CHAPTER IV

RESULTS AND CALCULATIONS

4.1 Conductivity Measurement

Typical Calculations: The System of Tl $(OAc)_3$ in Glacial Acetic Acid

(a) Limiting Equivalent Conductance, Λ°.

A preliminary value of Λ° (33.75×10^{-3} cm.^{2}mho.equi.$^{-1}$) obtained by extrapolation of Onsager's equation

$$\Lambda = \Lambda^\circ - (B_1\Lambda^\circ + B_2)\sqrt{c}$$

(see Table 3.7.1 and Fig. 3.2) was used to compute α through the relationship $\alpha = \frac{\Lambda}{\Lambda^\circ}$. Hence αc could be readily obtained and was then inserted in the equation of ionic strength i.e., $I = \frac{1}{2}\sum M_i z_i^2$ as shown below

$$Tl(OAc)_3 \rightleftharpoons Tl^{3+} + 3\ OAc^-$$

(the dissociation of HOAc is negligible being 1.392×10^{-7} equi/l)

$$\begin{aligned}
\text{Hence} \quad [Tl(OAc)_3] &= c(1-\alpha) \\
[Tl^{3+}] &= c\alpha \\
[3OAc^-] &= 3c\alpha \\
\text{Therefore} \quad I &= \frac{1}{2}\left(m_{Tl^{3+}} \cdot z^2_{Tl^{3+}} + \frac{3}{2} m_{OAc^-} z^2_{OAc^-} \right) \\
&= 6\alpha c
\end{aligned}$$

Once "I" was known, the value of Λ° was recalculated from the graph of Λ vs. $\sqrt{I}$ with Λ° is an intercept and $(B_1\Lambda^{\circ} + B_2)$ is its slope. The true value of Λ° was obtained by the method of successive approximations. Table 4.1 shows details of the results and calculations. Figure 4.1 shows the difference between the first, the fourth and the fifth approximations. The value of $\Lambda^{\circ} = 43.8 \times 10^{-3} \mathrm{cm}^2 \mathrm{mho.equi.}^{-1}$ was used in order to calculate the dissociation constant of ion-pair which is illustrated in (b) for the system of $Tl(OAc)_3$ in glacial acetic acid.

(b) <u>Dissociation Constant of Ion-pair, K.</u>

From the reaction:

$$Tl(OAc)_3 \rightleftharpoons Tl^{3+} + 3OAc^-$$

$$K = \frac{[Tl^{3+}][OAc^-]^3}{[Tl(OAc)_3]} \cdot f_{\pm}^{4} \qquad \text{.............} (4.1)$$

$$= \frac{27(\alpha c)^4}{(1-\alpha)c} \cdot f_{\pm}^{4}$$

$$K = K' f_{\pm}^{4} \qquad \text{.............} (4.2)$$

$$\text{where} \quad K' = \frac{27(\alpha c)^4}{(1-\alpha)c}$$

the right hand member of the equation (4.2) is determinable. Take log both sides of the equation (4.2), we get

$$\log K = \log K' + 4 \log f_{\pm}$$

$$\log K' = \log K - 4 \log f_{\pm}$$

$$\text{or} \quad (-\log K') = (-\log K) - 4(-\log f_{\pm})$$

The least square method was employed in fitting points on a straight line resulted from the plot of ($-\log K'$) against ($-\log f_{\pm}$). K can then be computed from ($-\log K$), the intercept of the straight line.

The mean ionic activity coefficient, $f_{\pm}$, can be first calculated by using the equation of Guntelberg.(39)

$$-\log f_{\pm} = \frac{A|Z_1 Z_2|\sqrt{I}}{1 + \sqrt{I}} \qquad \ldots\ldots\ldots\ldots (4.3)$$

In the case of $Tl(OAc)_3$, the equation becomes

$$-\log f_{\pm} = \frac{3A\sqrt{I}}{1 + \sqrt{I}} \qquad \ldots\ldots\ldots\ldots (4.4)$$

$$\text{where} \quad A = \frac{e^2}{2.303}\left(\frac{2\pi N}{1000\, k^3}\right)^{1/2}\frac{1}{(\varepsilon T)^{3/2}}$$

$$= \frac{1.8246 \times 10^6}{(\varepsilon T)^{3/2}} = 22.91098$$

$$\text{and} \quad \sqrt{I} = \sqrt{6\alpha C}$$

The values of $-\log K'$ and $-\log f_{\pm}$ were obtained and are shown in Table 4.2. Figure 4.2 shows the plot of $-\log K'$ vs. $-\log f_{\pm}$, the intercept of which is $-\log K$.

$$-\log K = 8.088277$$

$$\log K = -8.088277 = \bar{9}.911723$$

$$\text{therefore} \quad K = 8.160 \times 10^{-9}$$

(c) Calculation of "a"

From the value of K, obtained in (b), the ion-size parameter "a" can be computed by the method proposed by Bjerrum(40)

$$\frac{1}{K} = \frac{4\pi N}{1000}\left(\frac{|z_1 z_2| e^2}{\varepsilon kT}\right)^3 Q(b) \quad \ldots\ldots\ldots\ldots\ldots (4.5)$$

$$Q(b) = \int_2^b x^{-4} e^x dx$$

where

$$x = \frac{-z_1 z_2 e^2}{\varepsilon k Tr}$$

$$2 = \frac{|z_1 z_2| e^2}{\varepsilon k Tq} \quad (q = \text{critical Bjerrum distance})$$

$$b = \frac{|z_1 z_2| e^2}{\varepsilon k Ta} \quad \ldots\ldots\ldots\ldots\ldots (4.6)$$

The value of "a" can be calculated by using the equations (4.5) in conjunction with equation (4.6). Inserting numerical values into (4.5) and (4.6), the following equations are obtained

$$\frac{1}{K} = \frac{4 \times 3.1416 \times 6.023 \times 10^{23}}{1000}\left(\frac{|3 \times 1| \times (4.80 \times 10^{-10})^2}{6.21 \times 1.38054 \times 10^{-6} \times 298.1}\right)^3 Q(b)$$

$$= 149731.64\ Q(b) \quad \ldots\ldots\ldots\ldots\ldots (4.7)$$

$$\text{and } b = \frac{27.0456 \times 10^{-7}}{a} \quad \ldots\ldots\ldots\ldots\ldots (4.8)$$

Since K = 8.160×10^{-9} (see Table 4.2), equation (4.7) becomes

$$\frac{1}{8.160 \times 10^{-9}} = 149731.64\ Q(b)$$

therefore $Q(b) = 818.4577$

and $\log Q(b) = 2.9131$

The values of Q(b) and log Q(b) were tabulated in Table 2.1, as the function of "b" consequently b = 17.90

On introducing b in equation (4.8), "a" was evaluated and found to be 15.11×10^{-8} cm. and this enable the more accurate value of $f_{\pm}$ to be calculated using the Debye-Huckel equation.(5)

$$-\log f_{\pm} = \frac{A|Z_1 Z_2|\sqrt{I}}{1 + Ba\sqrt{I}} \quad \ldots\ldots\ldots\ldots\ldots \quad (4.9)$$

$$\text{where } B = \left(\frac{8\pi Ne^2}{1000\ k}\right)^{1/2} \frac{1}{(\varepsilon T)^{1/2}}$$

$$= \frac{50.29 \times 10^8}{(\varepsilon T)^{1/2}} = 1.168991 \times 10^8$$

and the cycle of $-\log K'$ vs. $-\log f_{\pm}$ plot was repeated by using the successive approximations until the constant values of K and "a" were obtained. Details are shown in Table 4.3. Figure 4.3 shows the difference of the first, the fourth, and the fifth approximations. The final values of K and "a" are 3.698×10^{-11} and 10.88×10^{-8} cm respectively.

Other systems such as thallic acetate in anhydrous acetic acid, thallous acetate in glacial acetic acid and in anhydrous acetic acid were computed in the similar manner. Results are collected in Tables 4.4 - 4.10, and Figures 4.4 - 4.10.

Attempt to Calculate Dissociation Constants from Solubility Measurement: Thallic Acetate in Glacial Acetic Acid with Added Potassium Acetate.

By using the method described by Davies,(41) the solubility product (K_{sp}) of the reaction:

$$Tl(OAc)_3 \rightleftharpoons Tl^{3+} + 3OAc^-$$

$$= [Tl^{3+}][OAc^-]^3 \cdot f_{\pm}^4 \quad \ldots\ldots\ldots\ldots \quad (4.10)$$

and the dissociation constant; K

$$K \quad = \quad \frac{[Tl^{3+}][OAc^-]^3}{[Tl(OAc)_3]} \cdot f_{\pm}^{4} \quad \ldots\ldots\ldots\ldots\ldots (4.11)$$

The increase in solubility indicates that the new species was formed, between ion-pair, $Tl(OAc)_3$, and OAc^--ion from KOAc as shown in the following equations.

$$KOAc\ (solution) \rightleftharpoons K^+ + OAc^-$$

$$Tl(OAc)_3 + OAc^- \rightleftharpoons Tl(OAc)_4^-$$

$$K_1 \quad = \quad \frac{[Tl(OAc)_3][OAc^-]}{[Tl(OAc)_4^-]} \cdot \frac{f_{OAc^-}}{f_{Tl(OAc)_4^-}}$$

$$= \quad \frac{[Tl(OAc)_3][OAc^-]}{[Tl(OAc)_4^-]} \quad \ldots\ldots\ldots (4.12)$$

where K_1 = instability constant of complex ion, $Tl(OAc)_4^-$ and assumed that $f_{OAc^-} \equiv f_{Tl(OAc)_4^-}$

$$So \quad [Tl(OAc)_4^-] \quad = \quad \frac{[Tl(OAc)_3][OAc^-]}{K_1} \quad \ldots\ldots\ldots (4.13)$$

Because $[Tl(OAc)_4^-] = \quad S - [Tl(OAc)_3]$

where S = measured solubility

and $[OAc^-] \quad = \quad A + S - [Tl(OAc)_3] - 2[Tl(OAc)_4^-]$

$= \quad A - S + [Tl(OAc)_3]$

where A = ionic concentrations of KOAc $= [OAc^-]$

$$K_1 \quad = \quad \frac{[Tl(OAc)_3]\{A - S + [Tl(OAc)_3]\}}{S - [Tl(OAc)_3]}$$

$$or \quad S - [Tl(OAc)_3] \quad = \quad \frac{[Tl(OAc)_3]\ (A - S + [Tl(OAc)_3])}{K_1}$$

$$A = \left(S - \left[Tl(OAc)_3\right]\right)\left(1 + \frac{K_1}{\left[Tl(OAc)_3\right]}\right) \ldots\ldots (4.14)$$

From equation (4.14) when

$$A = 0 ; \quad S = \left[Tl(OAc)_3\right]$$

and when $S = 0 ; \quad -A = \left[Tl(OAc)_3\right] + K_1$

Hence the plotting of S against A gives the straight line which has the intercept of $\left[Tl(OAc)_3\right]$. The extrapolation of straight line to $S = 0$ gives the value of K_1. The least square method was used in fitting the straight line. The slope and intercept were then found.

The values of A, the concentration of added acetate ion were from the conductivity measurement of KOAc at various concentrations in glacial acetic acid which is shown in Tables 3.8.1 - 3.8.2. Results of the solubility are collected in Table 3.9.1 and the plot between S vs. A is shown in Fig. 4.11 which yields an intercept of 0.250054 equi/l

$$\left[Tl(OAc)_3\right] = 0.250054 \qquad \text{equi/l}$$

and on extrapolation to S = 0 giving

$$A = -132.99178 \times 10^{-4}$$

(Calculated from the least square method)

$$\text{So} \quad K_1 = 132.99178 \times 10^{-4} = 0.013299$$

But the solubility of $Tl(OAc)_3$ in glacial acetic acid is 0.271592 equi/l (Table 3.9.3).

So the concentration of simple salt

$$\left[Tl^{3+}\right] = \left[OAc^{-}\right] = 0.271592 - 0.250054$$
$$= 0.021538 \quad \text{equi}/l$$

The dissociation constant,

$$K = \frac{\left[Tl^{3+}\right]\left[OAc^{-}\right]^{3}}{\left[Tl(OAc)_{3}\right]} \cdot f_{\pm}^{4} = K' f_{\pm}^{4}$$

$$\text{where } K' = \frac{\left[Tl^{3+}\right]\left[OAc^{-}\right]^{3}}{\left[Tl(OAc)_{3}\right]}$$

$$\text{Hence } K' = \frac{(0.021538)(0.021538)^{3}}{(0.250054)} = 8.605729 \times 10^{-7}$$

($f_{\pm}$ computed from Debye-Hückel equation is very small, because the concentration range of the salt is beyond the validity of this equation).

The other system, $Tl(OAc)_3$ in glacial acetic acid with added sodium acetate trihydrate is computed in the similar manner. Results are collected in Table 3.9.2 and Fig. 4.12 which have

$$K_1 = 0.035751$$
$$\text{and } K' = 9.097797 \times 10^{-11}.$$

Table 4.1

Λ° of Thallic Acetate in Glacial Acetic Acid Calculated by the Method of Successive Approximation

$\Lambda \times 10^3$ $(cm^2 .mho.equi.^{-1})$	$\sqrt{I} = \sqrt{6\alpha c}$					Remark
	First	Second	Third	Fourth	Fifth	
24.446345	0.09693	0.08337	0.08528	0.08451	0.08509	
18.609248	0.1453	0.1250	0.1279	0.1267	0.1276	
15.230563	0.1557	0.1340	0.1369	0.1357	0.1367	
13.227040	0.1743	0.1500	0.1533	0.1520	0.1530	
9.453190	0.1722	0.1482	0.1516	0.1502	0.1516	
8.960264	0.1871	0.1609	0.1646	0.1631	0.1642	
6.125439	0.1743	0.1500	0.1533	0.1520	0.1530	
6.507198	0.2133	0.1835	0.1876	0.1857	0.1872	
6.274751	0.2107	0.1813	0.1854	0.1837	0.1854	
5.462957	0.2202	0.1894	0.1937	0.1919	0.1933	
6.019725	0.2333	0.2007	0.2053	0.2035	0.2049	
5.358795	0.2355	0.2025	0.2071	0.2053	0.2066	
Λ° $(cm^2 .mho.equi.^{-1})$	$45.6\text{x}10^{-3}$	$43.6\text{x}10^{-3}$	$44.4\text{x}10^{-3}$	$43.8\text{x}10^{-3}$	$43.8\text{x}10^{-3}$	by graphical method of Λ vs. $\sqrt{I}$

Table 4.2

Preliminary Values of $-\log K'$, $-\log f_{\pm}$, K and "a" for the System of Thallic Acetate in Glacial Acetic Acid from Conductivity Measurement

$\left\{ K' = \frac{27(\alpha_c)^4}{(1-\alpha)c} \right\} \times 10^7$	$-\log K'$	$-\log f_{\pm} = \frac{3A\sqrt{I}}{1+\sqrt{I}}$
0.599435	7.2223	5.38986
3.972990	6.4009	7.77787
4.341833	6.3623	8.26585
6.928569	6.1593	9.12068
4.188936	6.3780	9.04821
6.304542	6.2004	9.69417
2.603774	6.5843	9.12068
9.388582	6.0274	10.83794
8.527129	6.0692	10.75003
9.284438	6.0323	11.13390
14.899932	5.8268	11.68842
13.573456	5.8674	11.76879
	K	8.160×10^{-9}
	"a" (cm)	15.11×10^{-8}

Table 4.3

Successive Approximations of $-\log K'$, and $-\log f_{\pm}$ for the System of Thallic Acetate in Glacial Acetic Acid from Conductivity Measurement

$-\log K'$	$-\log f_{\pm} = 3A\sqrt{I}/(1+Ba\sqrt{I})$					Remark
	First	Second	Third	Fourth	Fifth	
7.2223	2.336611	2.759985	2.773005	2.811450	2.808763	
6.4009	2.695359	3.274841	3.293188	3.347565	3.343749	
6.3623	2.751660	3.358326	3.377618	3.434837	3.430823	
6.1593	2.840273	3.491264	3.512123	3.574037	3.569694	
6.3780	2.833206	3.480601	3.501326	3.562850	3.558542	
6.2004	2.893581	3.572159	3.594000	3.658852	3.654303	
6.5843	2.840273	3.491264	3.512123	3.574037	3.569694	
6.0274	2.987660	3.716701	3.740341	3.810638	3.805701	
6.0692	2.980979	3.706304	3.742662	3.799711	3.794811	
6.0323	3.009748	3.750884	3.774969	3.846589	3.841562	
5.8268	3.048852	3.811810	3.836681	3.910681	3.905487	
5.8674	3.054292	3.820316	3.845300	3.919640	3.914411	
K	4.192×10^{-12}	3.051×10^{-11}	3.293×10^{-11}	3.736×10^{-11}	3.698×10^{-11}	by graphical method of $-\log K'$ vs. $-\log f_{\pm}$
"a" (cm)	9.87×10^{-8}	10.13×10^{-8}	10.86×10^{-8}	10.88×10^{-8}	10.88×10^{-8}	

Table 4.4

$\overset{\circ}{\Lambda}$ of Thallic Acetate in Anhydrous Acetic Acid Calculated by the Method of Successive Approximation

$\Lambda \times 10^3$ (cm^2.mho. $equi.^{-1}$)	$(\sqrt{I} = \sqrt{6\alpha c}) \times 10^2$			Remark
	First	Second	Third	
25.231657	11.15	9.817	9.872	
17.914327	15.78	13.89	13.96	
15.484431	18.02	15.86	15.95	
12.566915	17.31	15.24	15.33	
11.555635	18.27	16.08	16.18	
8.830203	20.78	18.30	18.39	
7.683677	21.92	19.30	19.40	
7.081314	22.07	19.43	19.54	
6.363191	23.28	20.49	20.61	
6.611739	24.68	21.72	21.84	
7.112235	26.22	23.08	23.20	
6.123890	26.44	23.28	23.41	
6.696899	29.53	25.99	26.13	
$\overset{\circ}{\Lambda}$ (cm^2.mho. $equi.^{-1}$)	45.3×10^{-3}	44.8×10^{-3}	44.8×10^{-3}	by graphical method of Λ vs. $\sqrt{I}$

Table 4.5

Preliminary values of $-\log K'$, $-\log f_{\pm}$, K and "a" for the System of Thallic Acetate in Anhydrous Acetic Acid from Conductivity Measurement

$\left\{ K' = \frac{27(\alpha c)^4}{(1-\alpha)c} \right\} \text{x}10^7$	$-\log K'$	$-\log f_{\pm} = \frac{3A\sqrt{I}}{1+\sqrt{I}}$
1.491583	6.8262	6.175655
6.168194	6.2098	8.419724
10.872320	5.9637	9.454854
6.318237	6.1995	9.136182
7.778223	6.1092	9.572206
11.905493	5.9241	10.676566
13.809817	5.8598	11.167663
13.042636	5.8848	11.235081
15.853185	5.7999	11.488732
23.492708	5.6291	12.320480
36.852273	5.4336	12.943215
32.537762	5.4876	13.038150
70.067727	5.1545	14.239211
	K	$1.231\text{x}10^{-8}$
	"a" (cm)	$15.54\text{x}10^{-8}$

Table 4.6

Successive Approximations of $-\log K'$ and $-\log f_{\pm}$ for the System of Thallic Acetate in Anhydrous Acetic Acid from Conductivity Measurement

$-\log K'$	$-\log f_{\pm} = 3A\sqrt{I}/(1+Ba\sqrt{I})$					Remark
	First	Second	Third	Fourth	Fifth	
6.8262	2.429088	3.311508	3.003623	3.064680	3.074299	
6.2098	2.713559	3.863691	3.450966	3.531810	3.544584	
5.9637	2.812807	4.068068	3.613095	3.701811	3.715848	
6.1995	2.783919	4.007919	3.565569	3.651940	3.665597	
6.1092	2.823103	4.089639	3.630102	3.719666	3.733843	
5.9241	2.911937	4.278729	3.778314	3.875439	3.890831	
5.8598	2.947286	4.355488	3.838043	3.938304	3.954198	
5.8848	2.951960	4.365705	3.991761	3.946655	3.962616	
5.7999	2.920837	4.343688	3.818774	3.920292	3.936389	
5.6291	3.021909	4.520452	3.965565	4.072692	4.089686	
5.4336	3.057996	4.601684	4.027942	4.138512	4.156068	
5.4876	3.063266	4.613627	4.037089	4.148170	4.165805	
5.1545	3.125199	4.755569	4.145356	4.262560	4.281186	
K	$4.991\mathrm{x}1\bar{0}^{13}$	$3.818\mathrm{x}1\bar{0}^{11}$	$1.635\mathrm{x}1\bar{0}^{11}$	$1.452\mathrm{x}1\bar{0}^{11}$	$1.511\mathrm{x}1\bar{0}^{11}$	by graphical method of $-\log K'$ vs. $-\log f_{\pm}$
"a" (cm)	$9.09\mathrm{x}1\bar{0}^{8}$	$10.91\mathrm{x}1\bar{0}^{8}$	$10.52\mathrm{x}1\bar{0}^{8}$	$10.46\mathrm{x}1\bar{0}^{8}$	$10.46\mathrm{x}1\bar{0}^{8}$	

Table 4.7

Preliminary Values of $-\log K'$, $-\log f_{\pm}$, K and "a" for the System of Thallous Acetate in Glacial Acetic Acid from Conductivity Measurement

$\{K' = (\alpha c)^2/(1-\alpha)c\} \times 10^6$	$-\log K'$	$-\log f_{\pm} = (A\sqrt{I})/(1+\sqrt{I})$
53.036920	4.2754	0.15517
58.591198	4.2321	0.15992
55.265314	4.2576	0.22300
75.790296	4.1204	0.28978
61.023603	4.2146	0.33325
75.144899	4.1242	0.34592
63.109698	4.1999	0.40754
66.932494	4.1744	0.47497
90.568044	4.0431	0.49012
81.511998	4.0887	0.51073
93.474591	4.0294	0.56535
103.342930	3.9860	0.60516
90.545640	4.0432	0.61037
107.163030	3.9698	0.65824
109.513481	3.9605	0.67724
116.945550	3.9318	0.71085
117.410512	3.9303	0.73084
124.816531	3.9038	0.75529
126.809544	3.8968	0.77947
130.042783	3.8861	0.79080
152.244841	3.8174	0.83598
150.853915	3.8214	0.84831
149.510514	3.8253	0.85935
	K	4.151×10^{-5}
	"a" (cm.)	9.18×10^{-8}

Table 4.8

Successive Approximations of $-\log K'$ and $-\log f_{\pm}$ for the System of Thallous Acetate in Glacial Acetic Acid from Conductivity Measurement

$-\log K'$	$-\log f_{\pm} = A\sqrt{I}/(1+Ba\sqrt{I})$		Remark
	First	Second	
4.2754	0.145577	0.145653	
4.2321	0.149746	0.149826	
4.2576	0.203706	0.203854	
4.1204	0.258020	0.258258	
4.2146	0.291926	0.292231	
4.1242	0.301607	0.301932	
4.1999	0.347402	0.347834	
4.1744	0.395235	0.395793	
4.0431	0.405669	0.406258	
4.0887	0.419684	0.420314	
4.0294	0.455876	0.456620	
3.9860	0.481415	0.482244	
4.0432	0.484707	0.485548	
3.9698	0.514415	0.515362	
3.9605	0.525948	0.526938	
3.9318	0.545996	0.547063	
3.9303	0.557711	0.558825	
3.9038	0.571839	0.573009	
3.8968	0.585595	0.586822	
3.8861	0.591964	0.593218	
3.8174	0.616924	0.618286	
3.8214	0.623612	0.625004	
3.8253	0.629559	0.630978	
K	3.665×10^{-5}	3.668×10^{-5}	by graphical method of $-\log K'$ vs. $-\log f_{\pm}$
"a" (cm.)	9.11×10^{-8}	9.11×10^{-8}	

Table 4.9

Preliminary Values of $-\log K'$, $-\log f_{\pm}$, K and "a" for the System of Thallous Acetate in Anhydrous Acetic Acid from Conductivity Measurement

$\{K'=(\alpha c)^2/(1-\alpha)c\}\times10^{6}$	$-\log K'$	$-\log f_{\pm}=(A\sqrt{I})/(1+\sqrt{I})$
82.886771	4.0815	0.249951
71.942363	4.1431	0.284416
82.813743	4.0819	0.330355
72.900523	4.1373	0.346589
72.057646	4.1423	0.390062
90.884877	4.0415	0.389243
71.389235	4.1464	0.502181
74.657909	4.1269	0.562293
81.886002	4.0867	0.610368
72.041781	4.1425	0.600379
82.705081	4.0824	0.660829
104.147890	3.8929	0.727340
99.834801	4.0007	0.795921
123.546282	3.9080	0.840021
143.592661	3.8429	0.893682
124.217722	3.9059	0.878014
152.257991	3.8174	0.944284
159.536983	3.7972	0.977152
167.724810	3.7755	1.003116
	K	4.916×10^{-5}
	"a" (cm.)	9.54×10^{-8}

Table 4.10

Successive Approximations of $-\log K'$ and $-\log f_{\pm}$ for the System of Thallous Acetate in Anhydrous Acetic Acid from Conductivity Measurement

$-\log K'$	$-\log f_{\pm} = A\sqrt{I}/(1+Ba\sqrt{I})$			Remark
	First	Second	Third	
4.0815	0.225028	0.225727	0.225675	
4.1431	0.252583	0.253465	0.253400	
4.0819	0.288171	0.289320	0.289234	
4.1373	0.300447	0.301696	0.301603	
4.1423	0.332578	0.334109	0.333995	
4.0415	0.402077	0.404316	0.404149	
4.1464	0.410774	0.413112	0.412938	
4.1269	0.450137	0.452946	0.452736	
4.0867	0.480430	0.483631	0.483392	
4.1425	0.474219	0.477338	0.477105	
4.0824	0.511152	0.514777	0.514507	
3.8929	0.550093	0.554294	0.553980	
4.0007	0.588401	0.593210	0.592851	
3.9080	0.612160	0.617366	0.616977	
3.8429	0.640172	0.645869	0.645443	
3.9059	0.632092	0.637645	0.637230	
3.8174	0.665862	0.672027	0.671566	
3.7972	0.681898	0.688364	0.687881	
3.7755	0.694462	0.701170	0.700668	
K	4.318×10^{-5}	4.334×10^{-5}	4.333×10^{-5}	by graphical method of $-\log K'$ vs. $-\log f_{\pm}$
"a" (cm.)	9.27×10^{-8}	9.29×10^{-8}	9.29×10^{-8}	

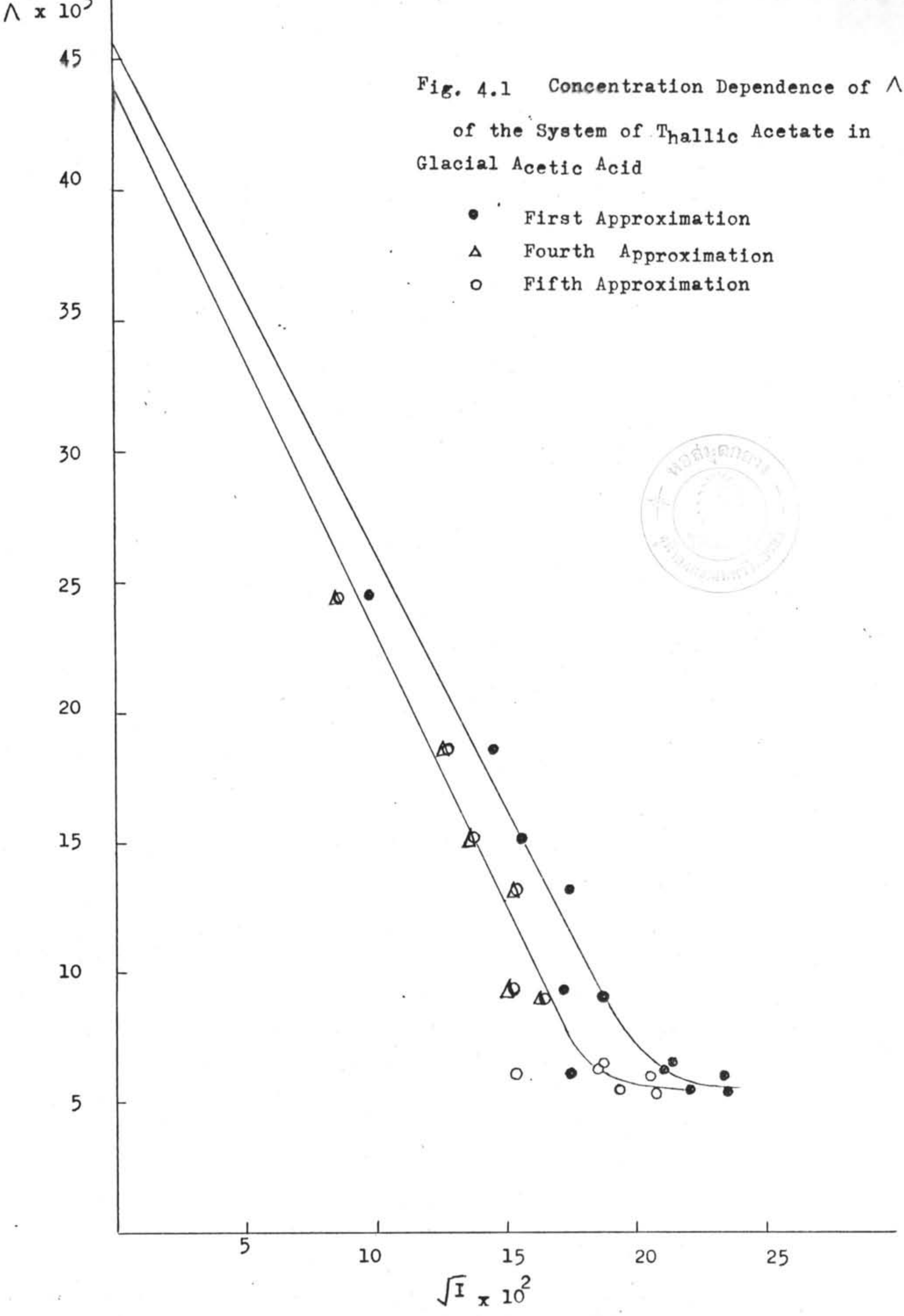

Fig. 4.1 Concentration Dependence of Λ of the System of Thallic Acetate in Glacial Acetic Acid

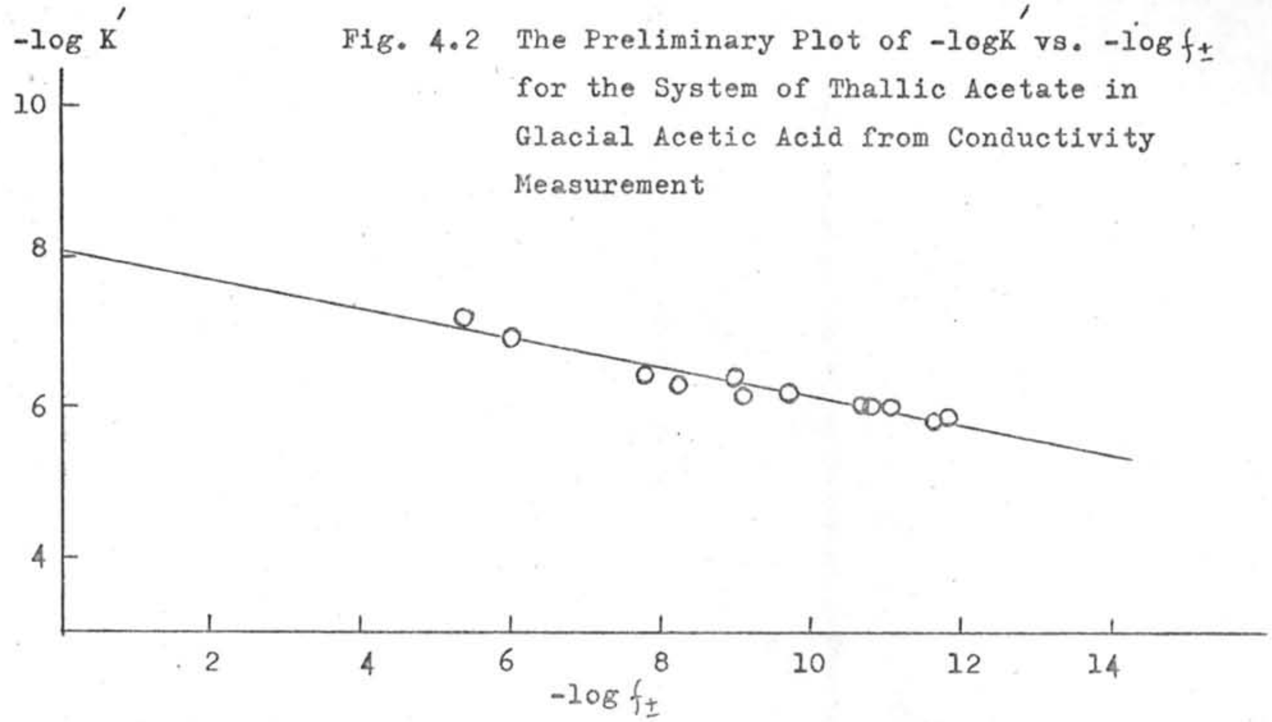

Fig. 4.2 The Preliminary Plot of $-\log K'$ vs. $-\log f_{\pm}$ for the System of Thallic Acetate in Glacial Acetic Acid from Conductivity Measurement

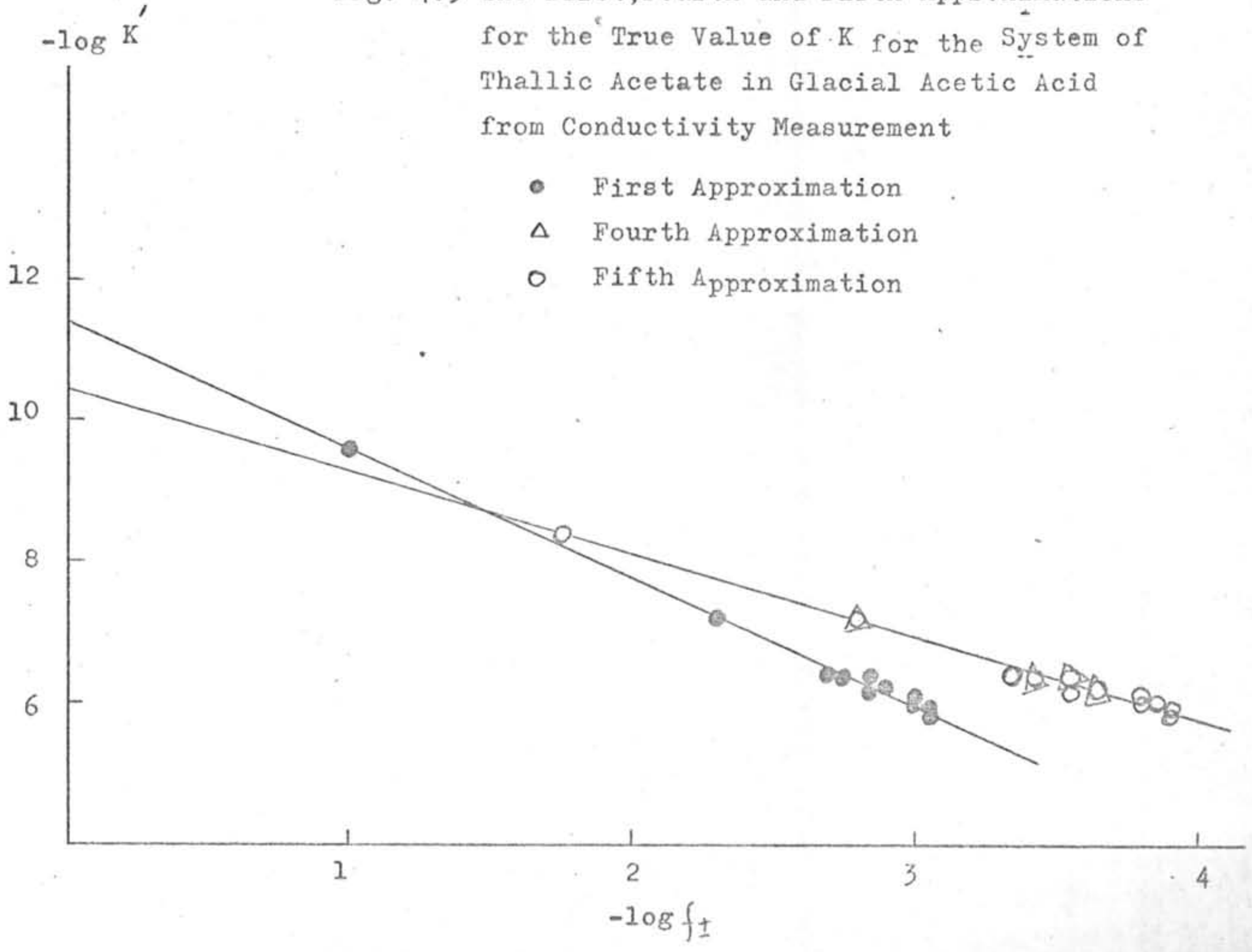

Fig. 4.3 The First, Fourth and Fifth Approximations for the True Value of K for the System of Thallic Acetate in Glacial Acetic Acid from Conductivity Measurement

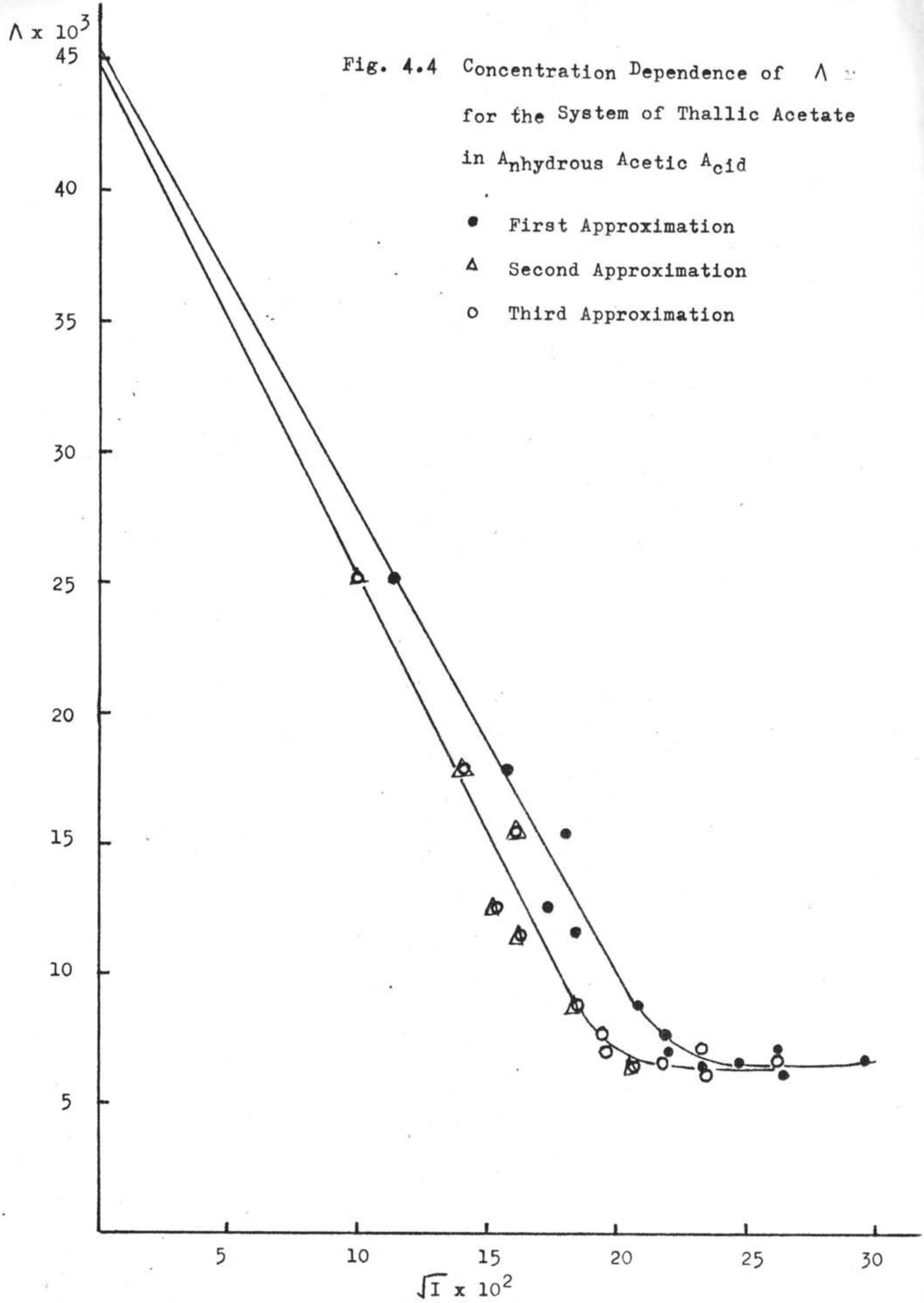

Fig. 4.4 Concentration Dependence of Λ for the System of Thallic Acetate in Anhydrous Acetic Acid

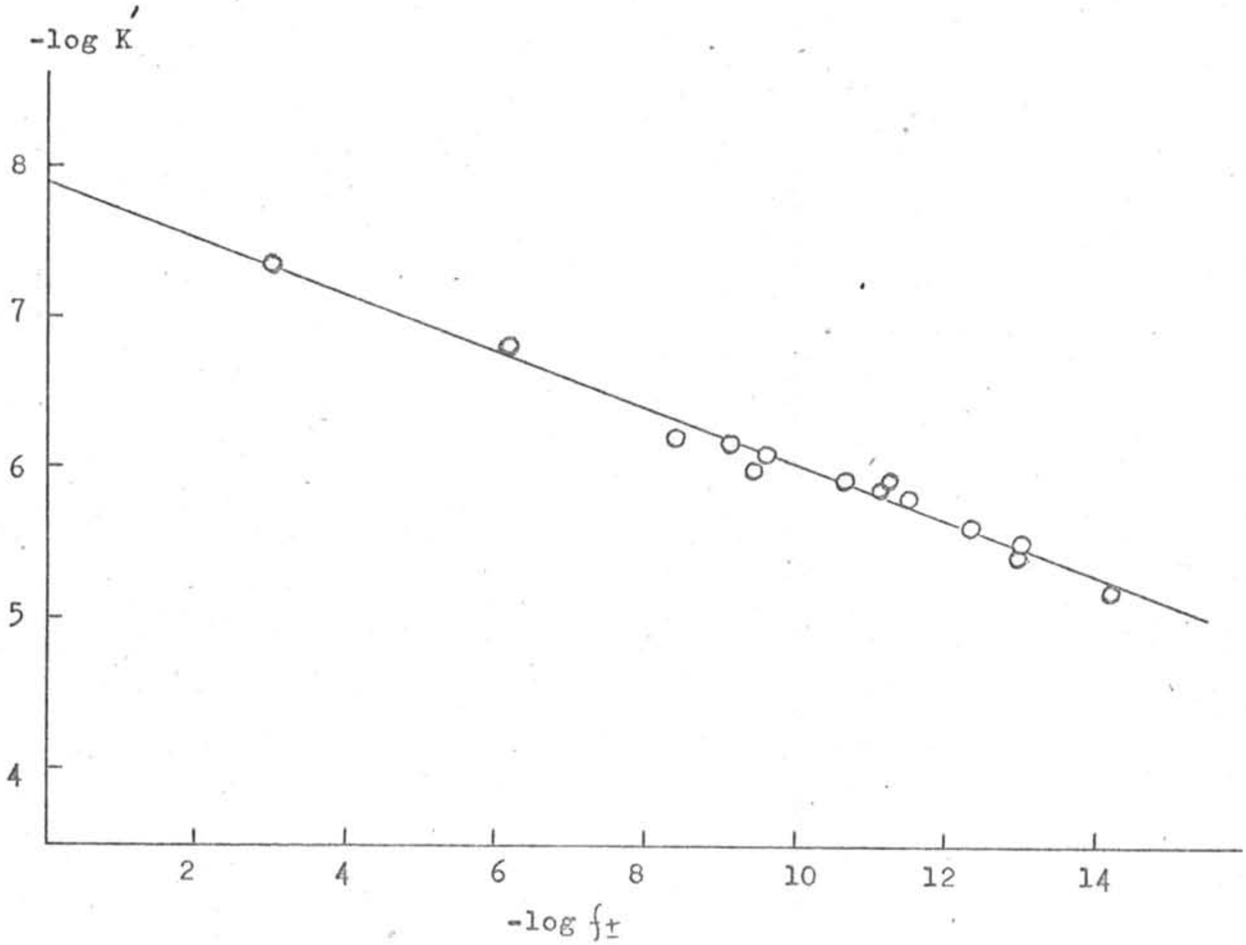

Fig. 4.5 Preliminary Plot of -logK' vs. -log $f_{\pm}$ for the System of Thallic Acetate in Anhydrous Acetic Acid from Conductivity Measurement

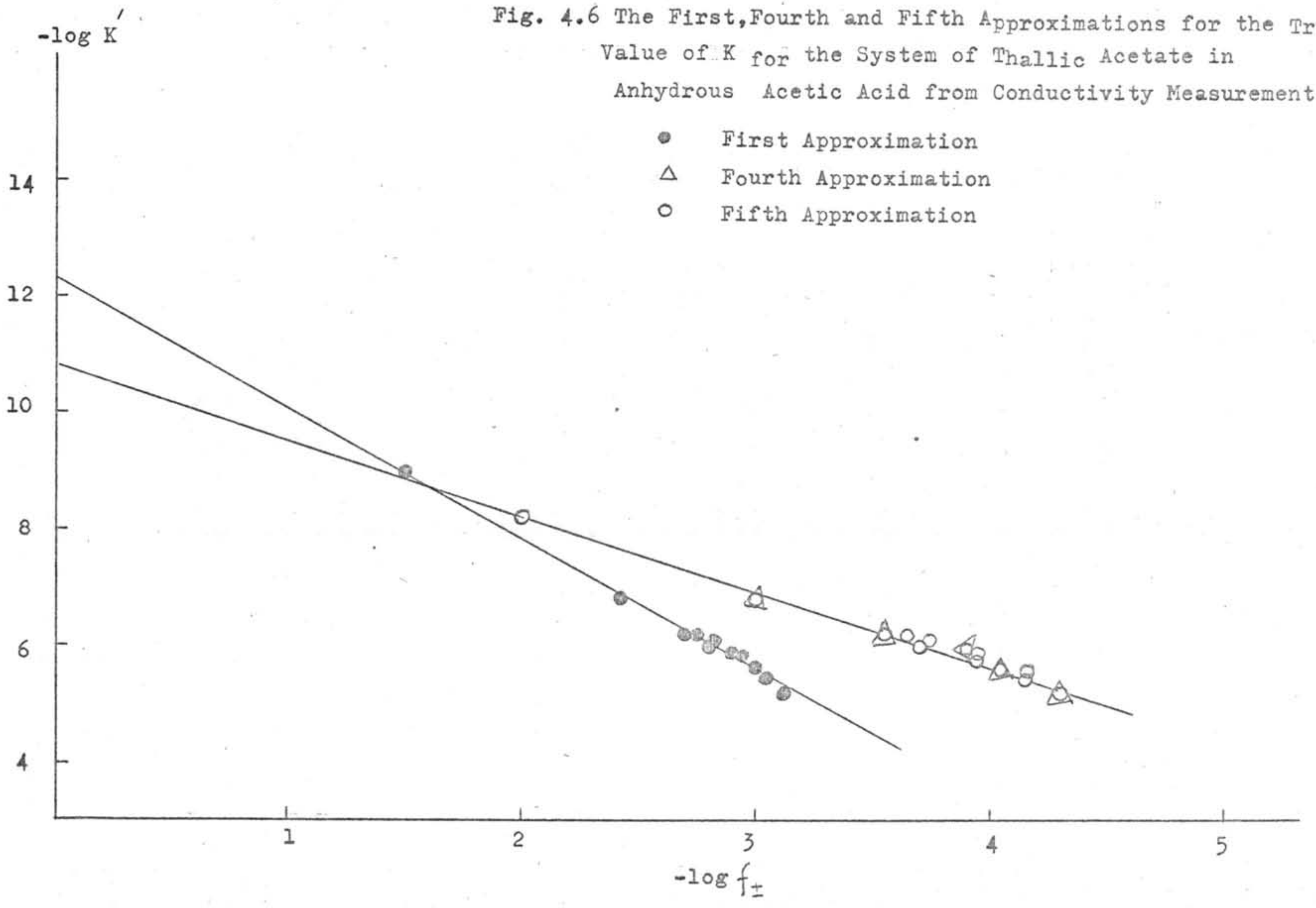

Fig. 4.6 The First, Fourth and Fifth Approximations for the True Value of K for the System of Thallic Acetate in Anhydrous Acetic Acid from Conductivity Measurement

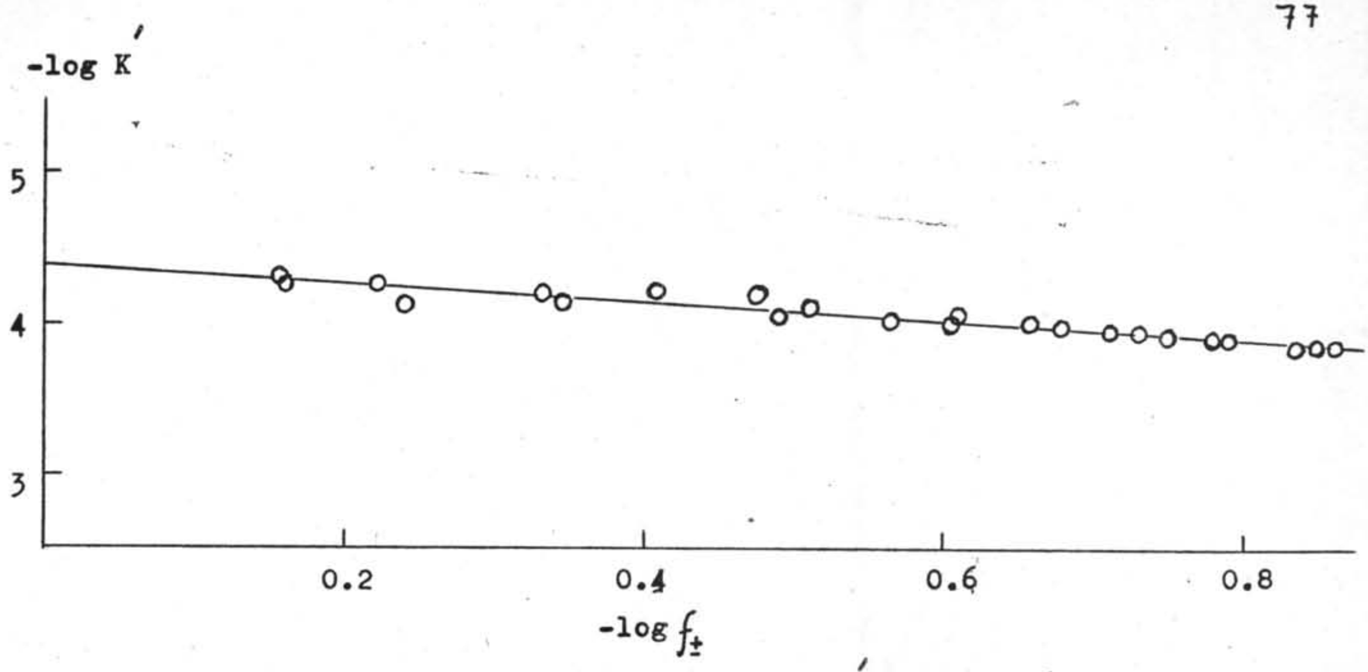

Fig. 4.7 The Preliminary Plot of -log K' vs. -log $f_{\pm}$ for the System of Thallous Acetate in Glacial Acetic Acid from Conductivity Measurement

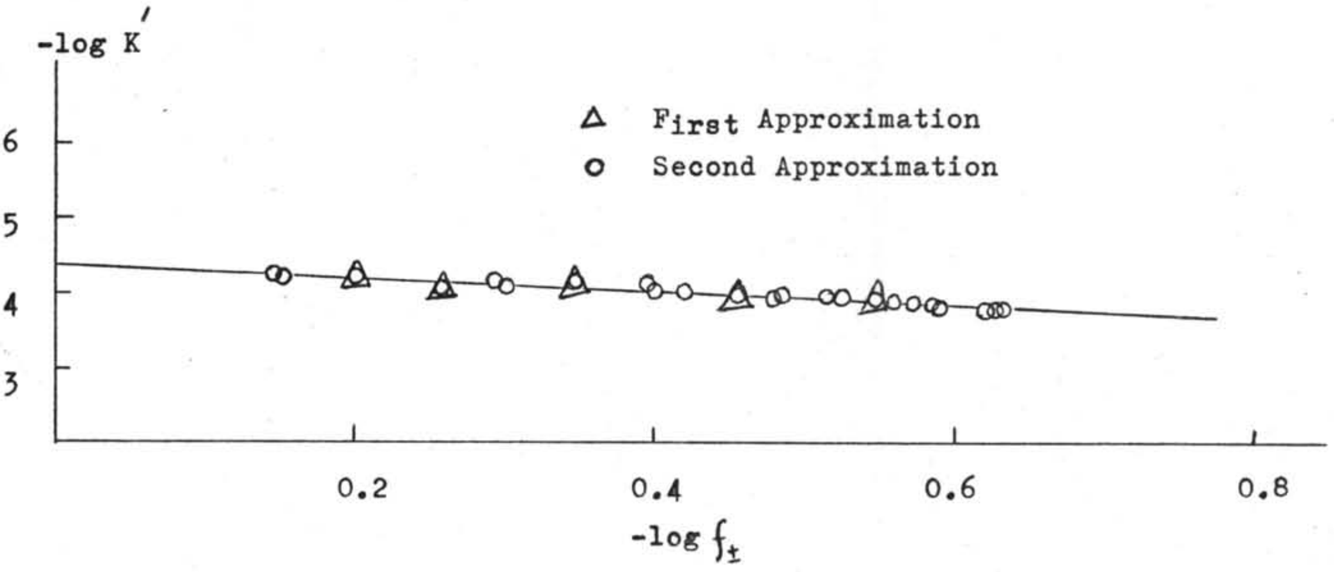

Fig. 4.8 The First, and Second Approximations for the True Value of K for the System of Thallous Acetate in Glacial Acetic Acid from Conductivity Measurement

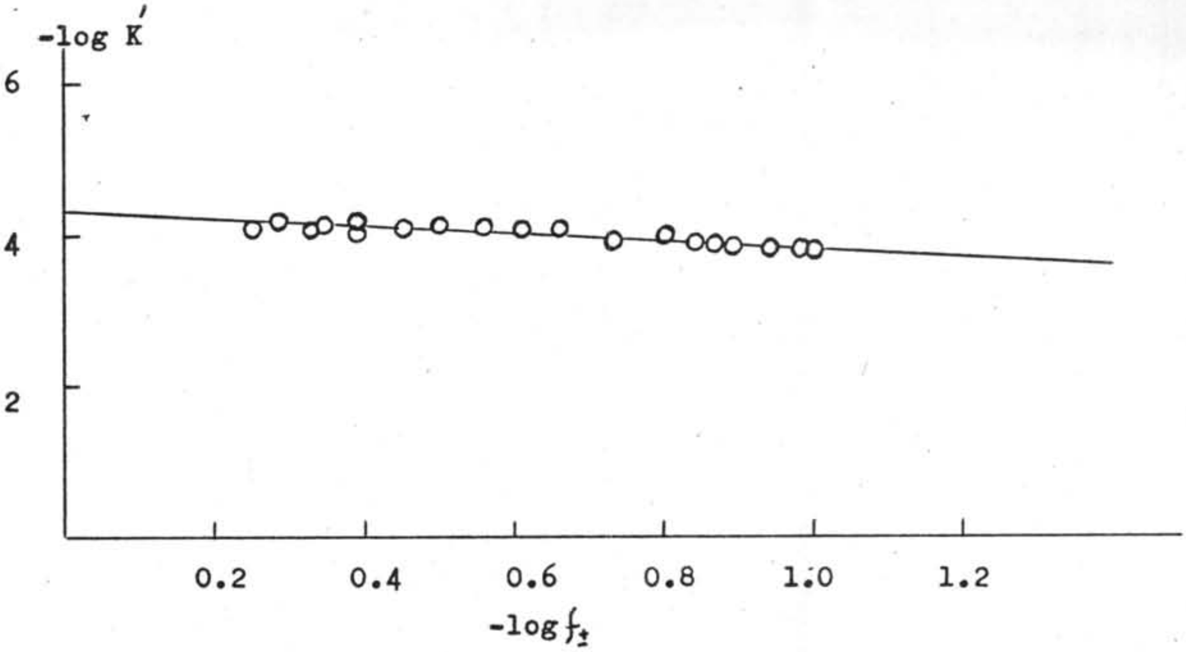

Fig. 4.9 The Preliminary Plot of $-\log K'$ vs. $-\log f_{\pm}$ for the System of Thallous Acetate in Anhydrous Acetic Acid from Conductivity Measurement

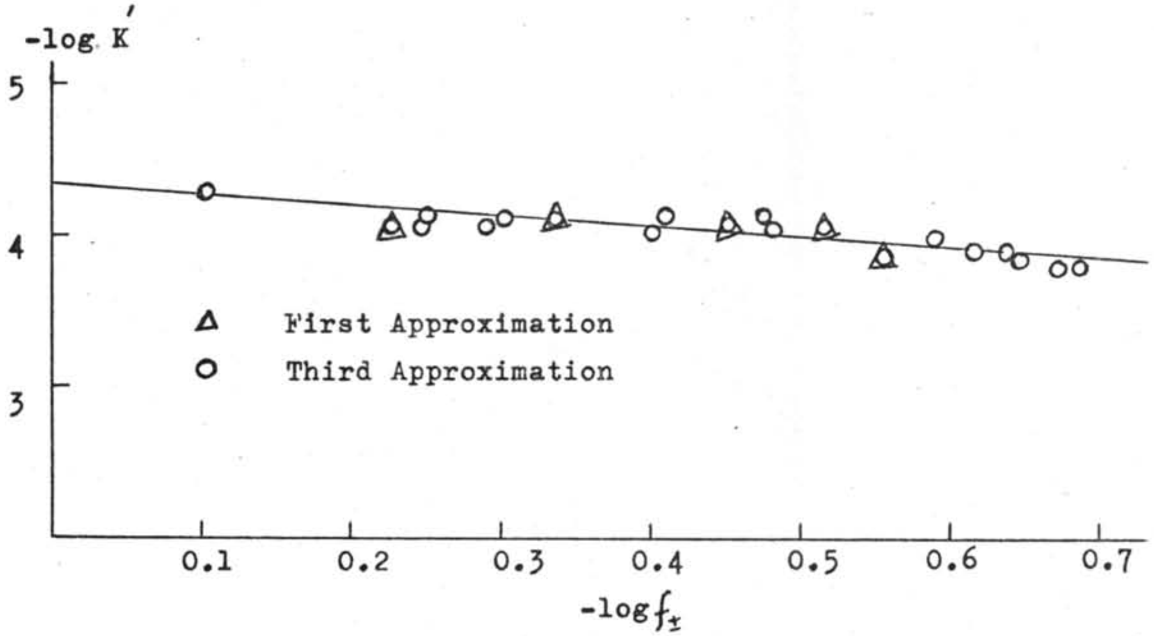

Fig. 4.10 The First and Third Approximations for the True Value of K for the System of Thallous Acetate in Anhydrous Acetic Acid from Conductivity Measurement

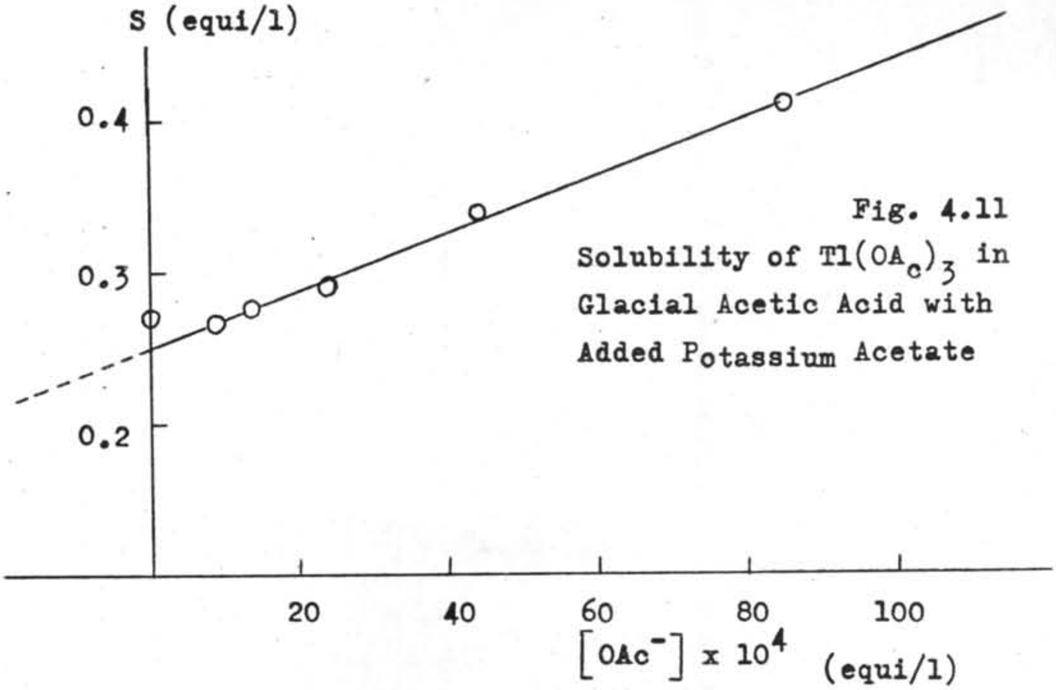

Fig. 4.11
Solubility of $Tl(OA_c)_3$ in
Glacial Acetic Acid with
Added Potassium Acetate

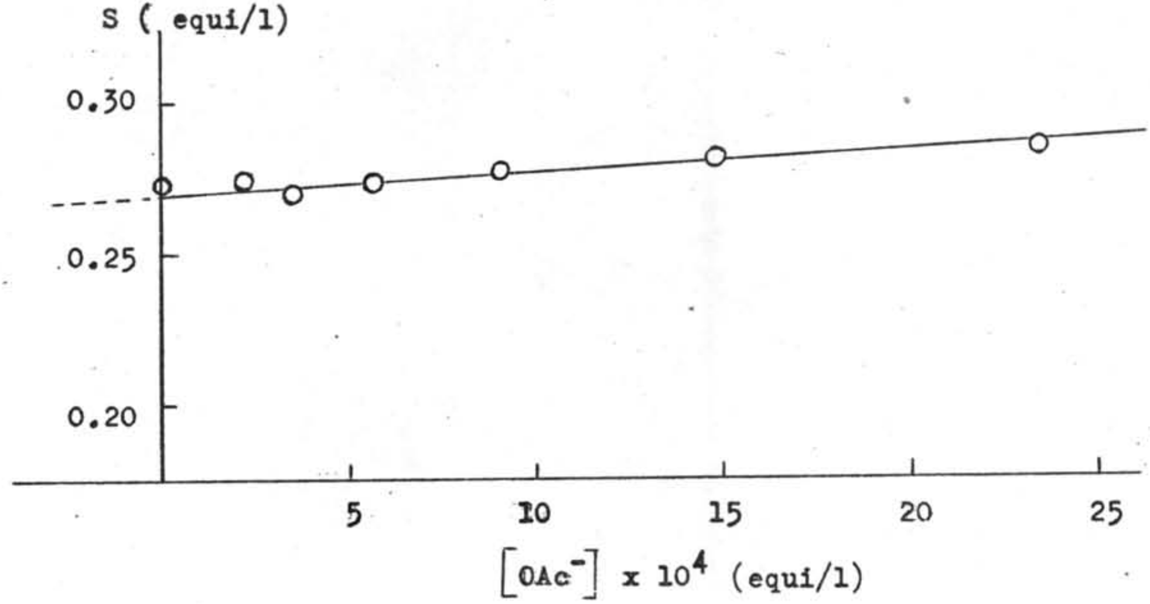

Fig. 4.12 Solubility of $Tl(OA_c)_3$ in Glacial Acetic Acid with Added Sodium Acetate Trihydrate