Zach Swain
MSEG804 – Exam 2

11/21/19

1)

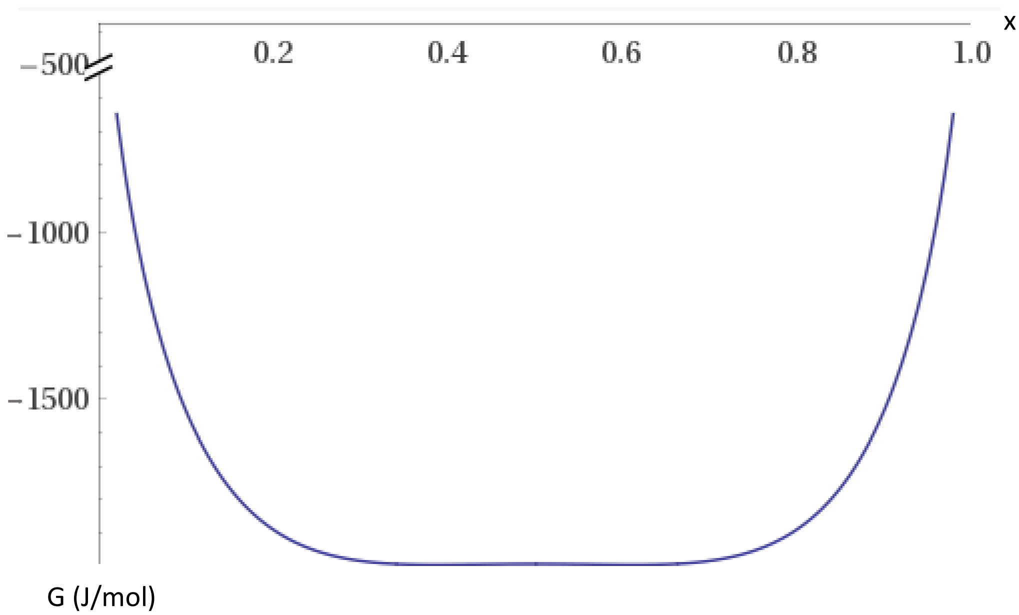

FIG. 1. G is plotted against x over full axes **[1].**

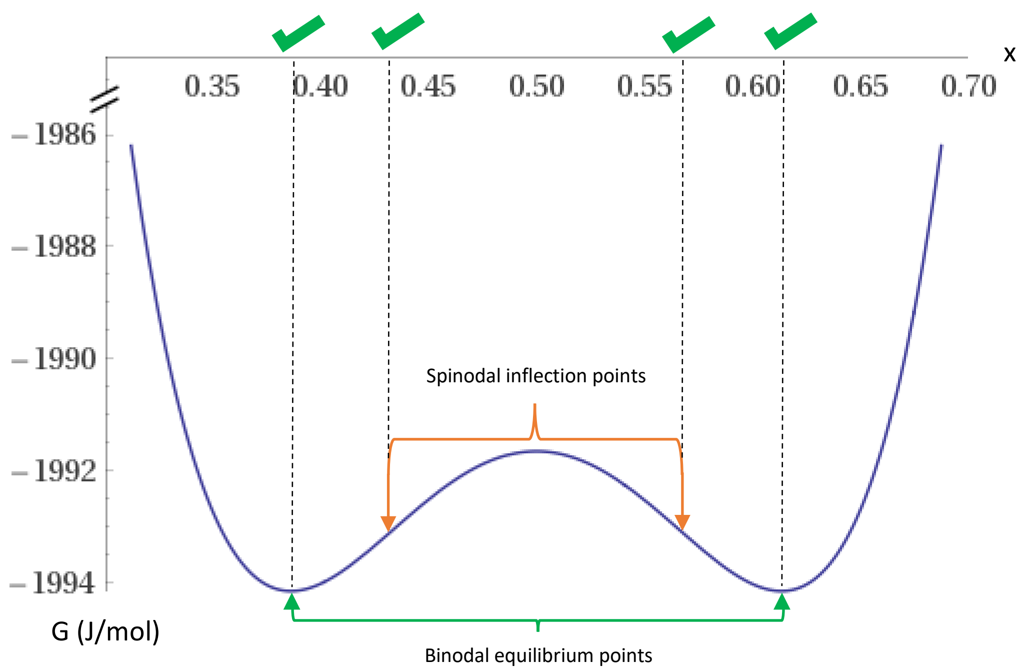

FIG. 2. G is plotted against x on truncated axes to display the local minima and maximum, as well as inflection points **[1].**

1) cont.

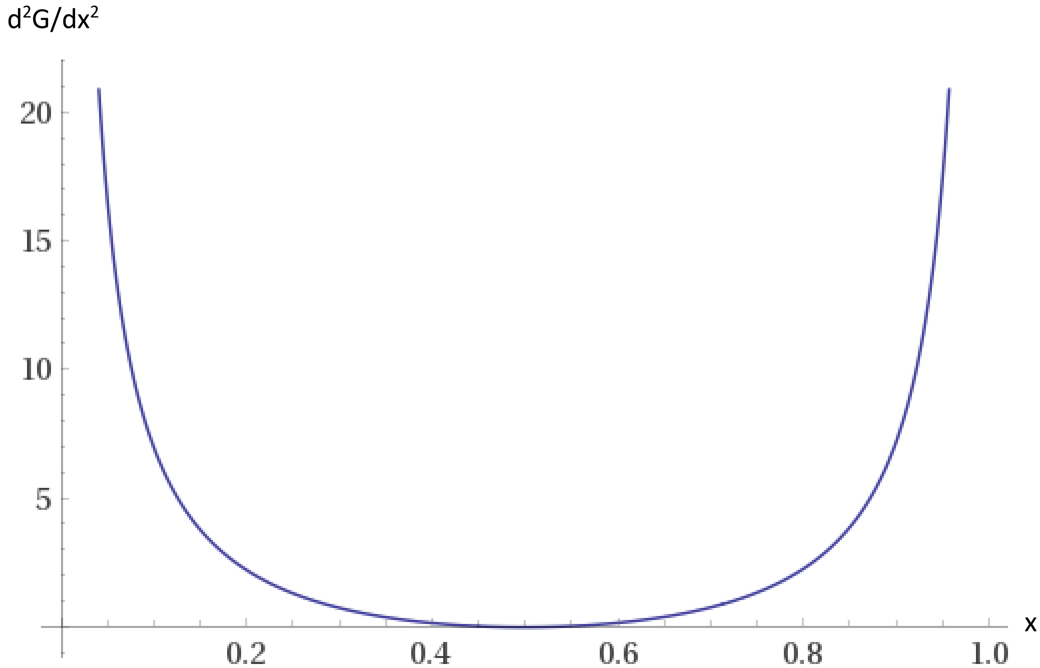

FIG. 3. d^2G/dx^2 is plotted against x over full axes **[1].**

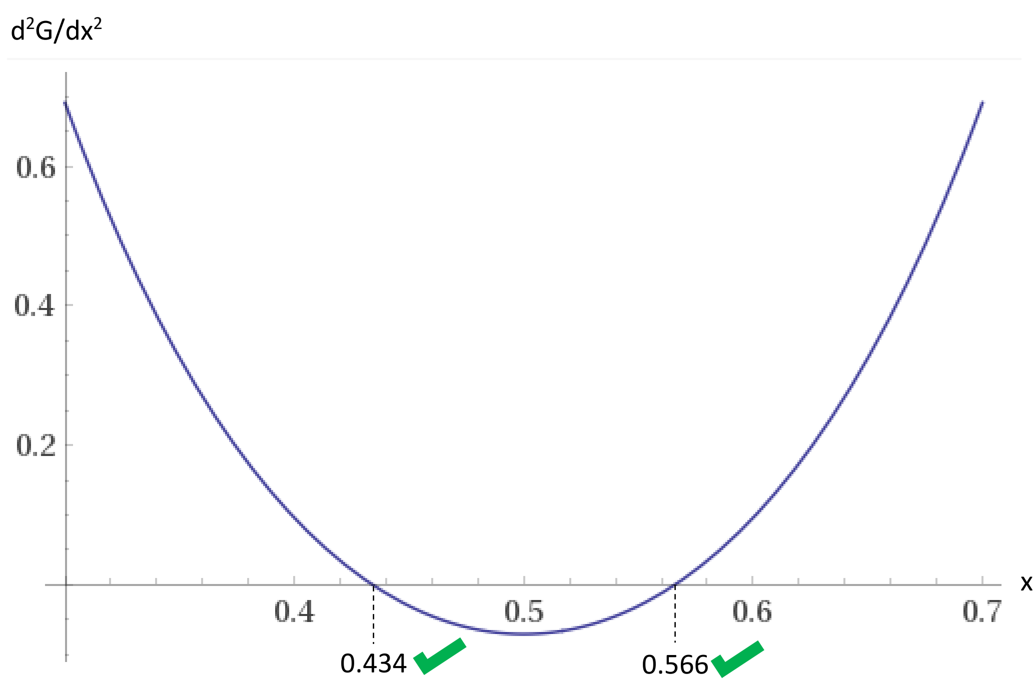

FIG. 4. d^2G/dx^2 is plotted on truncated axes to display its roots on x **[1].**

1) cont.

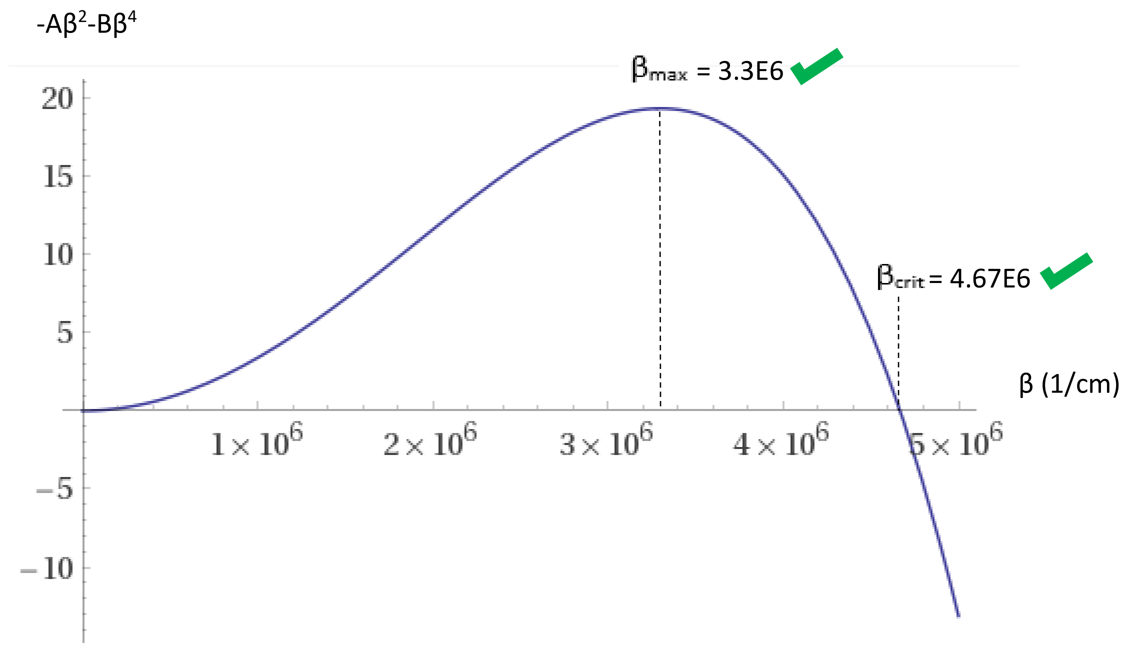

FIG. 5. Exponent term $-A\beta^2-B\beta^4$ is plotted against β to evaluate its values at β_{max} and β_{crit}. **[1].**

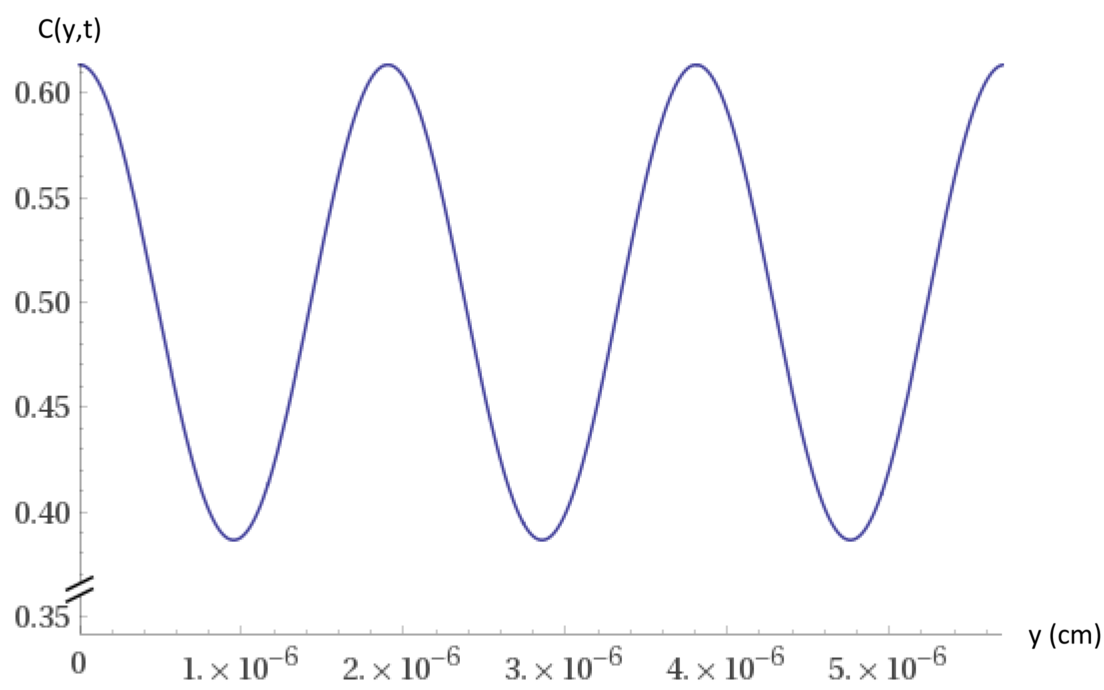

FIG. 6. $C(y,t)$ is plotted against y at its β_{max} condition for maximum fluctuation at t = 0.6381s before reaching an equilibrium concentration **[1].**

1) cont.

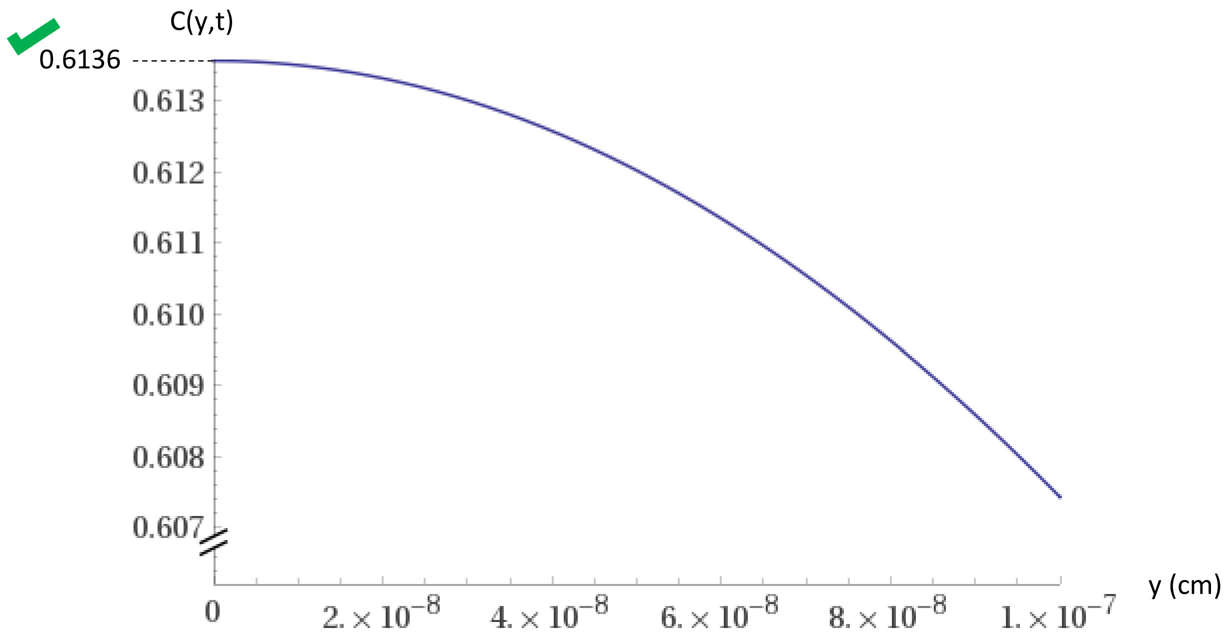

FIG. 7. C(y,t) for β_{max} is evaluated at its initial value to verify its maximum fluctuation at t = 0.6381s is equal to the corresponding binodal equilibrium point **[1].**

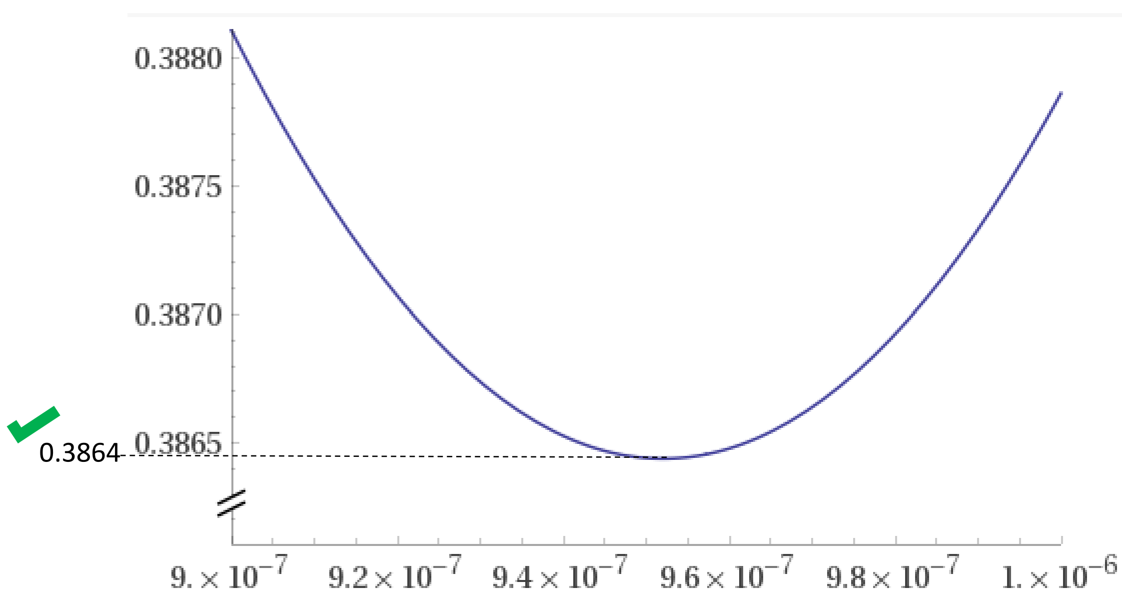

FIG. 8. C(y,t) for β_{max} is evaluated at its minimum value to verify its fluctuation at t = 0.6381s is equal to the corresponding binodal equilibrium point **[1].**

1) cont.

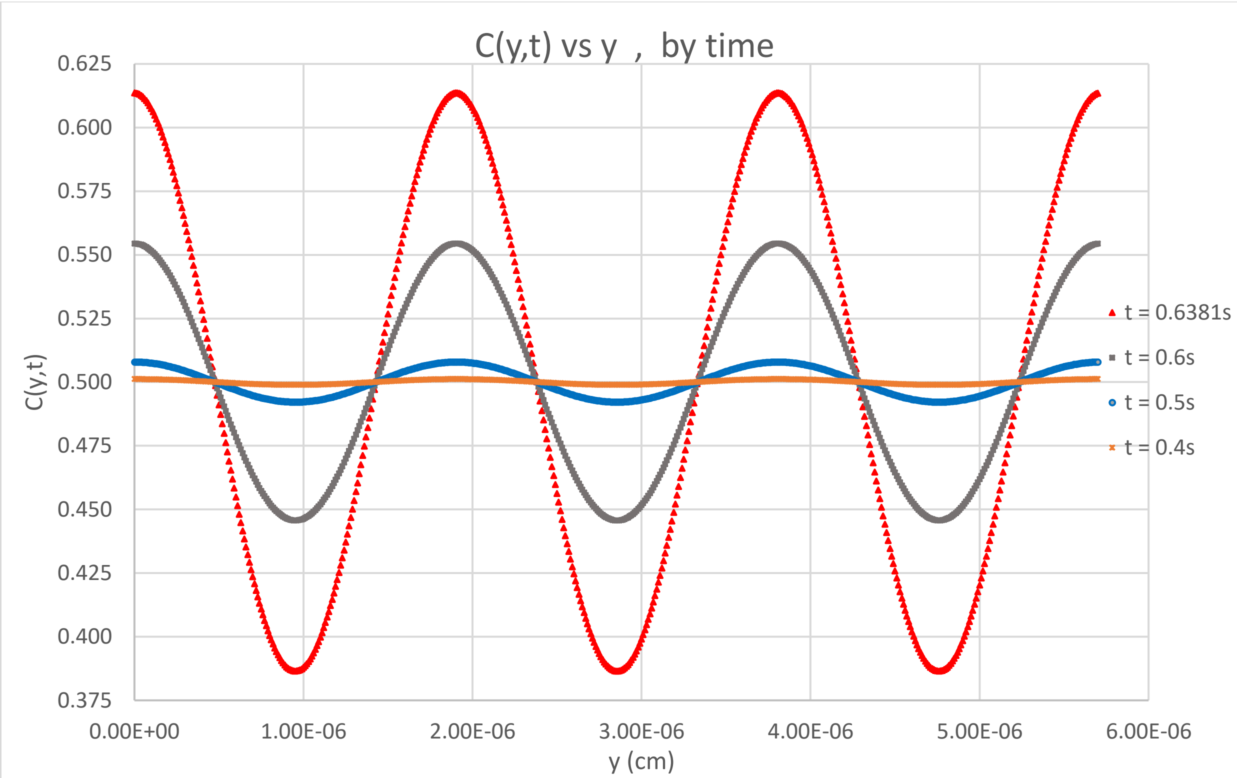

FIG. 9. C(y,t) is plotted against y over varied values of t. Amplitude of the cosinusoidal fluctuation increases with time until it reaches the equilibrium concentraion defined earlier (too many data points to fit on this document **[2]**).

2)

T_c =	***110°C***			***T_c =***	***236°C***			***T_c =***	***240°C***		
X_t	**t (min)**	**log(-ln(1-X_t))**	**log(t)**	**X_t**	**t (min)**	**log(-ln(1-X_t))**	**log(t)**	**X_t**	**t (min)**	**log(-ln(1-X_t))**	**log(t)**
0.096	15.8	-0.9960	1.1987	0.005	12.6	-2.2999	1.1004	0.004	20.2	-2.3971	1.3054
0.176	20	-0.7131	1.3010	0.014	14.4	-1.8508	1.1584	0.018	27.8	-1.7408	1.4440
0.275	25.7	-0.4927	1.4099	0.018	15.9	-1.7408	1.2014	0.029	35.5	-1.5312	1.5502
0.407	30.8	-0.2819	1.4886	0.026	17.7	-1.5793	1.2480	0.051	40.1	-1.2811	1.6031
0.469	36.2	-0.1986	1.5587	0.038	19.1	-1.4118	1.2810	0.099	45.3	-0.9819	1.6561
0.709	54.3	0.0915	1.7348	0.085	24.6	-1.0514	1.3909	0.16	52.7	-0.7586	1.7218
0.811	63.1	0.2217	1.8000	0.134	27.7	-0.8420	1.4425	0.238	59.5	-0.5657	1.7745
0.879	71.7	0.3247	1.8555	0.244	31.6	-0.5533	1.4997	0.395	67.1	-0.2988	1.8267
0.952	84.3	0.4824	1.9258	0.353	36.8	-0.3611	1.5658	0.592	79.9	-0.0475	1.9025
				0.608	44.3	-0.0285	1.6464	0.739	91.9	0.1282	1.9633
				0.736	47.4	0.1244	1.6758	0.855	99.3	0.2858	1.9969
				0.826	49	0.2427	1.6902	0.911	114.1	0.3837	2.0573
				0.907	58.8	0.3757	1.7694	0.976	128.6	0.5717	2.1092
				0.965	63.5	0.5254	1.8028				

Table 1. The given data is listed along with their respective calculations for Avrami analysis. A TA Instruments reference was utilized as extra reading and to determine ln(-ln()) vs. log(-ln()) convention **[3].** Excel equations are available for inspection **[4].**

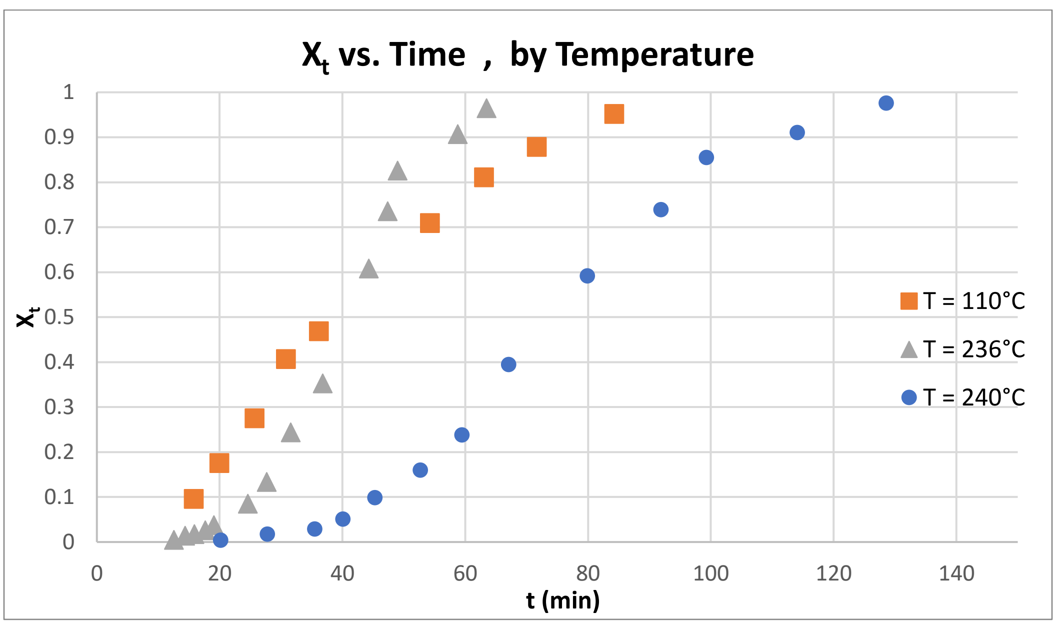

FIG. 10. The given degree of crystallization vs. time data is overlaid by isotherm **[4].**

2) cont.

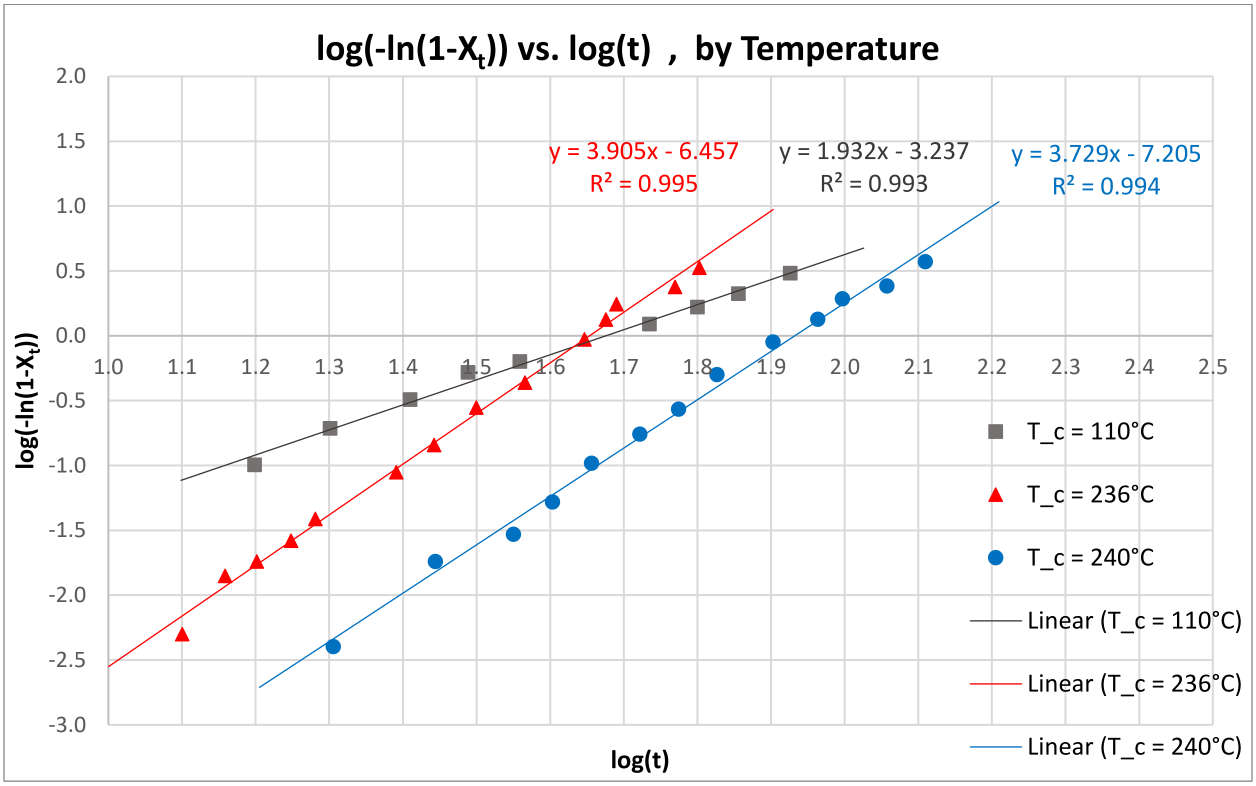

FIG. 11. Avrami analysis is presented, overlaid by linear-fit isotherms **[4].**

Temp(°C)	*n*	*log(k)*	*k*
110	1.932	-3.237	5.79E-04
236	3.905	-6.457	3.49E-07
240	3.729	-7.205	6.24E-08

Temp(°C)	*xtal*	*nucleation*	*rate det.*
110	rod	sporadic	diffusion
236	sphere	sporadic	contact
240	sphere	simultaneous	contact

Table 2. Avrami exponent and rate constant, as well as predicted crystal morphology, method of growth, and rate determining aspect are displayed above. **[3].**

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References / Supplemental

[1] Figure was plotted utilizing WolframAlpha computing suite.

[2] If there are any uncertainties of the calculations used, the full excel worksheet can be accessed here: https://github.com/zswain/MSEG804 as "ZachSwain_MSEG804-Exam2_#1.xlsx"

[3] **"**TA393," TA Instruments, New Castle, DE. http://www.tainstruments.com/pdf/literature/TA393.pdf

[4] If there are any uncertainties of the calculations used, the full excel worksheet can be accessed here: https://github.com/zswain/MSEG804 as "ZachSwain_MSEG804-Exam2_#2.xlsx"