The Data Check on the Tc of K1 Type Superconductor

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Abstract

The minus temperature of 91.02 (℃) detected by experimental analysis[1] is now significant data as a superconducting transition temperature (Tc) because there may be possible that it is the highest Tc as far as I know. But there is a catch to it, that is, I have to check the accuracy of measuring instrument with special care to gain confidence in my own ability. In this paper, I would like to report the some experimental results of the certificate examination by the computer-ided thermometric system and check the abnormal Tc of the K1 type superconductor.

1. Introduction

As to the certificate examination for the thermometer, there are three kinds of simple and easy ways for me to put them into the practice. One of them is to measure the boiling point of liquid nitrogen and the others are the temperature measuring of dry ice and iced water.

As widely known for typical temperatures, they have to be indicated about (−)196(℃), (−)80(℃), and 0(℃) respectively if they are in 1 atmospheric pressure and the thermometer normally works. Among of these subjects, I would like to check the latter two cases in paticular because the measurements of the boiling point of liquid nitrogen have been tried by many times untill now. And, as to the boiling point of it, the thermometer seems to normally work since it has been detected at the temperature of about (−)196(℃)[1] in this research.

2. The Data Based on the Experiment

Fig. 1 is the correlative graph between the cooling temperature (T) and the negative voltage indicated by the computer-ided observing system in this research. Here, the bold line, namely, the negative voltage generated with the resistance of the samples represents the resistant properties to check the superconductivity. The other, the thin line indicates the environmental temperature nearby the samples of K1 type superconductor. And so, the tip of thermocouple, that is, the sensor of temperature doesn't touch on the any parts of surface of the samples. Therefore, the Tc in this paper basically doesn't mean the critical temperature of translating into the superconductivity but means the environmental critical temperature nearby the samples of K1 type superconductor. This is because we need to know such temperature as the Tc when the applications of the high-Tc superconductors are

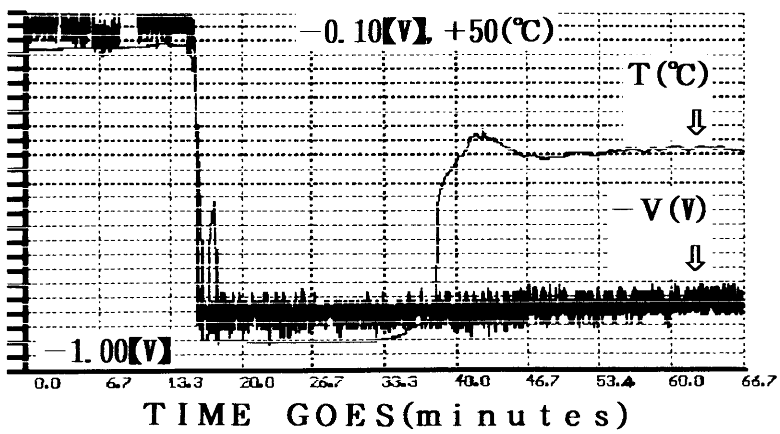

Fig 1. The correlative graph between the cooling temperature (thin line) and the negative voltage (bold line).

considered. By the way, we can find four wide bold lines in the early stages of the figure 1. Here, the first wide bold line was recorded when I fitted the samples of K1 type superconductor (hereafter, represent with the symbol "K1") on the computer-ided observing system as an element of electric circuit. Since the resistance value by the measuring of K1 at the room temperature is about 46 【Ω】, let us suppose that this first bold line is recorded about 46 【Ω】. Further, the second bold line is recorded by using a standard resistor of about 46 【Ω】 to make sure the precision of this observing system. And the third bold line is recorded by using a standard resistor of about 50 【Ω】 to make sure the direction of an increase in the negative voltage. As we can see them at the begining of this experiment, the negative voltage corresponding to the value of 50 【Ω】 is indicated by the ordinate lower than the 46 【Ω】 because the electrical resistance has a same sense of direction with the negative voltage. So the lowest negative voltage means that the electrical resistance is tiny but is not zero. And the fourth bold line is recorded by using the self same K1 sample just before the cooling. After that, we find both the temperature and the negative voltage are suddenly drop to the lowest one of each at 987 seconds later than the beginning of this experiment. Needless to say, this is because the K1 changed in quality and has suddenly taken on a superconductivity. Therefore, there must be Tc on the way of cooling to the lowest temperature zone, if it is a superconductor in the true sense of the word. However, it is still hard to make sure of the Tc at this stage because of its sudden drop into the lowest one. So what I suggest is making use of the stable temperature zone such as is observed immediately after the vaporization of liquid nitrogen. In the figure1, this corresponds to the temperature zone after about 40 minutes from the beginning of this experiment. Since the temperature does not under-go a violent change in these zones, so we should say that it is a proper environment for the measurement of the Tc. That is, when the temperature zone like this is adopted as a way of measuring the Tc, we may be able to get the following paticular notes,

(1) These measurements are very precise, if the measuring instrument works normally.

(2) As the magnet falling down slowly can be seen, the Tc which means the critical temperature of translating into the nonsuperconductivity can be measured.

Therefore, the numerical data Table 1 corresponding to the figure 1 is essential to check the Tc concretely and must be reported in detail here. However, when the Table 1 is announced in public, it has to be considered with the following provisoes that

(1) The measurements were carried out once a second,

(2) Table 1 starts from the data at the 898 seconds after the beginning of the measurements,

(3) The room temperature measured with the thermo metric soft program was about 26.8(℃) and was almost equal to one indicated by general thermometer,

(4) The data on the temperature near by the K1 corresponds to a thin line in the figure 2,

(5) The data on the negative voltage corresponds to a bold line in the figure 2.

Namely, since the data on (4) and (5) are taken at the same time, so I should say that it is possible to check the Tc if the Meissner effect signal can be seen.

3. Correlation between the Temperature and Negative Voltage

Figure 2 and 3 are just the graphs corresponding to the table 1, 2 and 3. Where, the Figure 2 indicates the behaviour of negative voltage on the way to the lowest level with the cooling and vaporization by liquid nitrogen. The other the figure 3 measuring up to the figure 4 indicates the behaviour of neative voltage at the instant of increasing over the lowest level. Namely, these graphs 2 and 3 have a big difference in the getting closer way that lead to their each levels of negative voltage. So, when we search a trace for the Tc, the figure 3 or 4 is to be the noteworthy graph in particular, because of its proper environment for the measurement of the Tc. Therefore, the table 4 must be also shown here as a numerical data corresponding to the subject of figure 4.

4. Circumstantial Evidence

Needless to say, it is essential to make sure of Meissner's effect signal, and a fall of magnet dropping slowly at that. Figure 5 is a graph indicated by the same way as figure 1. Where the aim of this graph is to find the Tc of K1 type superconductor. Since the numerical data will be recorded as clear as above mentioned tables, so it is possible for us to catch the Tc if the Meissner's effect signal can be seen and marked. As we can see the misshapen curve a little bit at the abscissa 46.7 minutes of the thin line, this is caused by touching the magnet with a pair of wooden chopsticks for asking if the magnet is floating or not. The magnet was undoubtedly floating

Table 1. The numerical data for 1.93 minutes from 898 to 1013 seconds in the figure 1.

Time Required (seconds)	Temp.near by the K1(℃)	Negative Voltage (V)	Time Required (seconds)	Temp.near by the K1(℃)	Negative Voltage (V)
898	26.80	−0.14	956	−44.00	−0.86
899	25.06	−0.09	957	−48.49	−0.85
900	23.84	−0.09	958	−52.41	−0.88
901	23.11	−0.18	959	−56.54	−0.85
902	22.62	−0.14	960	−59.56	−0.86
903	21.89	−0.11	961	−62.06	−0.86
904	22.77	−0.15	962	−64.41	−0.83
905	23.23	−0.12	963	−67.65	−0.88
906	22.41	−0.11	964	−70.19	−0.89
907	21.46	−0.10	965	−73.12	−0.88
908	20.88	−0.18	966	−75.01	−0.87
909	20.61	−0.12	967	−77.44	−0.85
910	20.58	−0.10	968	−79.88	−0.83
911	21.13	−0.11	969	−81.87	−0.89
912	21.80	−0.09	970	−85.08	−0.82
913	22.29	−0.12	971	−88.09	−0.88
914	22.56	−0.10	972	−91.12	−0.87
915	22.74	−0.14	973	−95.15	−0.83
916	22.26	−0.12	974	−98.15	−0.85
917	21.22	−0.17	975	−102.62	−0.80
918	20.73	−0.14	976	−107.48	−0.82
919	20.15	−0.12	977	−112.05	−0.88
920	19.63	−0.15	978	−116.81	−0.87
921	18.78	−0.18	979	−121.68	−0.85
922	17.86	−0.18	980	−128.78	−0.83
923	17.68	−0.15	981	−140.16	−0.86
924	16.43	−0.14	982	−177.52	−0.85
925	16.27	−0.11	983	−179.47	−0.83
926	15.30	−0.18	984	−179.78	−0.87
927	14.11	−0.18	985	−179.88	−0.87
928	12.86	−0.12	986	−179.97	−0.85
929	11.60	−0.14	987	−180.10	−0.87
930	10.38	−0.14	988	−180.05	−0.86
931	9.22	−0.12	989	−180.16	−0.87
932	8.19	−0.18	990	−180.25	−0.83
933	6.63	−0.18	991	−180.19	−0.86
934	4.83	−0.18	992	−180.27	−0.83
935	3.52	−0.23	993	−180.25	−0.85
936	2.57	−0.23	994	−180.27	−0.86
937	0.68	−0.17	995	−180.25	−0.86
938	−0.89	−0.18	996	−180.22	−0.86
939	−2.85	−0.18	997	−180.25	−0.85
940	−5.09	−0.20	998	−180.25	−0.85
941	−6.05	−0.23	999	−180.13	−0.87
942	−8.60	−0.25	1000	−180.13	−0.87
943	−10.85	−0.23	1001	−180.22	−0.82
944	−13.51	−0.25	1002	−180.13	−0.86
945	−16.04	−0.25	1003	−180.13	−0.88
946	−18.47	−0.30	1004	−180.02	−0.86
947	−21.11	−0.31	1005	−179.78	−0.85
948	−24.19	−0.34	1006	−179.97	−0.87
949	−27.20	−0.40	1007	−179.63	−0.85
950	−29.95	−0.41	1008	−179.69	−0.89
951	−31.97	−0.46	1009	−179.24	−0.87
952	−33.99	−0.56	1010	−177.99	−0.88
953	−35.79	−0.67	1011	−176.71	−0.86
954	−38.29	−0.72	1012	−172.77	−0.89
955	−40.83	−0.77	1013	−171.21	−0.88

Table 2. The numerical data for 1.93 minutes from 2288 to 2403 seconds in the figure 1.

Time Required (seconds)	Temp.near by the K1 (℃)	Negative Voltage (V)	Time Required (seconds)	Temp.near by the K1 (℃)	Negative Voltage (V)
2288	−161.36	−0.89	2346	−65.30	−0.85
2289	−160.38	−0.86	2347	−65.00	−0.86
2290	−159.30	−0.86	2348	−64.97	−0.85
2291	−138.03	−0.85	2349	−64.59	−0.85
2292	−116.63	−0.83	2350	−64.38	−0.85
2293	−105.44	−0.86	2351	−63.99	−0.87
2294	−98.51	−0.82	2352	−63.84	−0.87
2295	−93.80	−0.86	2353	−63.77	−0.81
2296	−90.58	−0.86	2354	−63.59	−0.83
2297	−88.31	−0.85	2355	−63.47	−0.83
2298	−86.55	−0.89	2356	−63.34	−0.87
2299	−85.26	−0.85	2357	−63.29	−0.82
2300	−84.23	−0.83	2358	−63.08	−0.87
2301	−83.27	−0.86	2359	−62.88	−0.87
2302	−82.40	−0.81	2360	−62.68	−0.81
2303	−81.81	−0.88	2361	−62.47	−0.85
2304	−81.15	−0.86	2362	−62.36	−0.88
2305	−80.50	−0.86	2363	−62.27	−0.88
2306	−79.98	−0.83	2364	−62.15	−0.85
2307	−79.25	−0.86	2365	−62.15	−0.85
2308	−78.63	−0.85	2366	−62.15	−0.88
2309	−78.15	−0.85	2367	−61.91	−0.86
2310	−77.59	−0.87	2368	−61.75	−0.83
2311	−76.98	−0.83	2369	−61.34	−0.86
2312	−76.48	−0.87	2370	−61.27	−0.85
2313	−75.98	−0.83	2371	−61.09	−0.87
2314	−75.55	−0.83	2372	−61.11	−0.85
2315	−75.27	−0.83	2373	−60.97	−0.86
2316	−74.76	−0.85	2374	−60.70	−0.87
2317	−74.37	−0.85	2375	−60.33	−0.86
2318	−74.22	−0.89	2376	−60.15	−0.89
2319	−73.81	−0.85	2377	−59.81	−0.88
2320	−73.63	−0.88	2378	−59.56	−0.85
2321	−73.48	−0.86	2379	−59.54	−0.87
2322	−73.12	−0.82	2380	−59.40	−0.87
2323	−72.69	−0.85	2381	−59.31	−0.86
2324	−72.26	−0.85	2382	−59.20	−0.86
2325	−71.70	−0.83	2383	−59.13	−0.85
2326	−71.12	−0.86	2384	−59.25	−0.86
2327	−70.58	−0.86	2385	−59.13	−0.87
2328	−70.09	−0.87	2386	−59.11	−0.91
2329	−69.58	−0.83	2387	−59.16	−0.86
2330	−68.97	−0.86	2388	−58.99	−0.83
2331	−68.56	−0.86	2389	−58.86	−0.83
2332	−68.13	−0.87	2390	−58.68	−0.86
2333	−67.80	−0.87	2391	−58.52	−0.89
2334	−67.58	−0.86	2392	−58.34	−0.86
2335	−67.29	−0.86	2393	−58.18	−0.86
2336	−67.23	−0.87	2394	−57.91	−0.86
2337	−66.80	−0.85	2395	−57.70	−0.88
2338	−66.55	−0.82	2396	−57.52	−0.86
2339	−66.37	−0.88	2397	−57.45	−0.87
2340	−66.27	−0.87	2398	−57.02	−0.86
2341	−66.09	−0.82	2399	−56.58	−0.87
2342	−65.87	−0.81	2400	−56.54	−0.83
2343	−65.63	−0.85	2401	−56.24	−0.86
2344	−65.55	−0.86	2402	−56.00	−0.82
2345	−65.43	−0.86	2403	−55.75	−0.85

Table 3. The numerical data for 1.93 minutes from 1189 to 1304 seconds in the figure 4.

Time Required (seconds)	Temp.near by the K1 (℃)	Negative Voltage (V)	Time Required (seconds)	Temp.near by the K1 (℃)	Negative Voltage (V)
1189	−29.04	−0.80	1247	−29.65	−0.81
1190	−28.88	−0.82	1248	−29.75	−0.75
1191	−28.64	−0.77	1249	−29.75	−0.75
1192	−28.55	−0.79	1250	−29.80	−0.80
1193	−28.50	−0.77	1251	−29.80	−0.81
1194	−28.46	−0.77	1252	−30.02	−0.81
1195	−28.30	−0.77	1253	−30.17	−0.79
1196	−28.30	−0.75	1254	−30.11	−0.81
1197	−28.43	−0.75	1255	−30.27	−0.77
1198	−28.37	−0.79	1256	−30.29	−0.80
1199	−28.37	−0.77	1257	−30.45	−0.81
1200	−28.55	−0.79	1258	−30.38	−0.79
1201	−28.55	−0.77	1259	−30.47	−0.82
1202	−28.64	−0.80	1260	−30.62	−0.79
1203	−28.68	−0.81	1261	−30.69	−0.77
1204	−28.68	−0.77	1262	−30.85	−0.75
1205	−28.79	−0.75	1263	−30.81	−0.77
1206	−28.79	−0.79	1264	−30.87	−0.79
1207	−28.79	−0.80	1265	−31.00	−0.77
1208	−28.86	−0.79	1266	−31.05	−0.75
1209	−28.79	−0.79	1267	−31.18	−0.80
1210	−28.77	−0.81	1268	−31.20	−0.77
1211	−28.82	−0.75	1269	−31.14	−0.74
1212	−28.97	−0.80	1270	−31.23	−0.80
1213	−28.95	−0.77	1271	−31.39	−0.81
1214	−28.95	−0.77	1272	−31.32	−0.83
1215	−29.01	−0.80	1273	−31.39	−0.81
1216	−29.07	−0.80	1274	−31.27	−0.80
1217	−29.07	−0.77	1275	−30.78	−0.81
1218	−28.79	−0.79	1276	−30.45	−0.80
1219	−28.59	−0.80	1277	−30.17	−0.79
1220	−28.55	−0.75	1278	−29.87	−0.77
1221	−28.43	−0.81	1279	−29.80	−0.75
1222	−28.50	−0.75	1280	−29.69	−0.81
1223	−28.39	−0.80	1281	−29.65	−0.75
1224	−28.34	−0.75	1282	−29.55	−0.79
1225	−28.46	−0.77	1283	−29.37	−0.79
1226	−28.53	−0.81	1284	−29.17	−0.80
1227	−28.55	−0.80	1285	−28.77	−0.81
1228	−28.59	−0.80	1286	−28.64	−0.74
1229	−28.55	−0.75	1287	−28.55	−0.75
1230	−28.64	−0.77	1288	−28.46	−0.75
1231	−28.77	−0.80	1289	−28.59	−0.80
1232	−28.79	−0.77	1290	−28.55	−0.79
1233	−28.86	−0.79	1291	−28.53	−0.75
1234	−29.07	−0.81	1292	−28.68	−0.77
1235	−29.04	−0.75	1293	−28.70	−0.75
1236	−29.04	−0.79	1294	−28.86	−0.80
1237	−29.13	−0.80	1295	−28.79	−0.77
1238	−29.26	−0.79	1296	−28.97	−0.75
1239	−29.17	−0.77	1297	−28.95	−0.79
1240	−29.26	−0.75	1298	−28.92	−0.79
1241	−29.35	−0.77	1299	−29.04	−0.79
1242	−29.35	−0.81	1300	−29.04	−0.75
1243	−29.50	−0.81	1301	−29.17	−0.77
1244	−29.59	−0.77	1302	−29.13	−0.79
1245	−29.65	−0.81	1303	−29.26	−0.79
1246	−29.69	−0.75	1304	−29.35	−0.81

Table 4. The numerical data for 1.93 minutes from 2689 to 2804 seconds in the figure 5.

Time Required (seconds)	Temp.near by the K1 (℃)	Negative Voltage (V)	Time Required (seconds)	Temp.near by the K1 (℃)	Negative Voltage (V)
2689	−87.12	−0.74	2747	−85.69	−0.73
2690	−87.04	−0.74	2748	−85.72	−0.73
2691	−87.04	−0.75	2749	−85.69	−0.73
2692	−87.06	−0.72	2750	−85.66	−0.74
2693	−87.01	−0.74	2751	−85.69	−0.74
2694	−87.04	−0.73	2752	−85.75	−0.72
2695	−87.01	−0.74	2753	−85.72	−0.75
2696	−86.94	−0.72	2754	−85.56	−0.75
2697	−86.97	−0.74	2755	−85.59	−0.75
2698	−86.91	−0.75	2756	−85.62	−0.75
2699	−86.84	−0.73	2757	−85.51	−0.74
2700	−86.84	−0.74	2758	−85.54	−0.75
2701	−86.79	−0.75	2759	−85.59	−0.73
2702	−86.73	−0.73	2760	−85.54	−0.73
2703	−86.81	−0.74	2761	−85.51	−0.73
2704	−86.76	−0.75	2762	−85.54	−0.73
2705	−86.66	−0.74	2763	−85.54	−0.73
2706	−86.63	−0.75	2764	−85.51	−0.75
2707	−86.69	−0.74	2765	−85.51	−0.74
2708	−86.55	−0.72	2766	−85.51	−0.75
2709	−86.63	−0.75	2767	−85.44	−0.73
2710	−86.51	−0.73	2768	−85.51	−0.73
2711	−86.43	−0.72	2769	−85.48	−0.75
2712	−86.55	−0.75	2770	−85.48	−0.73
2713	−86.48	−0.74	2771	−85.41	−0.73
2714	−86.30	−0.74	2772	−85.44	−0.72
2715	−86.30	−0.75	2773	−85.36	−0.72
2716	−86.45	−0.75	2774	−85.33	−0.75
2717	−86.30	−0.73	2775	−85.44	−0.74
2718	−86.30	−0.73	2776	−85.36	−0.77
2719	−86.23	−0.73	2777	−85.38	−0.73
2720	−86.26	−0.74	2778	−85.36	−0.73
2721	−86.20	−0.73	2779	−85.36	−0.74
2722	−86.26	−0.72	2780	−85.36	−0.72
2723	−86.18	−0.73	2781	−85.23	−0.74
2724	−86.18	−0.74	2782	−85.38	−0.75
2725	−86.15	−0.72	2783	−85.38	−0.75
2726	−86.18	−0.73	2784	−85.13	−0.74
2727	−86.15	−0.73	2785	−85.26	−0.75
2728	−86.20	−0.75	2786	−85.26	−0.74
2729	−86.08	−0.73	2787	−85.16	−0.73
2730	−86.15	−0.75	2788	−85.19	−0.72
2731	−86.15	−0.73	2789	−85.13	−0.72
2732	−86.05	−0.75	2790	−85.11	−0.73
2733	−86.12	−0.73	2791	−85.11	−0.74
2734	−86.05	−0.74	2792	−85.05	−0.73
2735	−85.97	−0.74	2793	−85.05	−0.74
2736	−85.97	−0.73	2794	−85.05	−0.73
2737	−85.97	−0.73	2795	−84.95	−0.73
2738	86.05	−0.74	2796	−84.93	−0.75
2739	−85.87	−0.74	2797	−84.87	−0.72
2740	−85.97	−0.74	2798	−84.87	−0.75
2741	−85.87	−0.73	2799	−84.77	−0.73
2742	−85.80	−0.73	2800	−84.80	−0.69
2743	−85.91	−0.74	2801	−84.83	−0.74
2744	−85.80	−0.73	2802	−84.65	−0.75
2745	−85.87	−0.74	2803	−84.69	−0.74
2746	−85.87	−0.75	2804	−84.65	−0.69

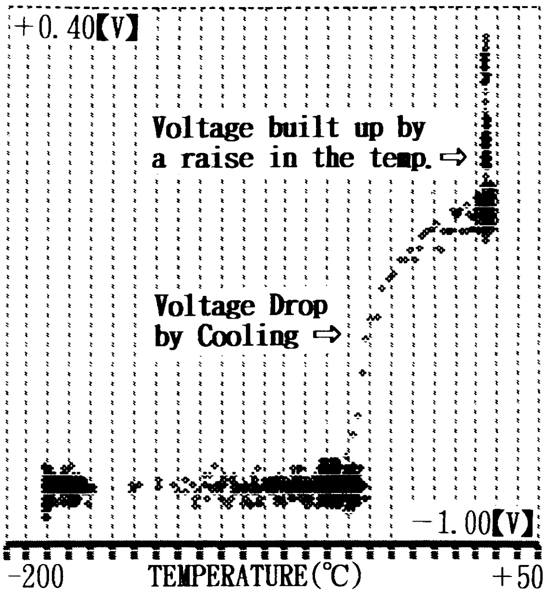

Fig 2. The graph corresponding to the figure 1 and table 1, 2.

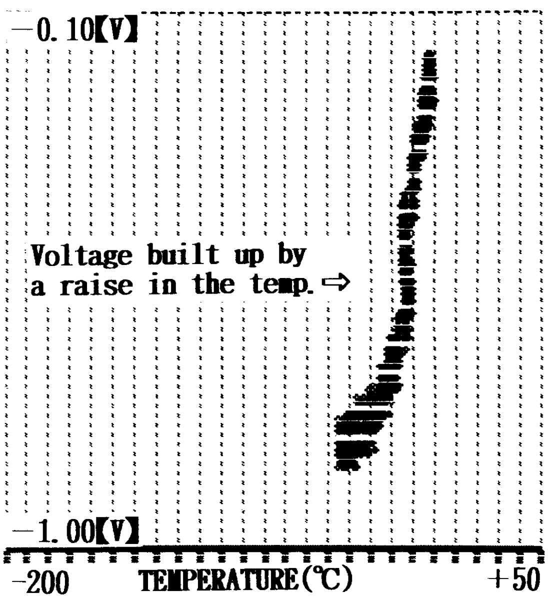

Fig 3. The graph corresponding to the figure 4 and table 3.

in the vaporized liquid nitrogen at the abscissa about 45 minutes, however when I made sure of floating by touching, the magnet had already fallen. That is, according to the table 4, the Tc must be existed in the range of (−) 86.84 to (−) 84.65 (℃).

5. Exam of Thermometer measuring by dry ice

Temperature measuring of dry ice is one of the effective way to check the thermometer in this measurement because of its special properties of a refrigerant. To make sure of the

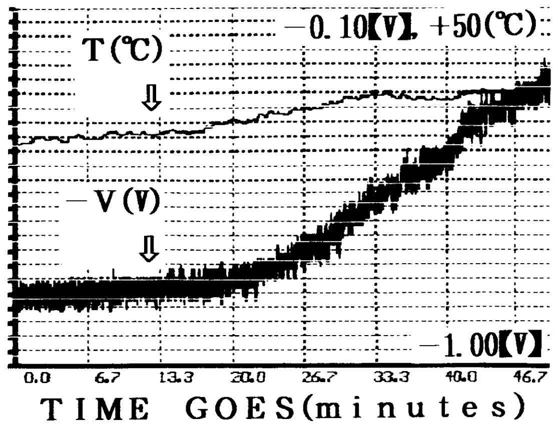

Fig 4. The rest of figure 1. K1 may indicate the high-Tc unexpectedly.

results, it is essencial to check the thermistor system[2] by making use of the dry ice, and the experiments were made as follows, namely,

(1) The first is to fill up a vessel with the dry ice.

(2) The second is to fit the system with the thermocouple which makes a pair of copper and constantan.

(3) The third is to feed a program into the computer and starting it.

(4) The fourth is putting the tip of thermocouple in the deep vessel filled up with the dry ice to get the temperature of sublimation.

(5) The fifth is watching the temperature changes indicated graphically or numerically in the computer display followed by an analog to digital converter.

As mentioned above, the accuracy of this measurement depends mainly on the data to feed into the computer program. So the Table[3] used here is a matter of great importance as the sensible program to low temperature. The data[4] on this Table[3] suggest that a user ought to write the necessary conditions on each of the lines, such as the lowest temperature on the 16th line and the highest one on the 18th line. Since the boiling point of liquid nitrogen is about (−)196 (℃), I marked a scale (−)200 (℃) on a thermometer as the lowest temperature to write on the 16th line and marked (+) 50 (℃) as the highest one to write on the 18th line. So, a pair of figures should be written on the 17th, and 18th lines are (0, −200) and (8191, 50) respectively. Here, the output voltage in the range of 0.00 to 5.00 【V】 is proportionally distributed to the 8191 decomposition values of 13 binary digits[4]. And, the results detected by this thermometer are as follows:

(1) The Tc must be existed in the range of (−) 86.84 to (−) 84.65 (℃).

(2) The temperature of dry ice is (−) 79.73 (℃).

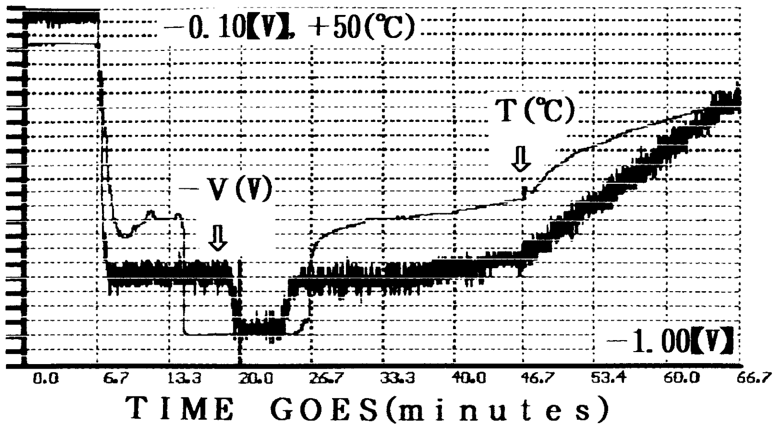

Fig 5. The magnet was floating at the 45 minutes , however it had already fallen at the abscissa 46.7 minutes. So, we may be able to find the Tc with an error of less than 2.19 (℃).

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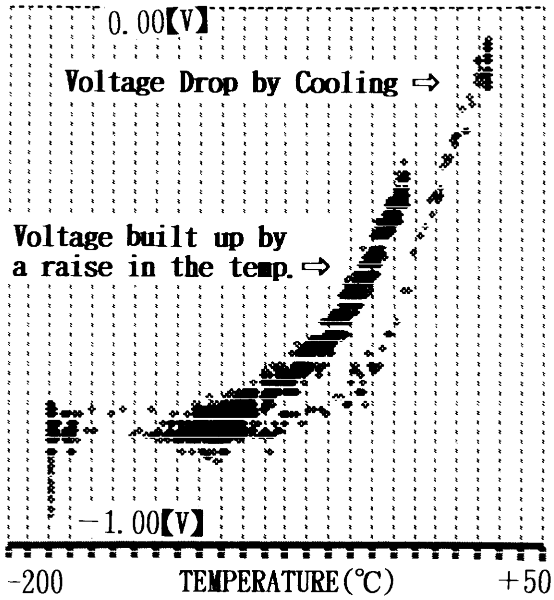

Fig 6. The graph corresponding to the figure 5 and table 4.