolator, Programmable peripheral device, Timer/counter, Address decoding logic circuitry, Interrupt logic circuit etc. This interfacing card is fitted inside the PC and analog input for

different channel is given through the 37-pin D type connector, which comes from outside the PC. In this we can select applications randomly or sequentially. This system have 12 analog input channels. The voltage and current range of each analog input channels +/- 4.096 V and +/- 100 mA respectively. The speed of the system is one sample per 133 millisecond.

This dissertation consisting of five chapters. In the first chapter complete theory of the data acquisition system has been given. It gives the information regarding to the work performed by the DAS. Optional units which are very important for the DAS are also included. Different types of the DAS and their comparison is made in detail. Sampling theorem and its proof is discussed which is necessary for the A/D conversion. Some factors which are important for the DAS design are also given. The first chapter ends with the applications of the DAS.

Second chapter deals PC hardware, system software overview and digital interfacing concepts. PC hardware overview includes introduction about the PC, IBM PC motherboard, I/O port addresses, I/O channel and their description has been given. The system software discussion is carried about the basic system software regarding the operating system and program development software. At the end of this chapter digital interfacing concepts are discussed.

Third chapter includes system design considerations. It started with the information regarding mV/mA input interfacing card. It gives the block diagram of the input card and its specifications. Hardware details of this card are discussed

blockwise. The four applications for which this system was designed are discussed in details.

The chapter four gives the software designed for work out the four applications of the DAS. This chapter also includes the flowcharts for easy understanding of the software.

DATA FILES:

When the experimental process is going on, we can see the progress of the experimental results on the screen . At the same time data file is prepared. From the data file we can verify the validity of the recorded data by using the graph plotting software. Due to that data file is required. Data plotted after acquisition tallied well as one can see in the data sheets enclosed.

Data sheet No-1 shows the data file prepared from the temperature measurement experiment. It consists of time in seconds and temperature in degree Celsius for both heating and cooling of the sensor.

Data set No-2 shows the data file of only few readings for cooling of the sensor.

Data sheet No-3 gives the data file of the experiment for find out the electrical field for conductivity measurement. It gives the electrical field in volts per cm. and current density in ampere per sq.cm.

Data file No-4 deals the data from the thermoelectric power measurement experiment. It consists of furnace temperature(in degree Celsius), E.M.F., difference temperature and thermoelectric power. This experiment is work out for the

pellet of Lithium Vanadate doped with Ø.Ø25 mole % of Chromium oxide.

Data file No-5 gives the data of the experiment of T.E.P measurement for the pure Lithium Vanadate.

The last data file NO-6 is regarding to the semiconductor characteristics measurement experiment. It gives the voltage(mv) and current(micro ampere).

PLOTTING THE GRAPHS FROM THE DATA FILES :

Fig.(5.1) shows the graph of the temperature measurement application for both heating as well as cooling of the sensor.

Fig.(5.2)- The temperature measurement for cooling of the sensor.

Fig.(5.3)- To find out the electrical field for conductivity measurement for the sample pure KVO_3.

Fig.(5.4)- The thermoelectric power measurement for Lithium Vanadate ($LiVO_3$) doped with Ø.Ø25 mole % of Chromium Oxide (Cr_2O_3) (for delta T= 2Ø to 25 deg. Celsius).

Fig.(5.5)- Thermoelectric power measurement for pure Lithium Vanadate ($LiVO_3$).

Fig.(5.6)- Diode characteristics measurements.

▪TA SHEET NUMBER 1
OR HEATING AND COOLING OF THE SENSOR)

ME (SEC)	TEMP.	TIME (SEC)	TEMP.
0	30.3611	510	50.8
10	30.7222	520	51.0889
20	32.6	530	51.3056
30	33.7556	540	51.5222
40	34.6944	550	51.8111
50	35.56111	560	52.02777
60	36.28333	570	52.38888
70	36.93333	580	52.60555
80	37.5833	590	52.9667
90	38.0889	600	53.2556
100	38.6667	610	47.55
110	39.1	620	47.8389
120	39.6056	630	49.3556
130	40.0389	640	49.0667
140	40.4722	650	54.7
150	40.8333	660	54.9889
160	41.3389	670	55.2056
170	41.3389	680	55.4222
180	41.6278	690	55.7111
190	41.9167	700	55.9278
200	42.1333	710	56.1444
210	42.4944	720	56.4333
220	42.7833	730	56.65
230	43.0722	740	56.8667
240	43.3611	750	52.0278
250	43.5778	760	51.0889
260	43.7944	770	57.5889
270	44.0111	780	57.7333
280	44.3722	790	58.0944
290	44.6611	800	51.9556
300	44.95	810	51.1611
310	45.2389	820	52.3167
320	45.5278	830	51.5222
330	45.8167	840	52.3167
340	46.3222	850	58.7444
350	46.6833	860	58.5278
360	46.9722	870	0.461111
370	47.3333	880	0.461111
380	47.55	890	0.461111
390	47.7667	900	58.3111
400	48.0556	910	57.6611
410	48.2722	920	57.2278
420	48.5611	930	56.8667
430	48.7778	940	56.5056
440	48.9944	950	56.2167
450	49.2833	960	55.9278
460	49.5722	970	55.5667
470	49.7889	980	55.2778
480	50.0778	990	55.0611
490	50.2944	1000	54.7722
500	50.5833		

TIME (SEC)	TEMP.	TIME (SEC)	TEMP.
1010	54.5556	1510	44.7333
1020	54.2667	1520	44.5889
1030	54.05	1530	44.5167
1040	53.6889	1540	42.2056
1050	53.4	1550	44.2278
1060	53.1833	1560	44.0833
1070	52.8944	1570	44.0111
1080	52.6056	1580	43.8667
1090	52.3167	1590	43.7944
1100	52.1722	1600	43.65
1110	51.8833	1610	40.3278
1120	51.6667	1620	43.4333
1130	51.45	1630	43.3611
1140	51.2333	1640	43.1444
1150	51.0889	1650	43.1444
1160	50.8	1660	43.0722
1170	50.6556	1670	43
1180	50.4389	1680	42.9278
1190	50.2944	1690	42.8556
1200	50.0778	1700	42.7111
1210	49.8611	1710	42.6389
1220	49.6444	1720	42.6389
1230	49.4278	1730	42.4944
1240	49.2111	1740	42.4222
1250	49.0667	1750	38.5944
1260	48.85	1760	42.2778
1270	48.6333	1770	42.35
1280	48.4167	1780	42.1333
1290	48.2722	1790	41.9889
1300	48.0556	1800	41.8444
1310	47.8389	1810	41.8444
1320	47.6222	1820	41.8444
1330	47.4778	1830	41.7722
1340	47.2611	1840	41.2667
1350	47.0444	1850	41.5556
1360	46.8278	1860	41.4833
1370	46.7556	1870	41.4833
1380	46.4667	1880	41.3389
1390	46.3222	1890	41.2667
1400	46.1778	1900	41.1944
1410	46.0333	1910	41.1944
1420	45.8889	1920	41.05
1430	45.8889	1930	40.9778
1440	45.6722	1940	40.9778
1450	45.5278	1950	40.9056
1460	45.3833	1960	40.8333
1470	45.2389	1970	40.7611
1480	45.0944	1980	39.8944
1490	44.95	1990	38.8833
1500	44.8056	2000	40.5444

TIME (SEC)	TEMP.	TIME (SEC)	TEMP.
2010	40.5444	2510	38.2333
2020	40.4722	2520	38.2333
2030	38.7389	2530	38.1611
2040	40.3278	2540	38.1611
2050	40.2556	2550	38.0889
2060	40.2556	2560	38.0167
2070	38.7389	2570	38.0167
2080	38.9556	2580	37.9444
2090	38.5944	2590	37.9444
2100	39.6778	2600	37.9444
2110	39.9667	2610	37.8722
2120	39.8944	2620	37.8722
2130	39.8944	2630	37.8
2140	39.8222	2640	38.0167
2150	38.8111	2650	37.3667
2160	38.6667	2660	37.9444
2170	39.6778	2670	37.6556
2180	39.6056	2680	37.7278
2190	39.6056	2690	37.6556
2200	39.5333	2700	38.1611
2210	39.4611	2710	38.3778
2220	39.3889	2720	37.4389
2230	39.3889	2730	37.5111
2240	39.3167	2740	37.4389
2250	39.2444	2750	37.3667
2260	39.2444	2760	37.2222
2270	39.1722	2770	37.2944
2280	39.1	2780	37.2944
2290	39.1	2790	37.3667
2300	39.0278	2800	37.15
2310	38.9556	2810	36.5722
2320	38.9556	2820	37.2944
2330	38.8833	2830	37.15
2340	38.8833	2840	37.15
2350	38.8111	2850	37.0778
2360	38.8111	2860	37.15
2370	38.7389	2870	37.15
2380	38.6667	2880	37.15
2390	38.6667	2890	37.15
2400	38.5944	2900	37.4389
2410	38.5944	2910	37.5833
2420	38.5944	2920	37.15
2430	38.5222	2930	38.0889
2440	38.45	2940	37.15
2450	38.3778	2950	36.8611
2460	38.3778	2960	38.1611
2470	38.3778	2970	38.0889
2480	38.6667	2980	37.0778
2490	38.8833	2990	37.5833
2500	38.2333	3000	37.6556

TIME (SEC)	TEMP.	TIME (SEC)	TEMP.
3010	37.5111	3510	36.2111
3020	37.0778	3520	36.2111
3030	36.7889	3530	36.2111
3040	37.5111	3540	36.2111
3050	38.0889	3550	36.2111
3060	37.6556	3560	36.2111
3070	37.5111	3570	36.2111
3080	37.5111	3580	36.2111
3090	36.7889	3590	36.2111
3100	38.0167	3600	36.6444
3110	37.8		
3120	37.5111		
3130	36.8611		
3140	36.7167		
3150	34.6944		
3160	37.9444		
3170	37.15		
3180	37.9444		
3190	37.7278		
3200	37.6556		
3210	38.0167		
3220	37.3667		
3230	37.9444		
3240	36.8611		
3250	36.7167		
3260	37.6556		
3270	37.6556		
3280	37.8		
3290	37.5833		
3300	36.8611		
3310	37.5833		
3320	36.9333		
3330	36.5722		
3340	37.15		
3350	36.8611		
3360	37.0778		
3370	37.6556		
3380	36.3556		
3390	36.3556		
3400	36.3556		
3410	36.3556		
3420	36.3556		
3430	36.3556		
3440	36.2833		
3450	36.2111		
3460	36.2833		
3470	36.2833		
3480	36.2111		
3490	36.2111		
3500	36.2111		

DATA SHEET NO-2. (FOR COOLING OF THE SENSOR).

TIME(SEC.)	TEMP(DEG.CELSIUS)
Ø	35.85
1Ø	35.9222
2Ø	35.9222
4Ø	35.7778
5Ø	35.5611
6Ø	35.2722
7Ø	35.Ø556
8Ø	34.9111
9Ø	34.8389
1ØØ	34.6944
11Ø	34.6944
13Ø	34.55
16Ø	34.2611
17Ø	34.1889
18Ø	34.1167
19Ø	33.9722
2ØØ	33.9722
21Ø	33.9
22Ø	33.9
24Ø	33.8278
25Ø	33.8278
26Ø	33.8278
28Ø	33.6833
29Ø	33.6833
3ØØ	33.6833

TA SHEET NO.3 ELECTRIC FIELD FOR DENSITY MEASUREMENT.

SR_NO	ELECTRIC FIELD	CURRENT DENSITY
1	10	11
2	30	15
3	40	17
4	80	25
5	100	29
6	118	34
7	149	43
8	150	43.5
9	151.2	48
10	151.5	49

^THERM01.DAT DATA-FILE

DATA SHEET NO.4 THERMOELECTRIC POWER MEASURMENT
FOR LITHIUM VANADATE DOPED WITH Ø.Ø25 MOLE % OF CHROMIUM [redacted]-OXIDE

FURNACE TEMP.	E.M.F.	DIFF.TEMP.	E.M.F./25
19Ø.25	Ø.Ø413	21.Ø97	Ø.ØØ1652
2Ø5.75	Ø.Ø82	2Ø.8757	Ø.ØØ328
21Ø.75	Ø.1Ø31	22.34	Ø.ØØ4Ø84
216	Ø.1139	27.59Ø8	Ø.ØØ4556
22Ø.5	Ø.1257	3Ø	Ø.ØØ5Ø28
226.25	Ø.1617	19.6789	Ø.ØØ6468
231.75	Ø.181	27.8979	Ø.ØØ724
237.25	Ø.27Ø9	22.7161	Ø.Ø1Ø836
241	Ø.4Ø71	27.6913	Ø.Ø16284
252.5	Ø.8657	28.7619	Ø.Ø34628
255.75	Ø.8959	28.ØØØ8	Ø.Ø35876
26Ø.5	Ø.9331	23.Ø9Ø4	Ø.Ø37324
266.25	Ø.9532	23.Ø915	Ø.Ø38128
271.5	1.ØØ79	23.Ø997	Ø.Ø4Ø316
276.75	1.Ø189	24.Ø112	Ø.Ø4Ø756
281.5	1.Ø453	25.Ø718	Ø.Ø41812
285.75	1.Ø749	25.131	Ø.Ø42996
29Ø.5	1.16Ø9	25.43Ø9	Ø.Ø46416
296.25	1.24Ø8	25.89	Ø.Ø49632
3Ø2	1.3453	26.Ø118	Ø.Ø53812
3Ø5.25	1.4717	26.Ø7Ø9	Ø.Ø65886
32Ø.75	1.8Ø11	21.Ø11	Ø.Ø72Ø44
336.75	5.2Ø67	21.8313	Ø.2Ø8268
342.25	5.6896	23.6Ø18	Ø.227584
345.75	5.7237	24.Ø597	Ø.228948
351.25	6.Ø989	26.Ø9	Ø.243956
367	5.2232	28.48Ø8	Ø.2Ø8928
376.75	3.8413	21.5212	Ø.153652
381.5	2.2412	23.Ø889	Ø.Ø89648
384.57	Ø.574	23.1979	Ø.Ø2296
39Ø.25	-Ø.7657	24.6972	-Ø.Ø3Ø628
385	-2.4232	25.Ø139	-Ø.Ø96928
385.75	-2.8Ø47	25.7Ø49	-Ø.112188
39Ø.5	-3.2292	25.8953	-Ø.129168
396.25	-3.6399	25.9334	-Ø.145596
4Ø2	-3.8223	25.9619	-Ø.152892
411.75	-4.2445	25.9911	-Ø.16978

^THERMO2.DAT DATA-FILE
DATA SHEET NO. 5
THERMOELECTRIC POWER MEASUREMENT FOR PURE LITHIUM VANADATE

FURNACE TEMP.	E.M.F.	DIFF.TEMP.	E.M.F./20
206.75	3.6479	19.7908	0.182395
237.25	3.7686	19.89	0.18843
240.25	3.8654	21.03	0.19327
245.75	3.94	21.0811	0.197
255.5	4.0203	22.1019	0.201015
282.1	4.5889	22.2977	0.229445
349.1	3.3269	18.891	0.166345
352.87	3.1255	19.1	0.156275
360.25	2.9901	18.0072	0.149505
367	2.9435	17.8794	0.147175
371.57	2.9087	19.1064	0.145435
378.25	-0.3803	19.3612	-0.019515
382.5	-0.3945	20.0008	-0.019725
384.45	-0.3197	20.0797	-0.015985
385.5	-0.2518	20.0782	-0.01259
402.25	-2.1227	23.1184	-0.106135
412	-2.4118	19.8909	-0.12059
414.8	-1.9312	21.1121	-0.09656
422.25	-1.7508	20.7789	-0.08754
433.07	-2.2797	21.3219	-0.113985
445.25	-3.481	22.0037	-0.17405
451	-3.7114	20.1181	-0.18557
457.1	-4.2269	20.0957	-0.211345

DATA SHEET NO.6 (DIODE CHAR. MEASUREMENT)

"Sr.No."	"Voltage(mV)"	"Current(micro Amp.)"
Ø	Ø	Ø
1	2Ø4	2Ø
2	1ØØ	1Ø
3	84	2Ø
4	132	1Ø
5	164	2Ø
6	188	2Ø
7	224	2Ø
8	24Ø	3Ø
9	268	3Ø
1Ø	288	3Ø
11	32Ø	4Ø
12	344	5Ø
13	368	5Ø
15	4ØØ	8Ø
17	456	1ØØ
18	468	12Ø
2Ø	516	17Ø
21	56Ø	24Ø
22	596	29Ø
23	664	44Ø
24	8Ø4	72Ø
25	112Ø	143Ø
26	112Ø	143Ø

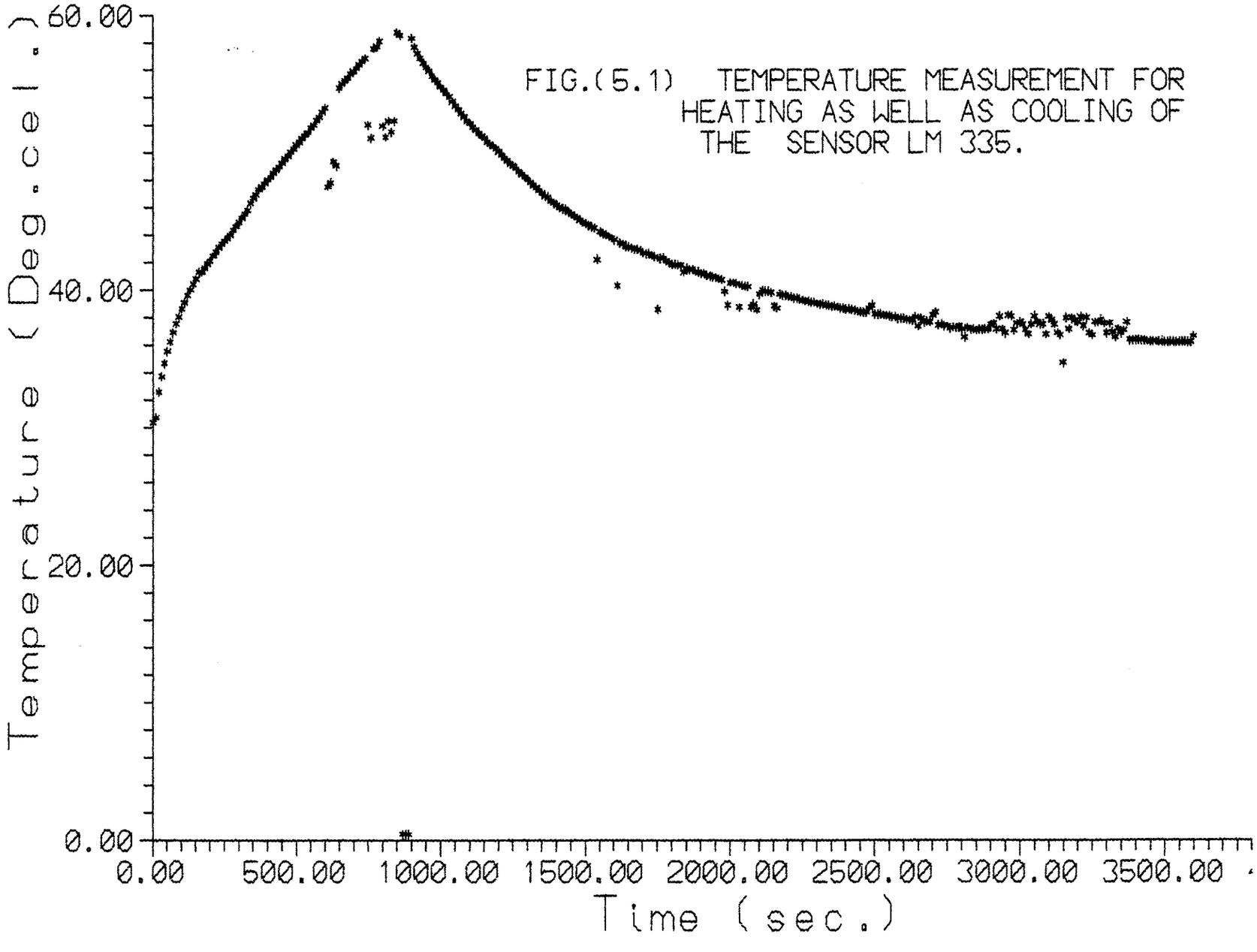


FIG.(5.1) TEMPERATURE MEASUREMENT FOR HEATING AS WELL AS COOLING OF THE SENSOR LM 335.

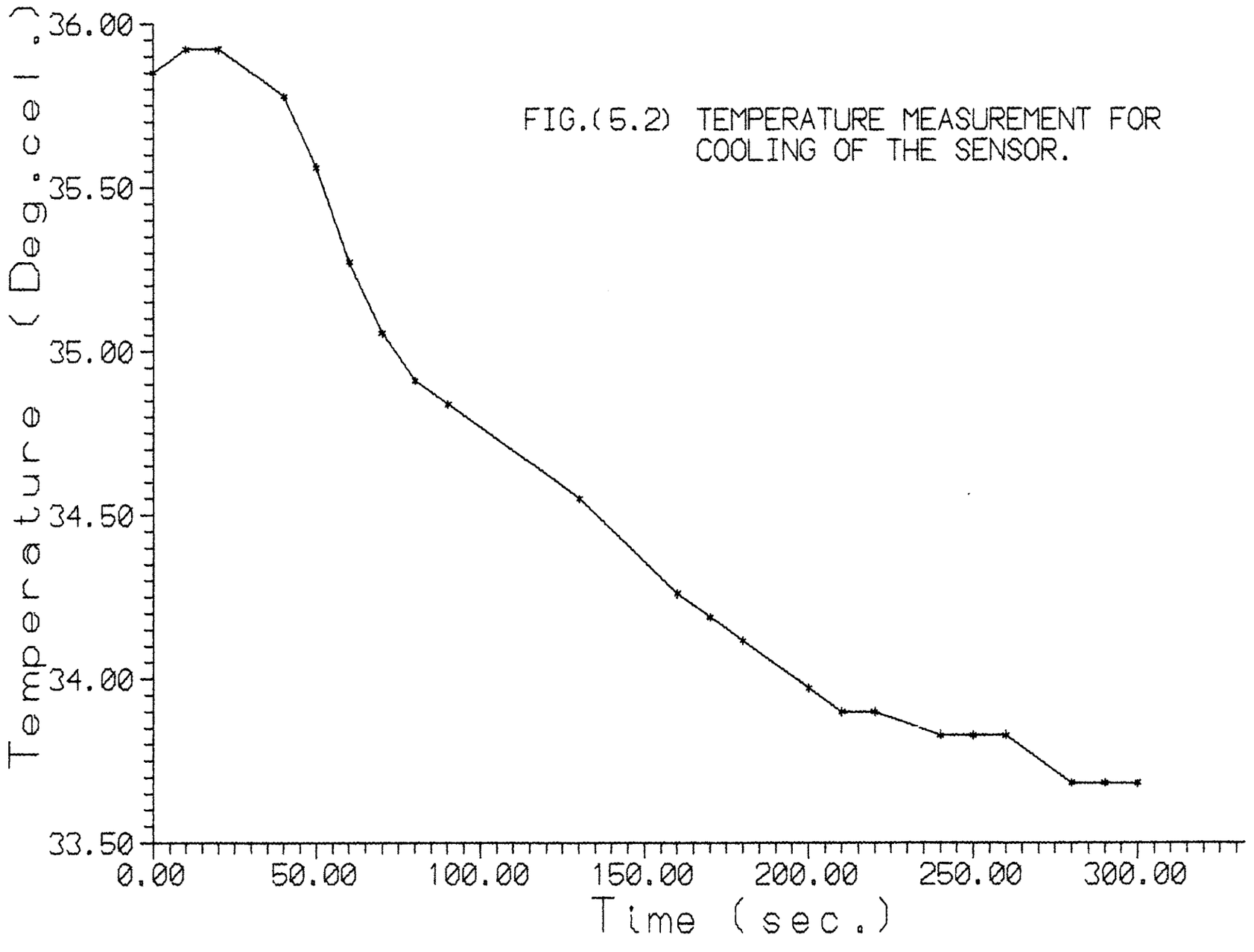


FIG.(5.2) TEMPERATURE MEASUREMENT FOR COOLING OF THE SENSOR.

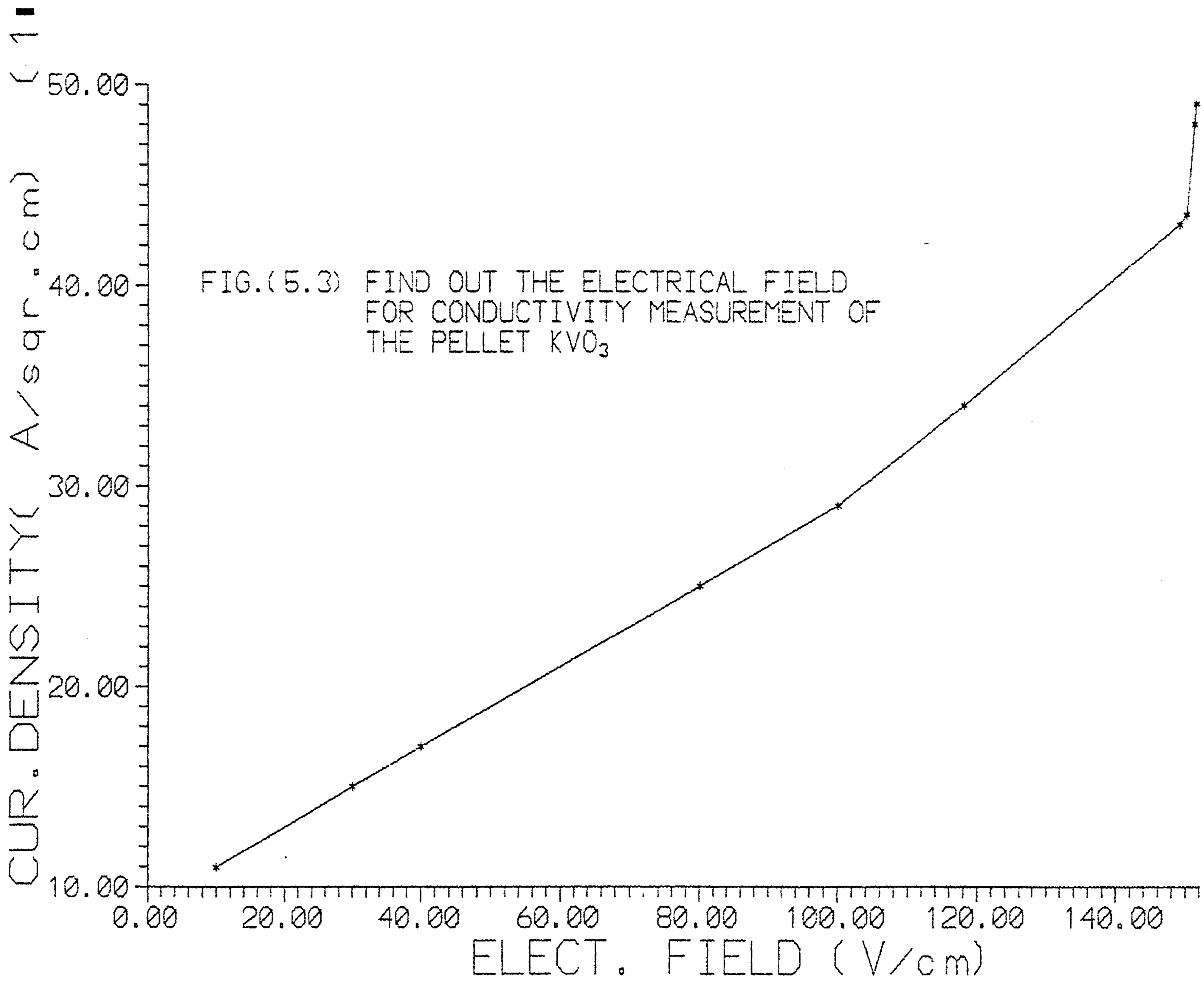


FIG.(5.3) FIND OUT THE ELECTRICAL FIELD FOR CONDUCTIVITY MEASUREMENT OF THE PELLET KVO_3

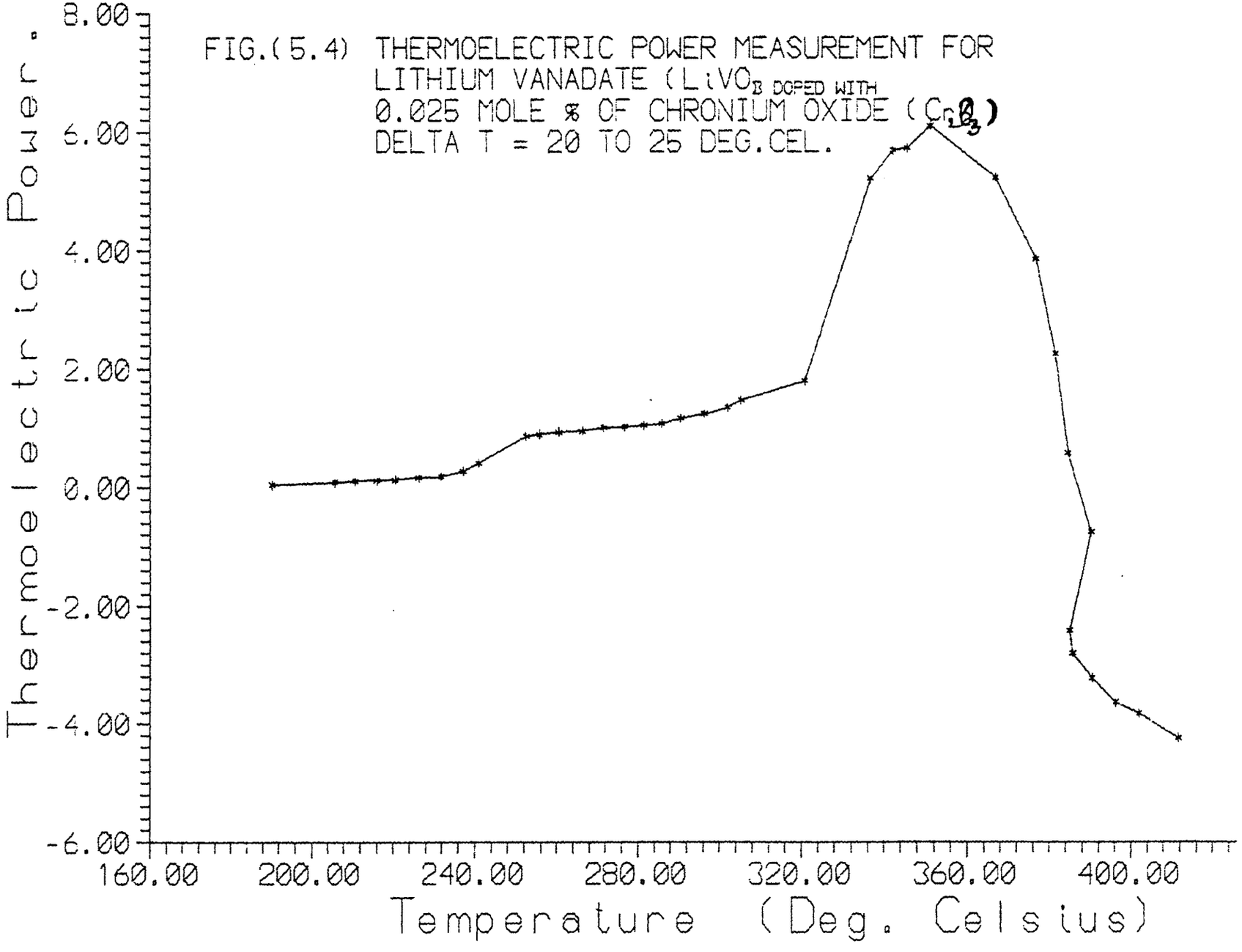
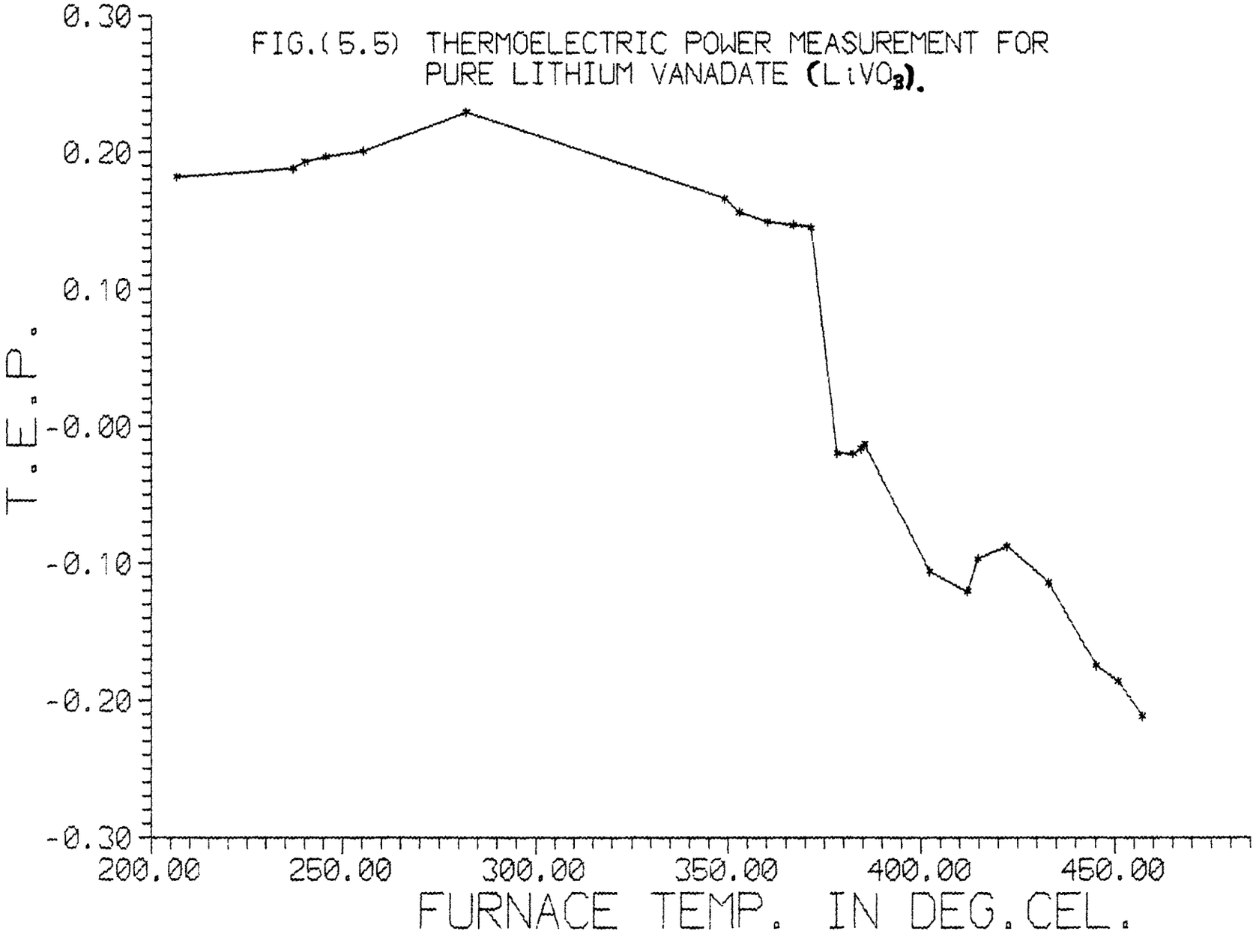


FIG.(5.4) THERMOELECTRIC POWER MEASUREMENT FOR
LITHIUM VANADATE ($LiVO_3$ DOPED WITH
0.025 MOLE % OF CHRONIUM OXIDE (Cr_2O_3)
DELTA T = 20 TO 25 DEG.CEL.
Thermoelectric Power.
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
160.00
200.00
240.00
280.00
320.00
360.00
400.00
Temperature (Deg. Celsius)

FIG.(5.5) THERMOELECTRIC POWER MEASUREMENT FOR PURE LITHIUM VANADATE ($LiVO_3$).



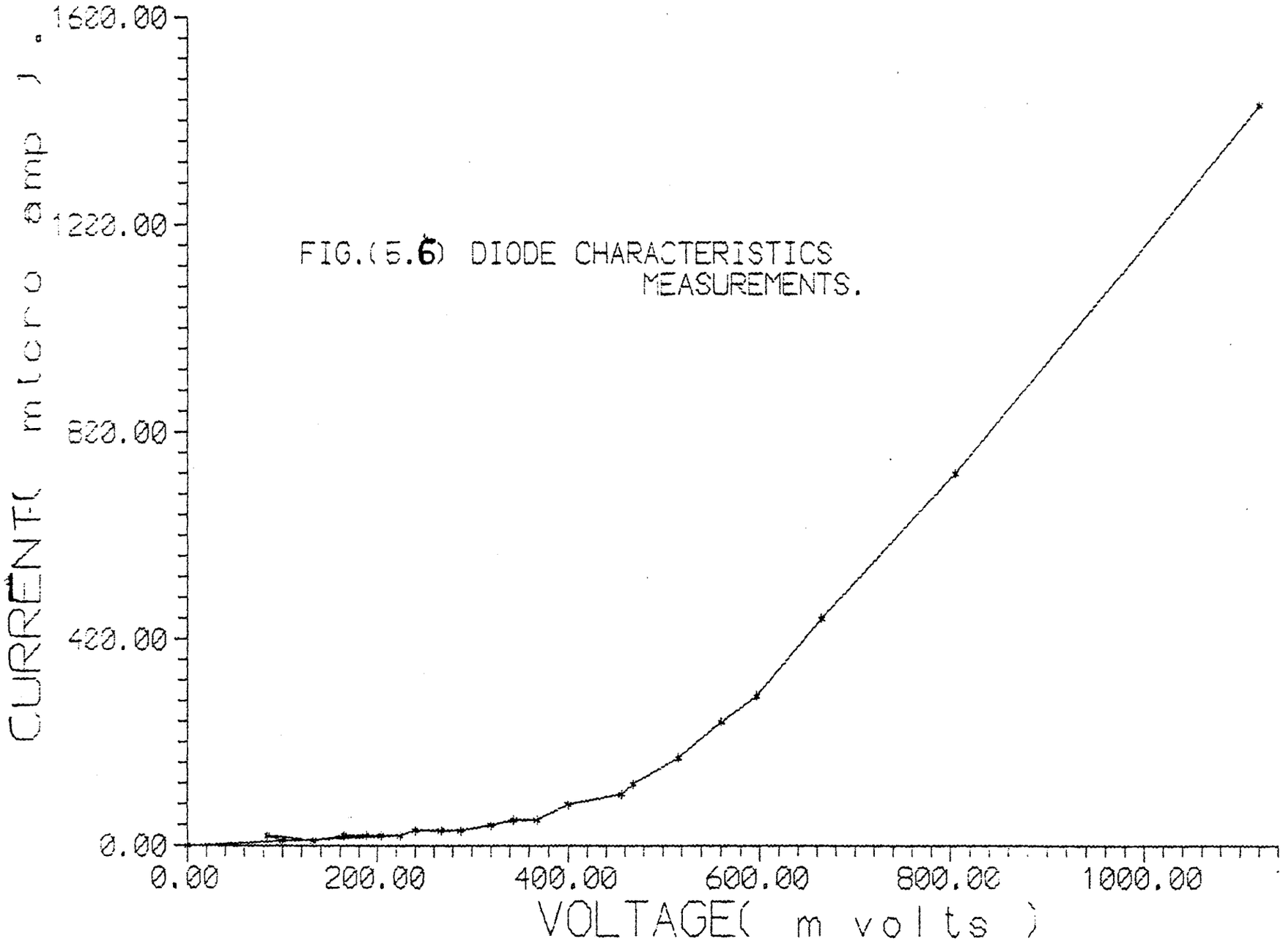


FIG.(5.6) DIODE CHARACTERISTICS MEASUREMENTS.