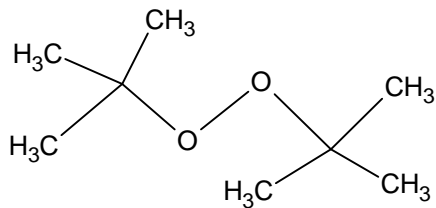


tert-Butyl peroxide

$C_8H_{18}O_2$

TBP



ARC device: New ARC (TIAX, LLC)

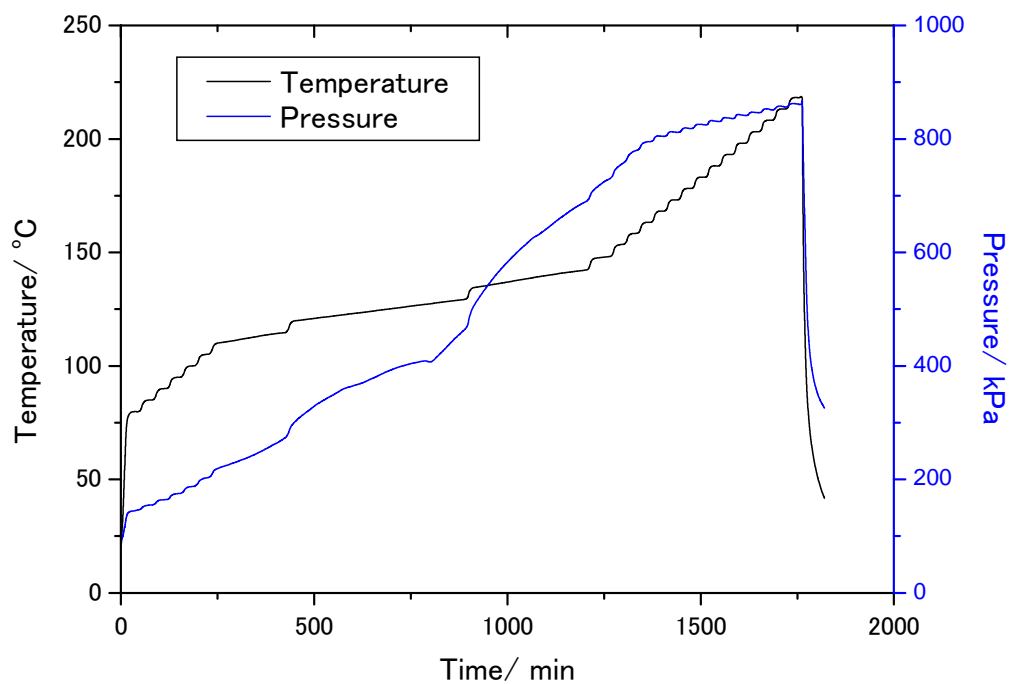
Material of Bomb: Ti

Waiting & Searching Time: 15 min

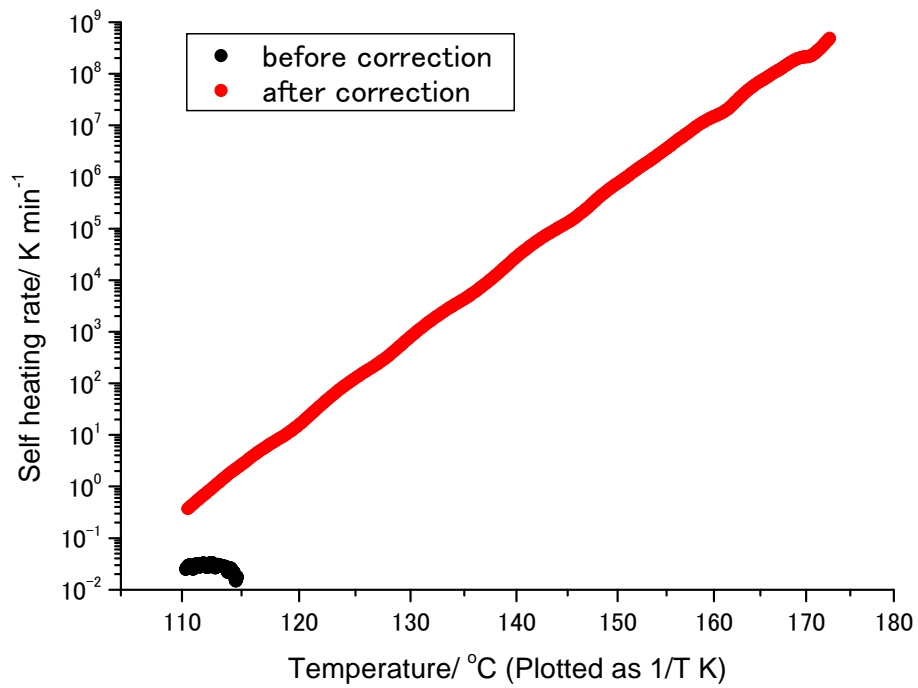
Date: 2009/6 – 2009/7

Operator: Y. S.

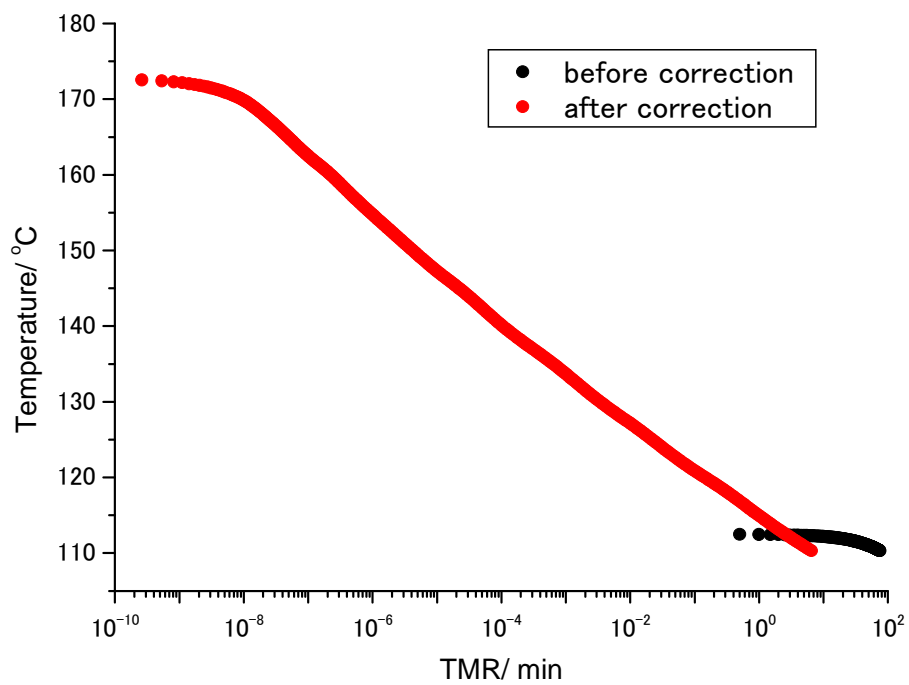
a) Weight: 0.189 g



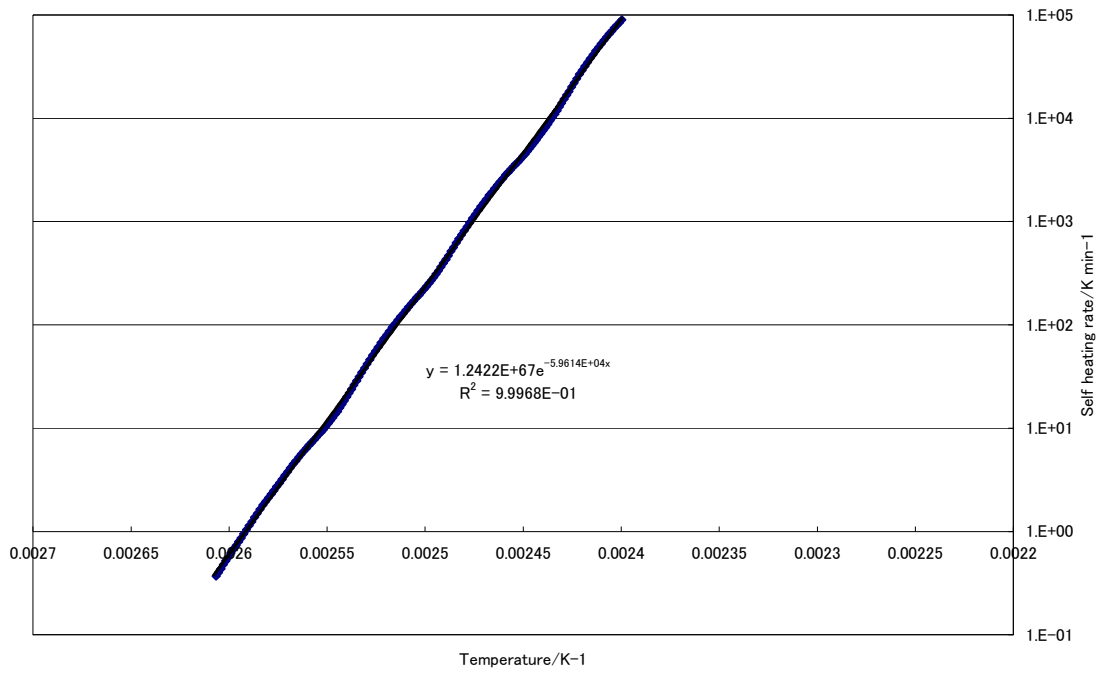
Time vs. Temperature and Pressure



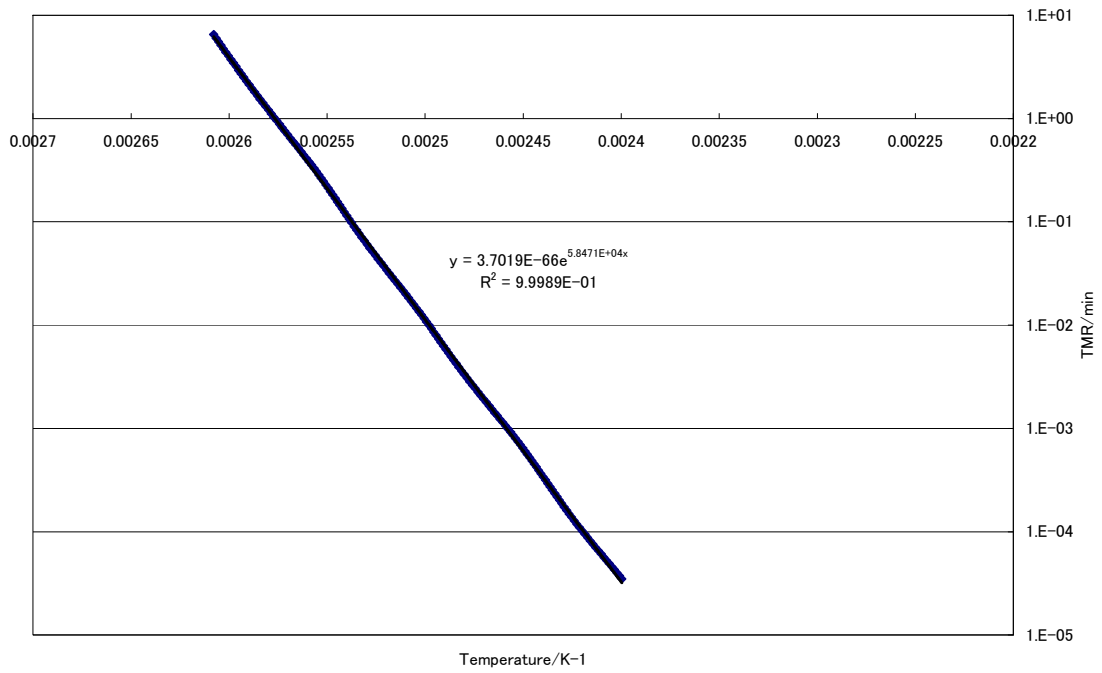
Temperature vs. Self heating rate



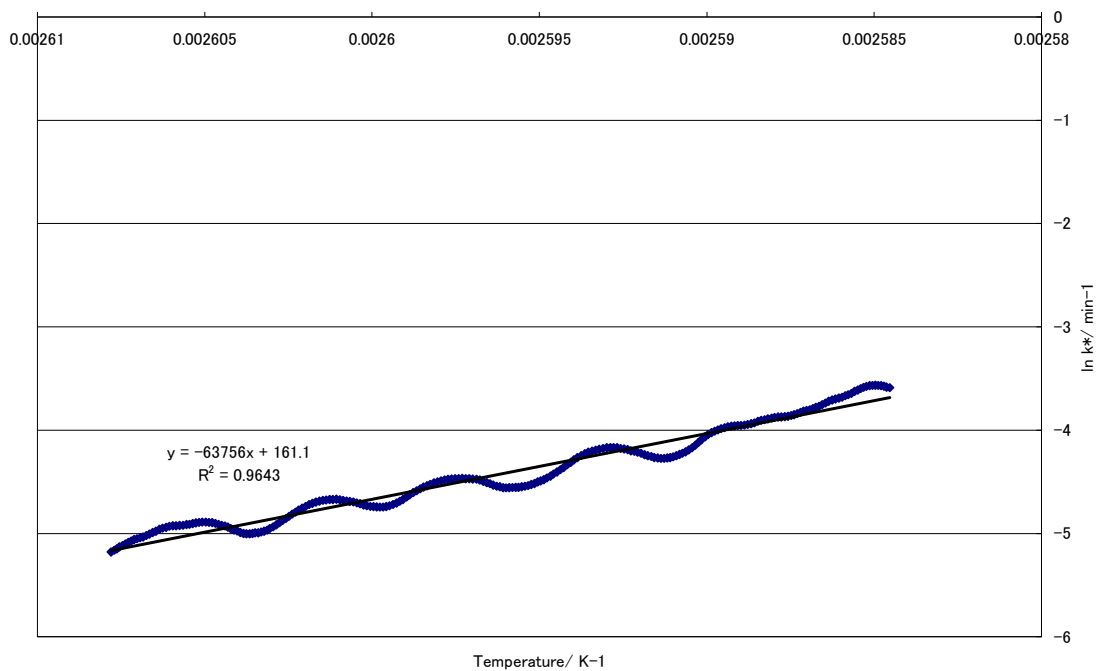
TMR vs. Temperature



Temperature vs. Self heating rate (approximate calculation)

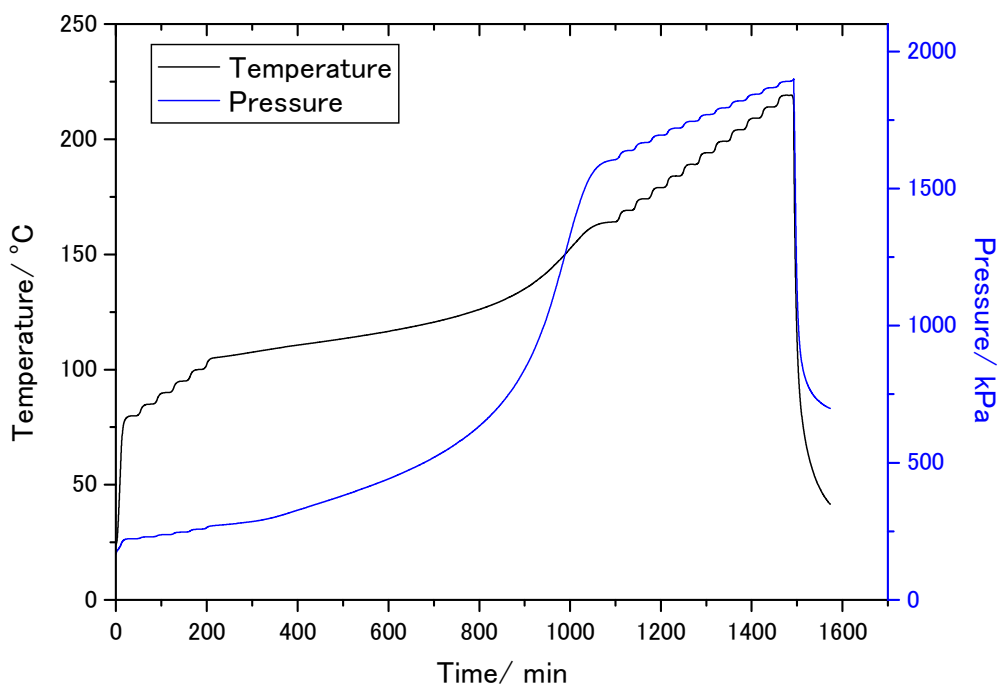


Temperature vs. TMR (approximate calculation)

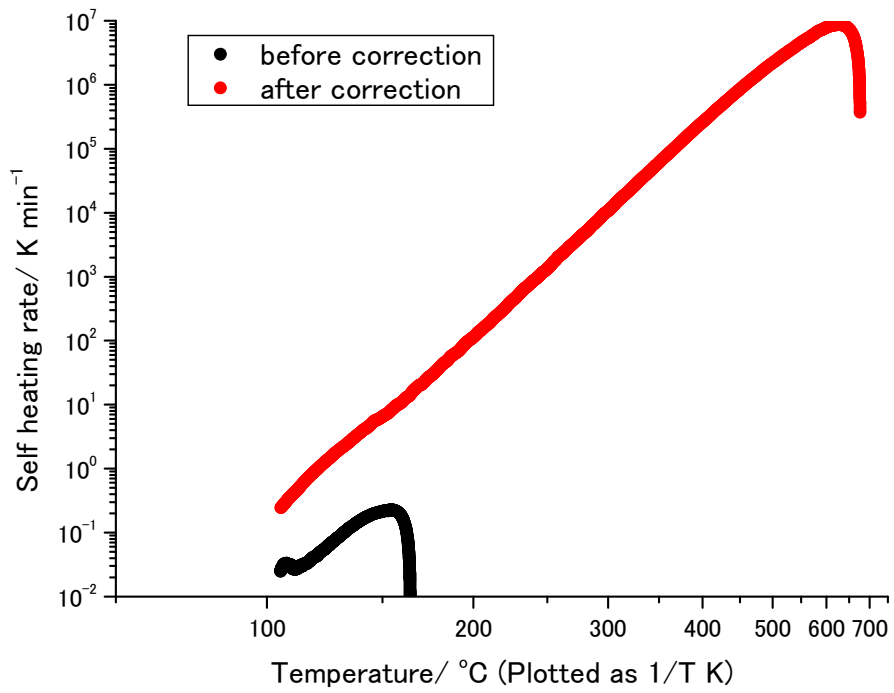


Arrhenius equation (approximate calculation)

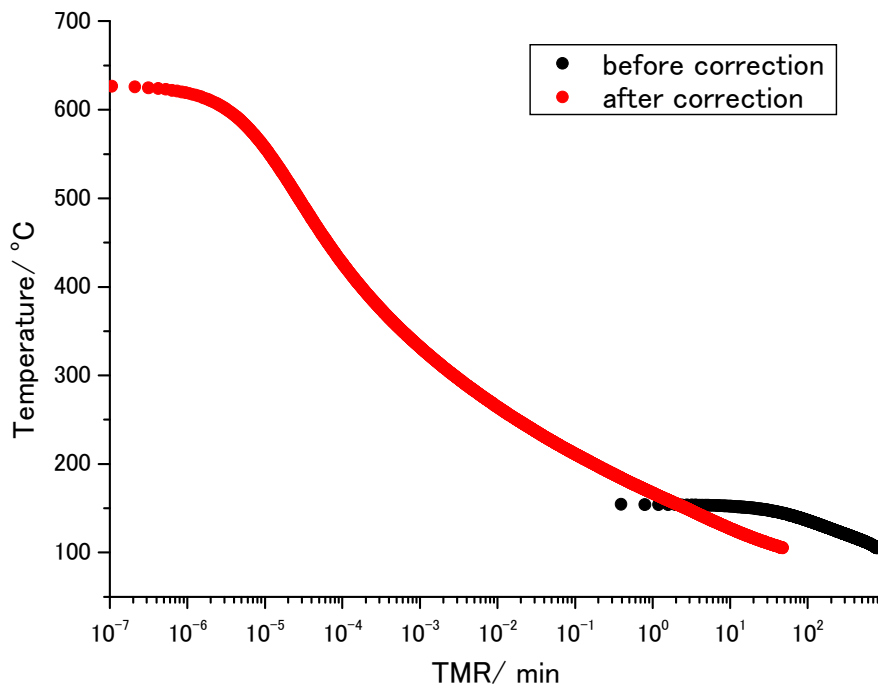
b) Weight: 0.305 g



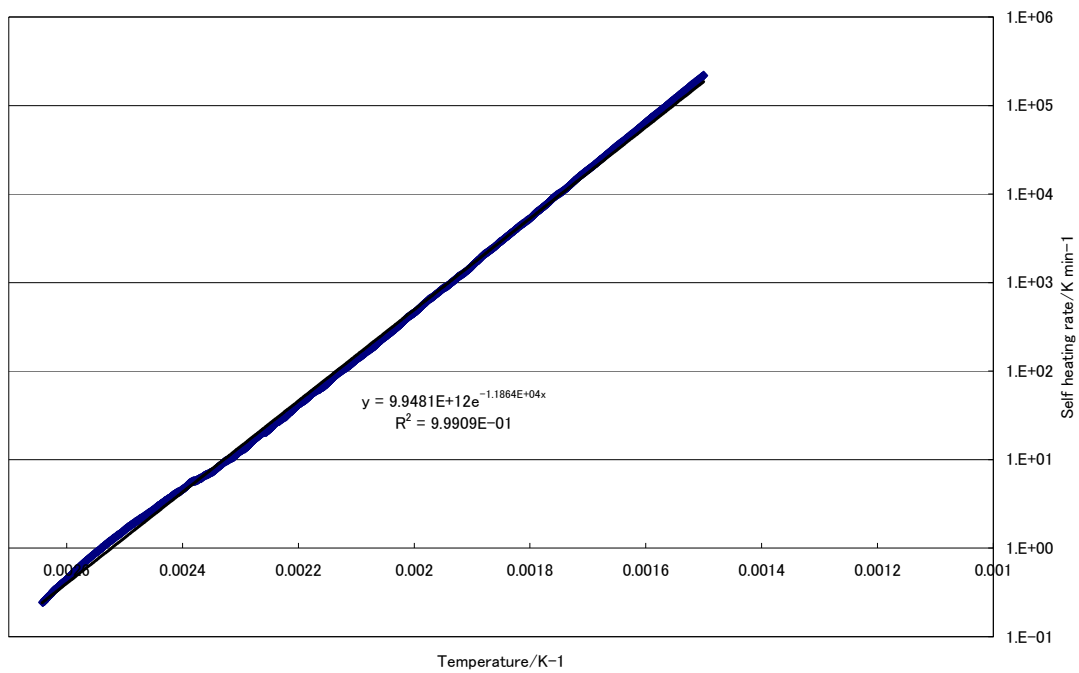
Time vs. Temperature and Pressure



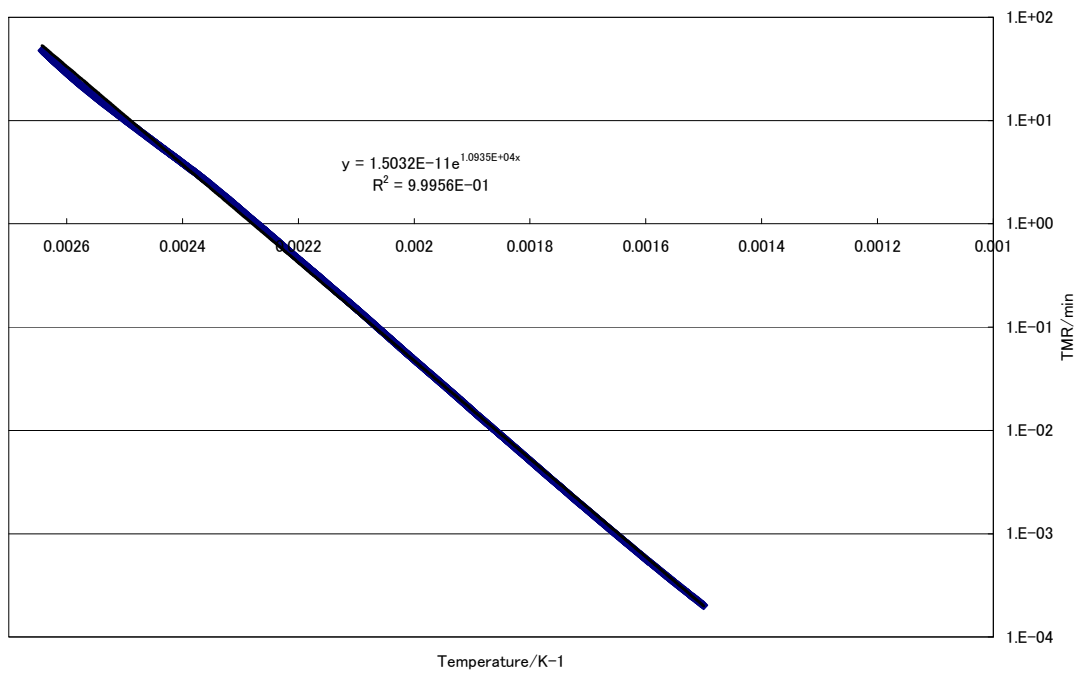
Temperature vs. Self heating rate



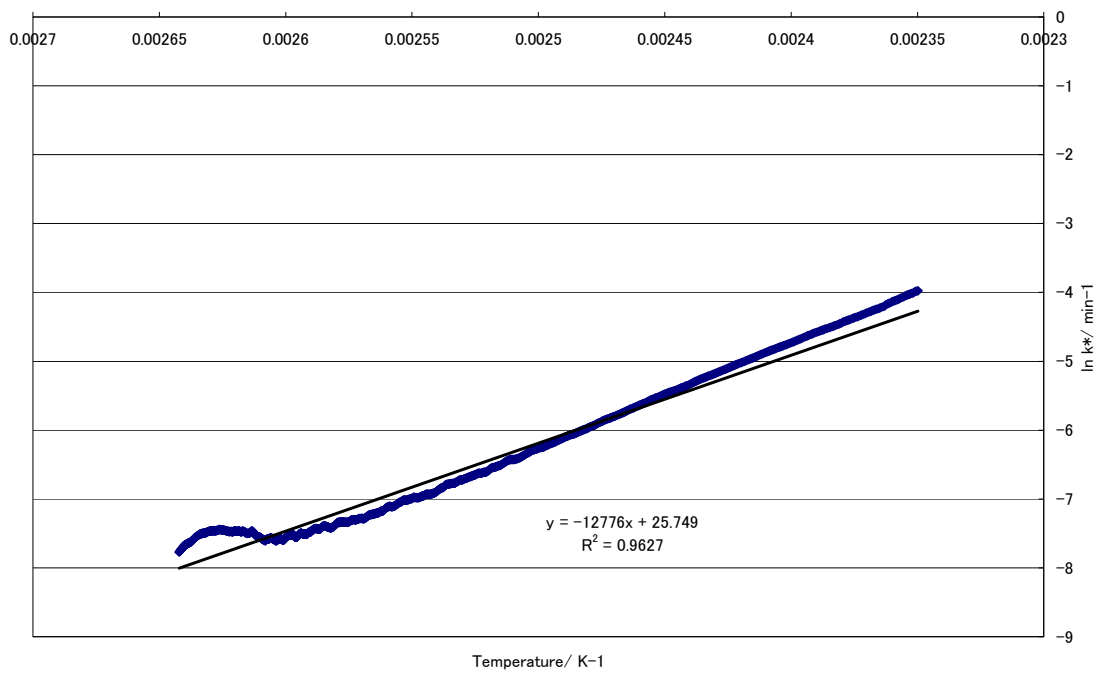
TMR vs. Temperature



Temperature vs. Self heating rate (approximate calculation)

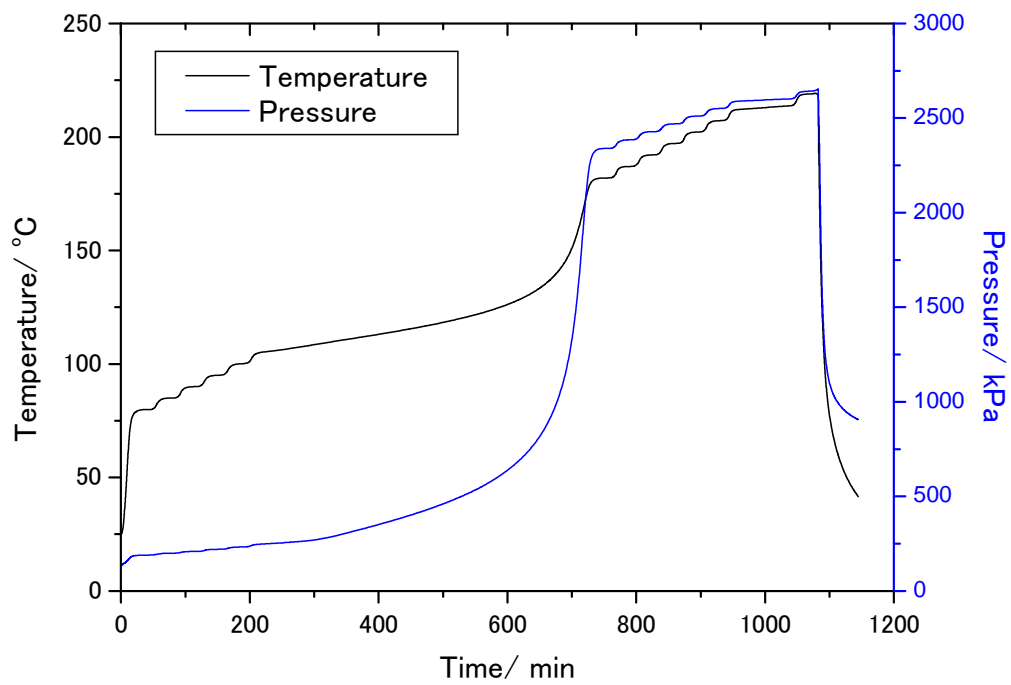


Temperature vs. TMR (approximate calculation)

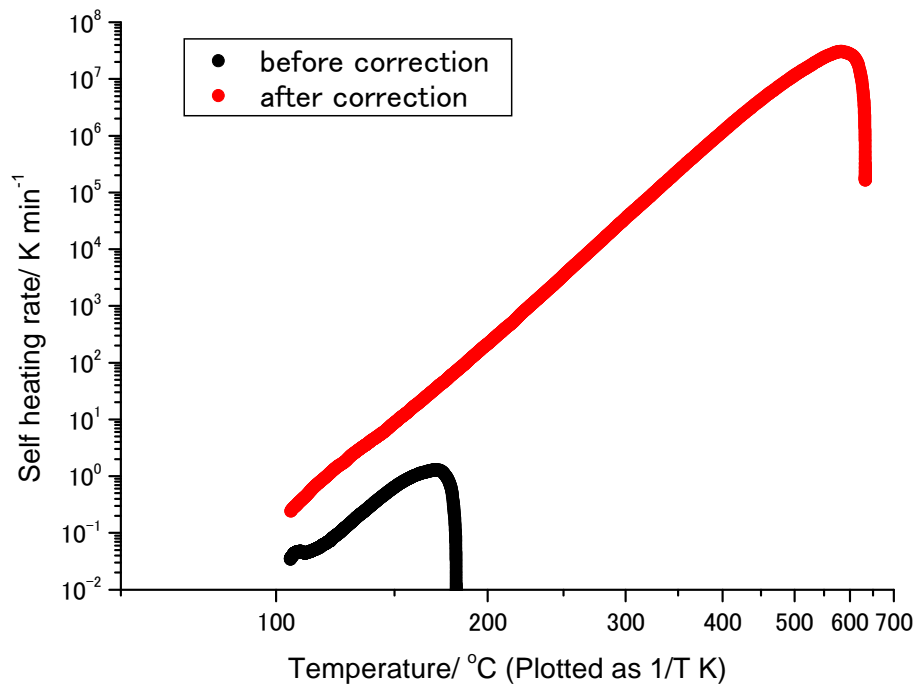


Arrhenius equation (approximate calculation)

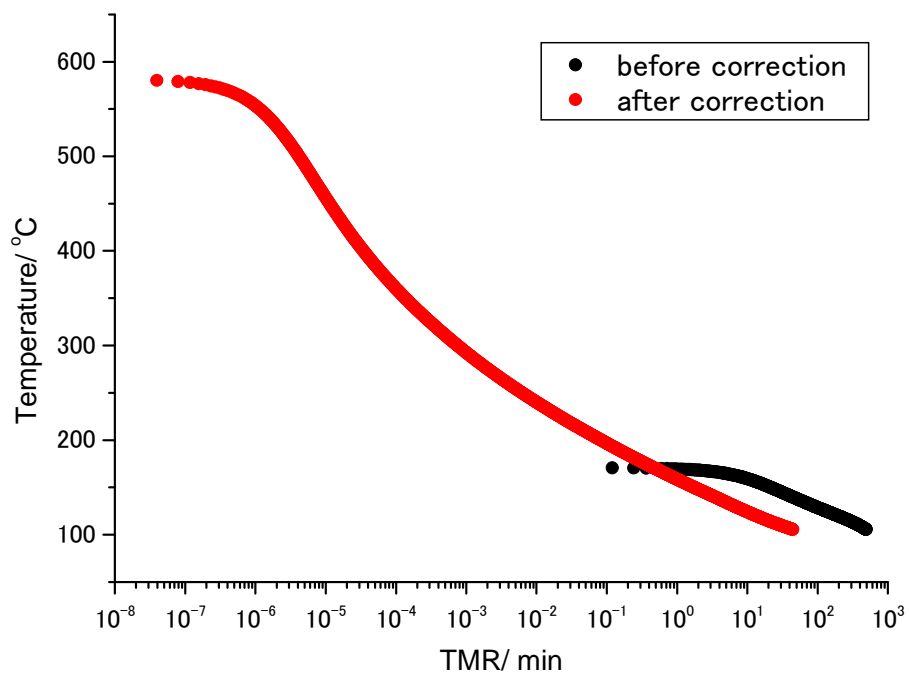
c) Weight: 0.446 g



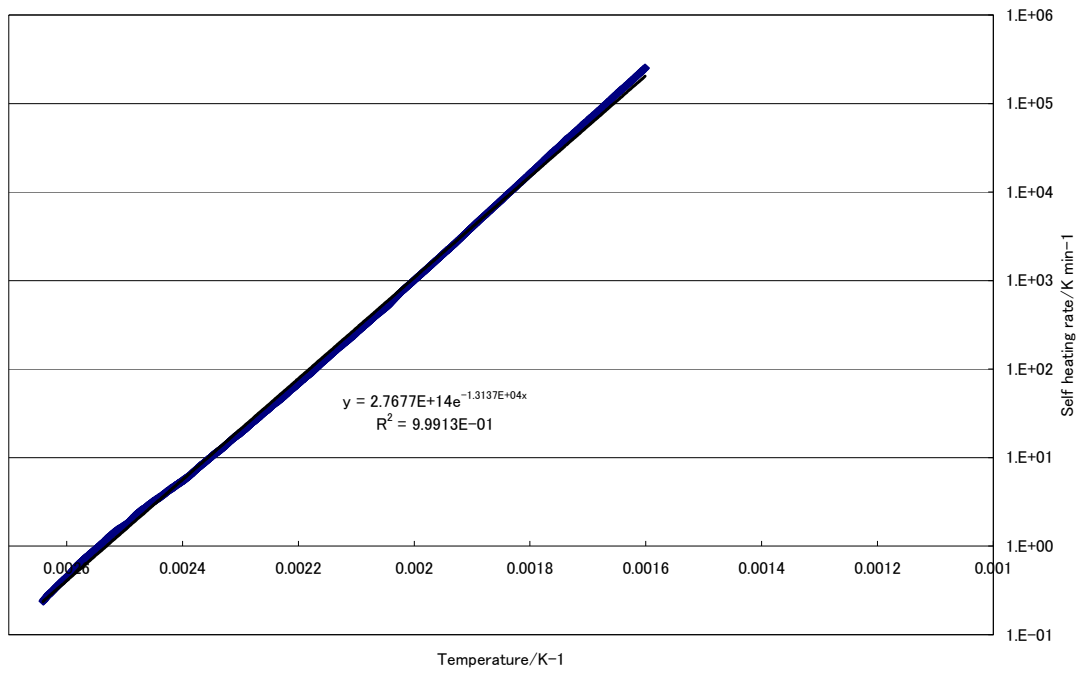
Time vs. Temperature and Pressure



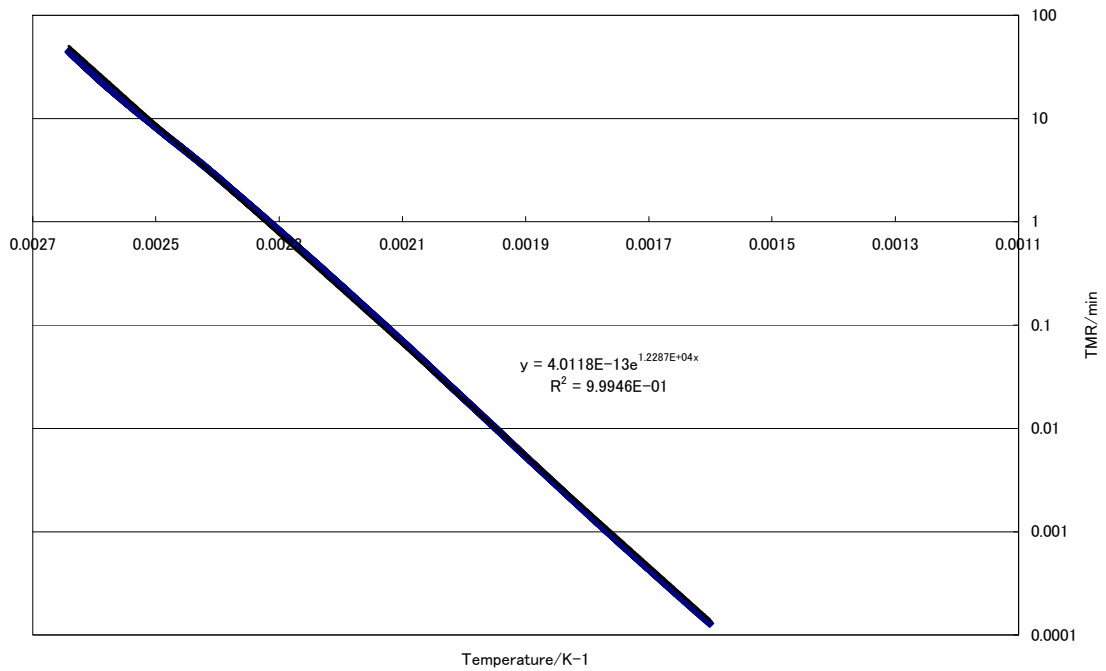
Temperature vs. Self heating rate



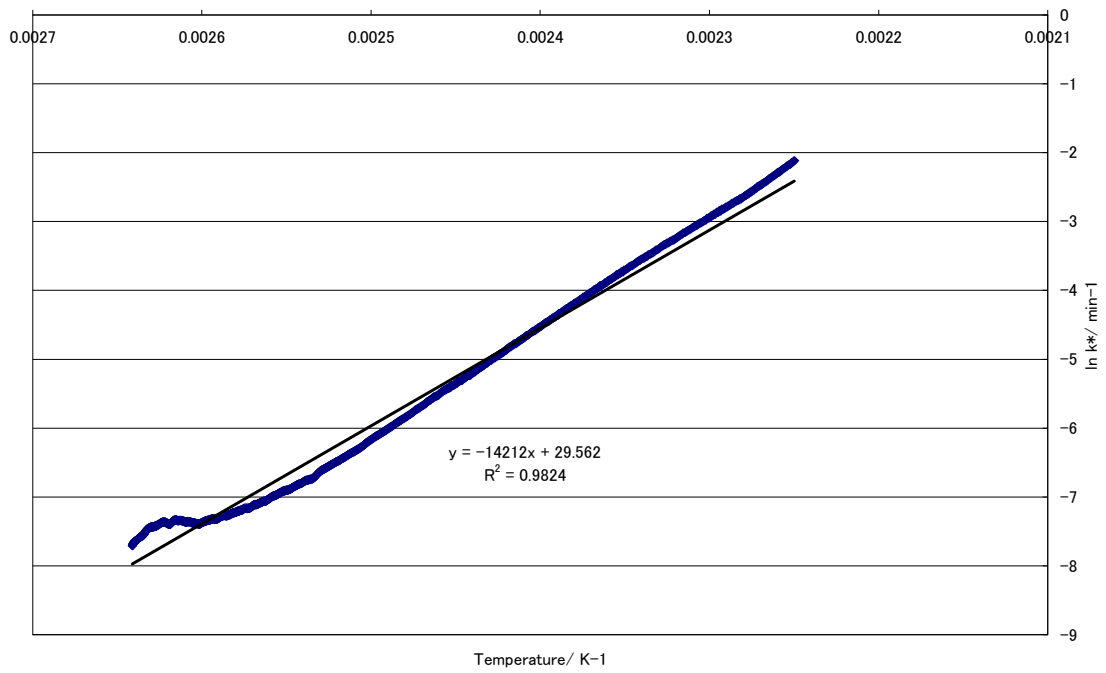
TMR vs. Temperature



Temperature vs. Self heating rate (approximate calculation)

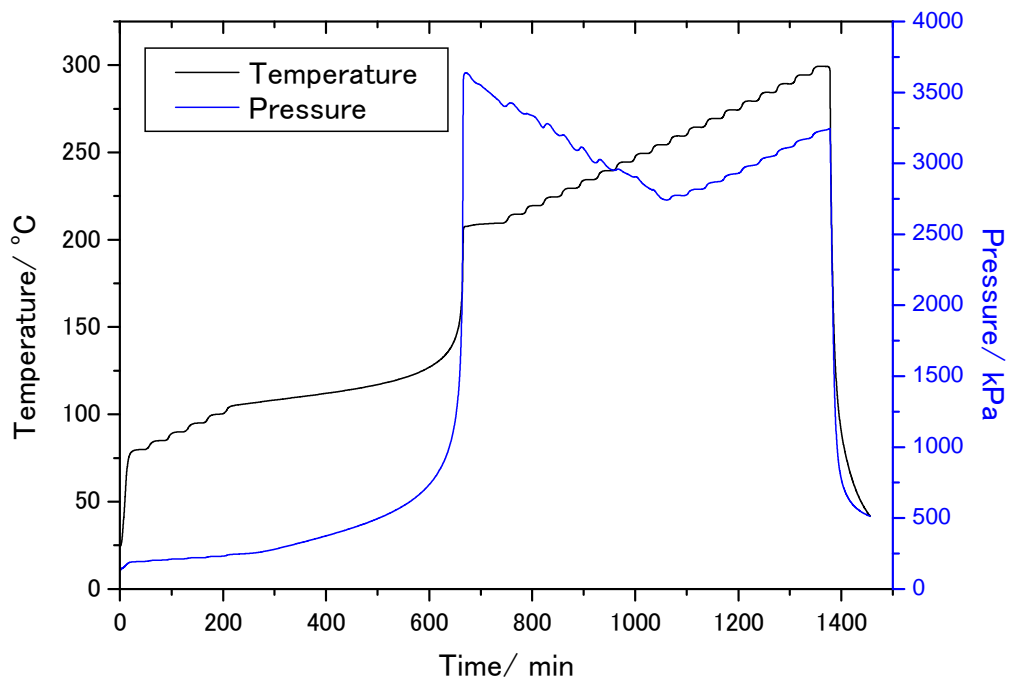


Temperature vs. TMR (approximate calculation)

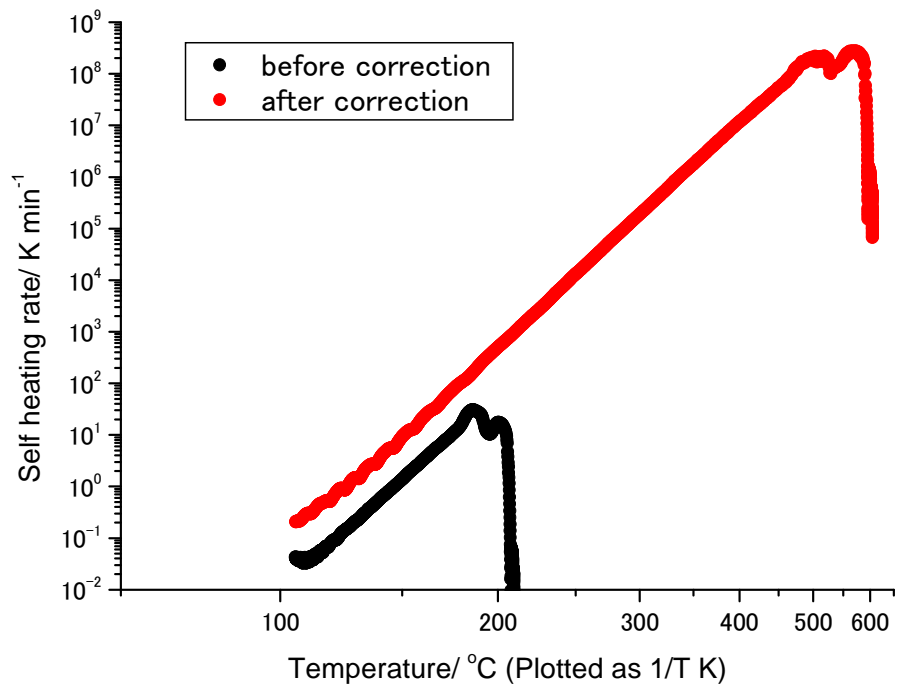


Arrhenius equation (approximate calculation)

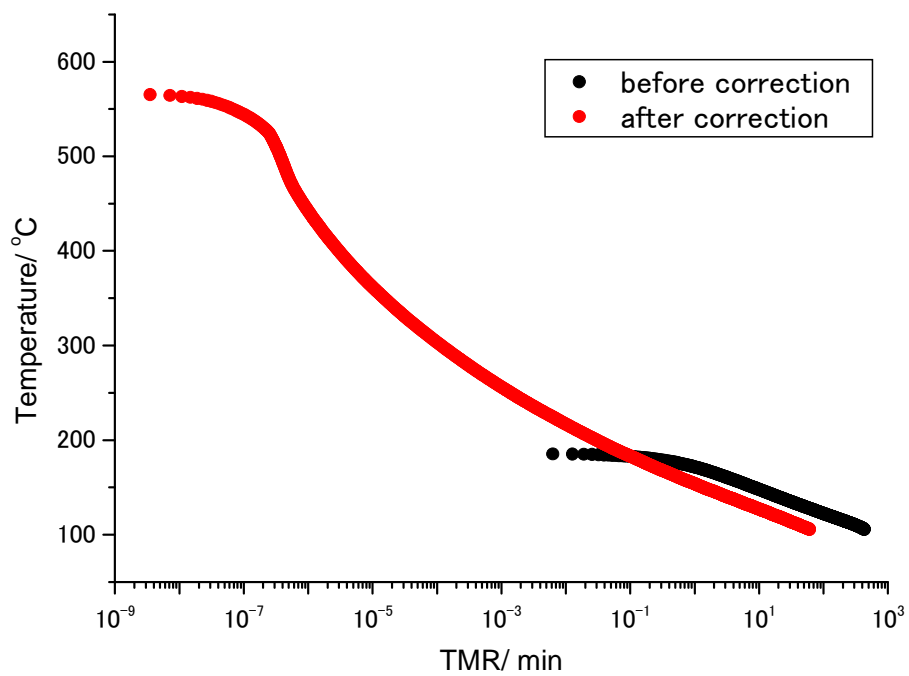
d) Weight: 0.693 g



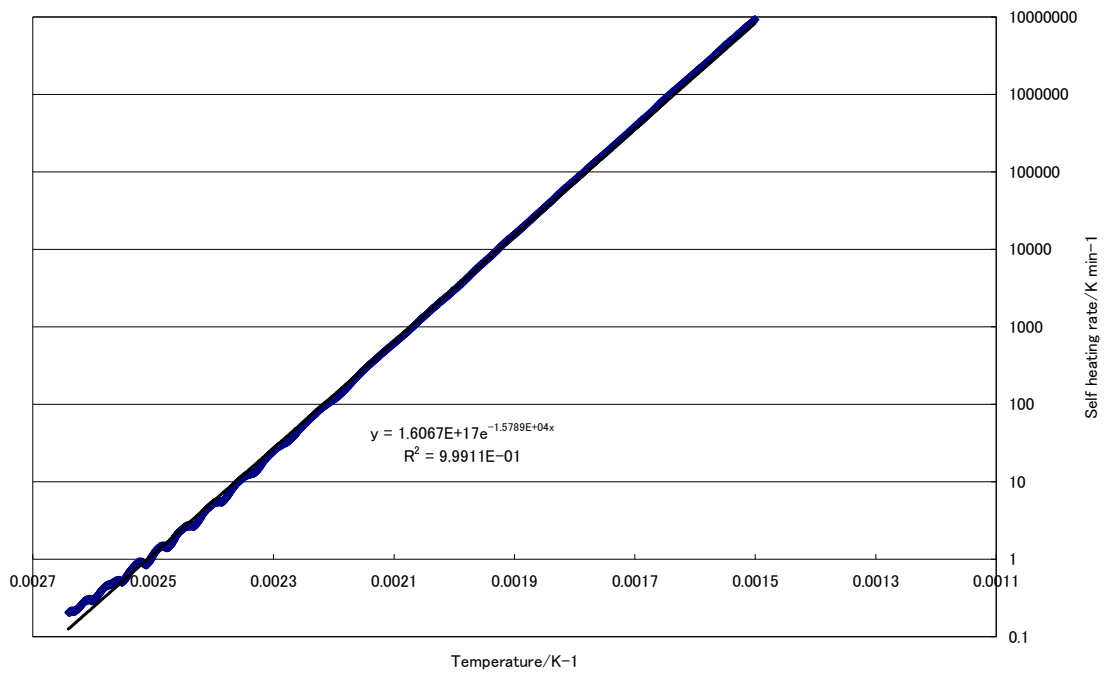
Time vs. Temperature and Pressure



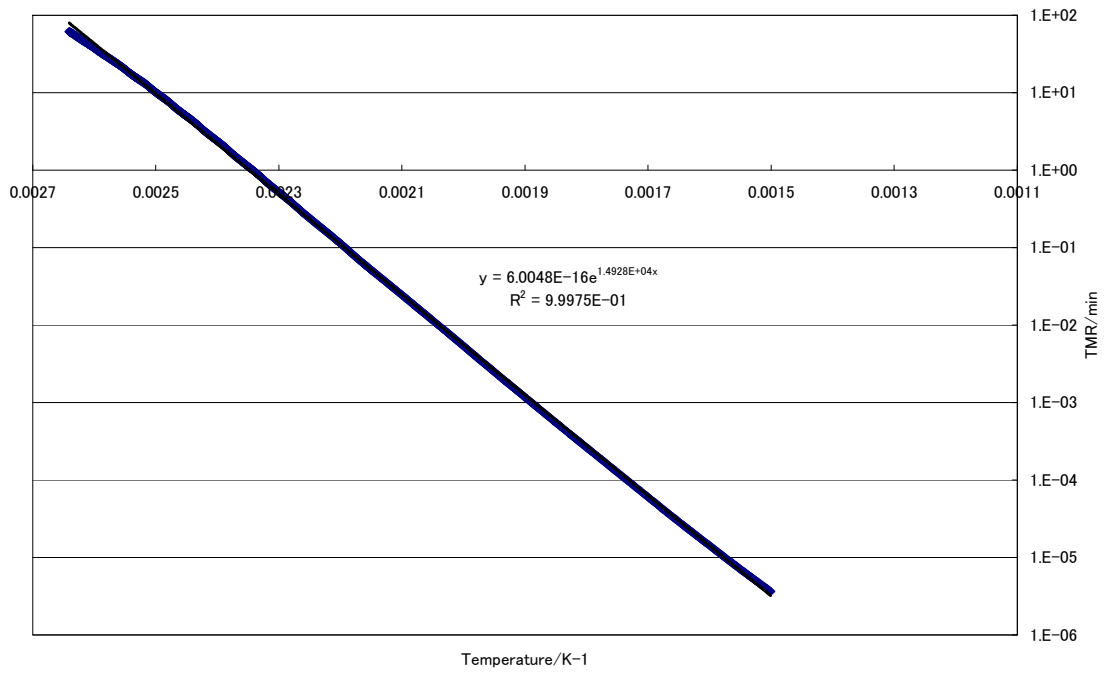
Temperature vs. Self heating rate



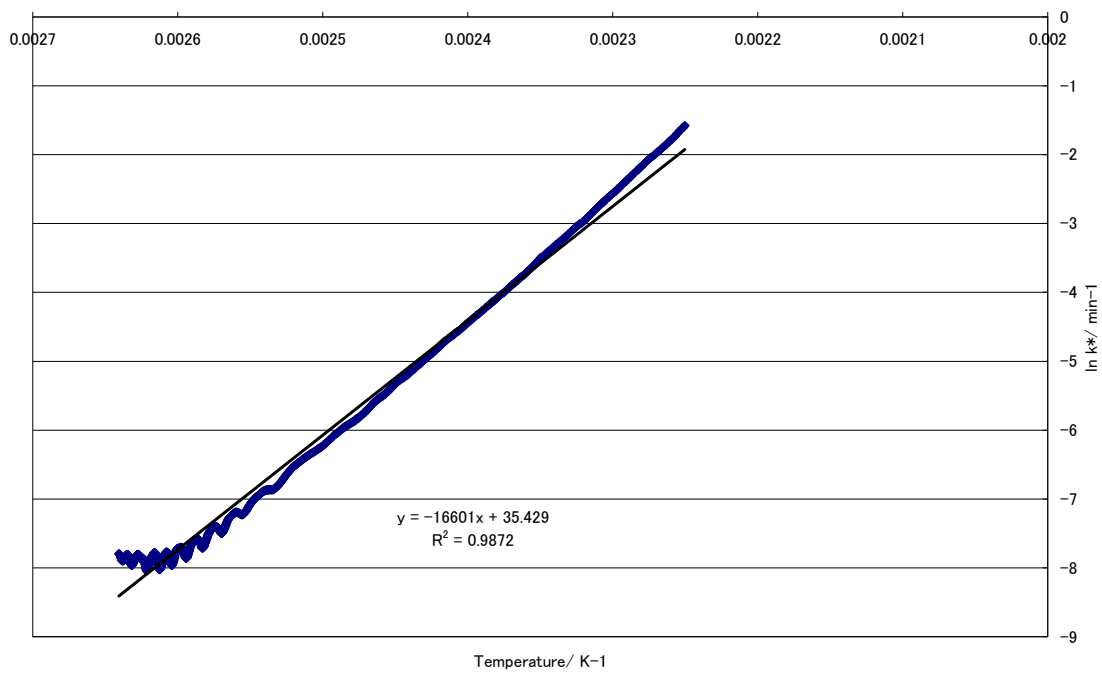
TMR vs. Temperature



Temperature vs. Self heating rate (approximate calculation)

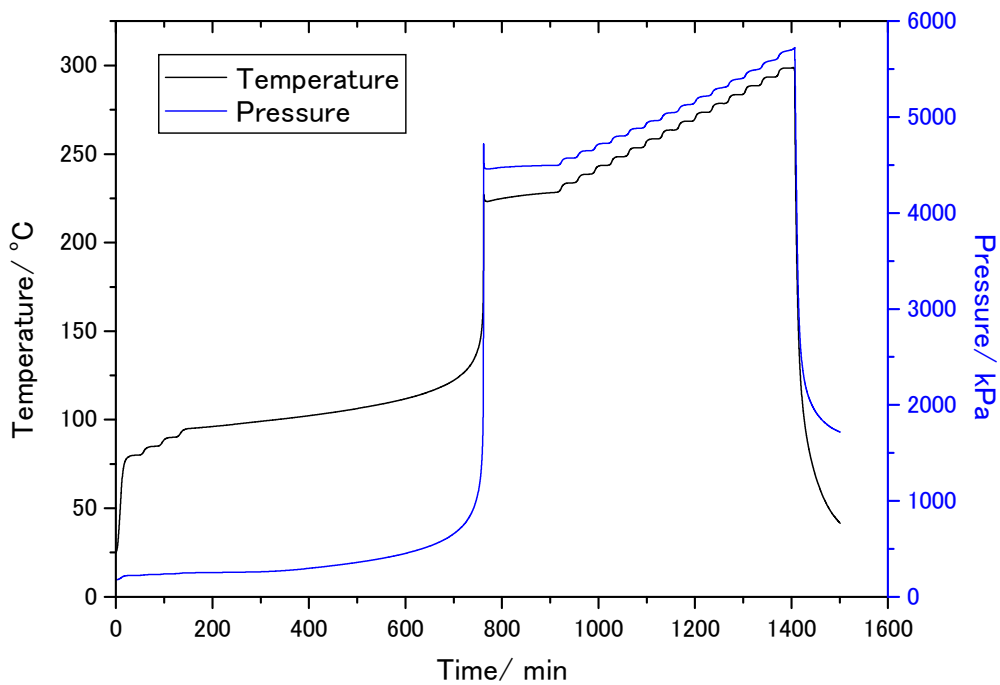


Temperature vs. TMR (approximate calculation)

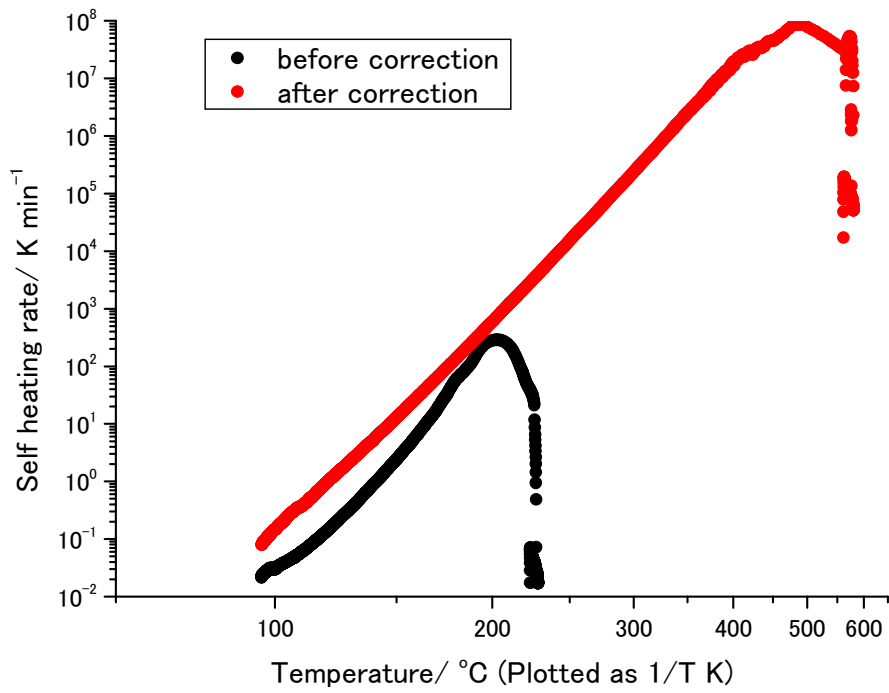


Arrhenius equation (approximate calculation)

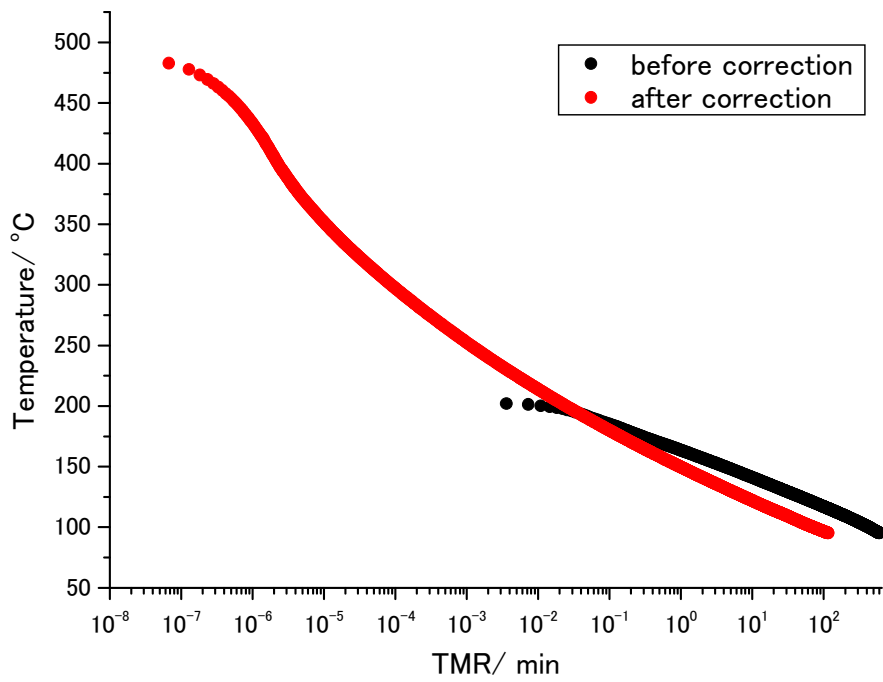
e) Weight: 1.008 g



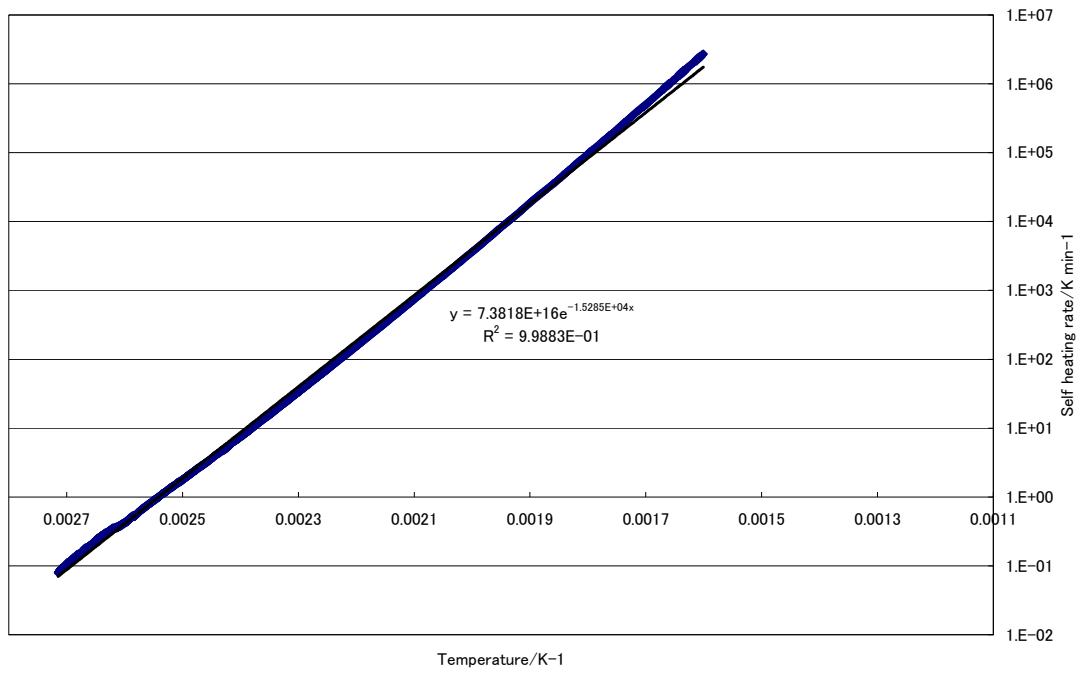
Time vs. Temperature and Pressure



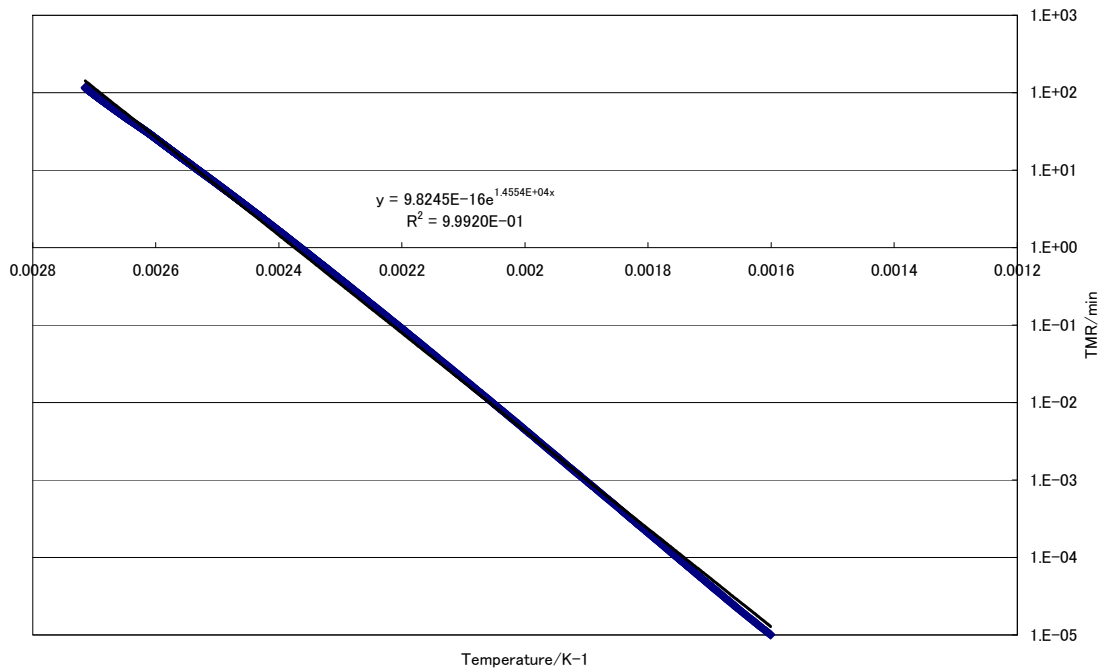
Temperature vs. Self heating rate



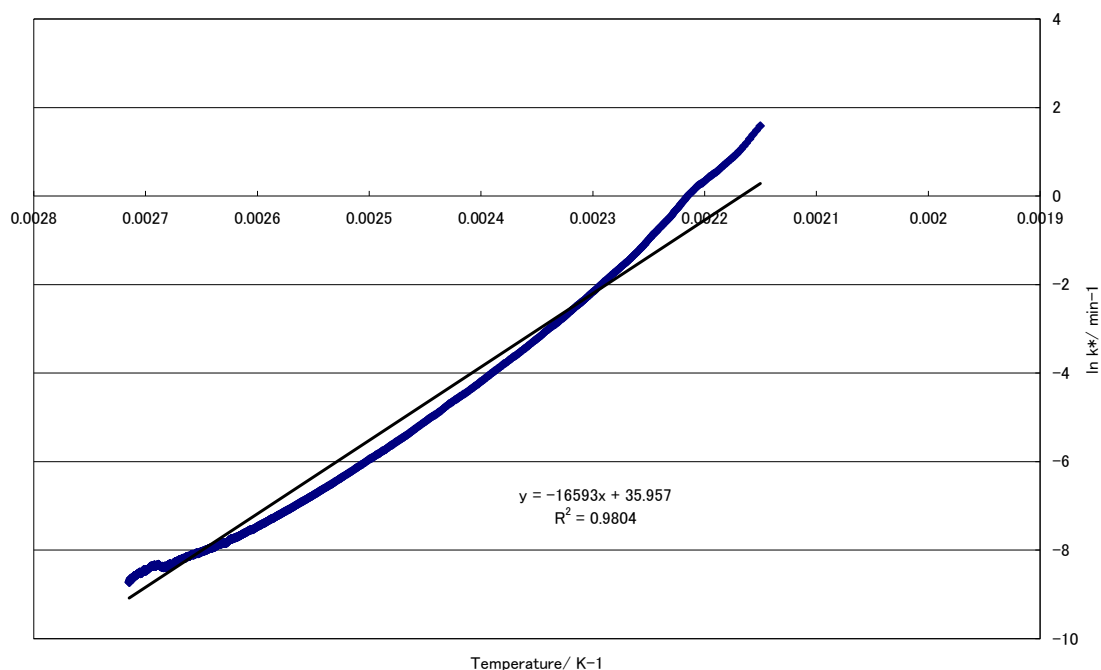
TMR vs. Temperature



Temperature vs. Self heating rate (approximate calculation)



Temperature vs. TMR (approximate calculation)



Arrhenius equation (approximate calculation)

a) Weight: 0.189 g

	Date	2009/6/24
Measuring conditions	ARC device	NewARC (TIAX, LLC)
	Operating Institute	AIST
	Operator	Y. S.
	Material of Bomb	Ti
	Weight of Bomb (g)	10.1759
	Volume of Bomb (mL)	about 9
	Weight of sample (g)	0.1983
	Weight of residue (g)	—
	Specific heat of Bomb ($\text{J K}^{-1} \text{g}^{-1}$)	0.544
	Specific heat of sample ($\text{J K}^{-1} \text{g}^{-1}$)	2.093
	ϕ facotr	14.34
	Start temperature ($^{\circ}\text{C}$)	80
	End temperature ($^{\circ}\text{C}$)	220
	Temperature increment (K)	5
	Waiting time (min)	15
	Searching time (min)	15
Exothermic threshold (K min^{-1})	0.02	

	Logging intervals (°C)	0.15 °C
	Pressure limit (kPa)	20000
	Atmosphere	Air, atmospheric pressure
Results	T _o , Exothermic temperature (°C)	110.32
	Self heating rate at T _o (K min ⁻¹)	0.025
	Pressure at T _o (kPa)	222.15
	Temperature at maximum self heating rate (°C)	112.49
	Maximum self heating rate (K min ⁻¹)	0.033
	Pressure at maximum self heating rate (kPa)	240.86
	Pressure rising rate at maximum self heating rate (kPa min ⁻¹)	0.2665
	Maximum pressure (kPa)	272.68
	Maximum pressure rising rate (kPa min ⁻¹)	0.4572
	Temperature at maximum pressure rising rate (°C)	114.59
	Time to maximum rate (min)	74.986
	Maximum temperature (°C)	114.67
	Adiabatic temperature rise (°C)	4.35
	Activation energy (kJ mol ⁻¹)	530
Heat of decomposition (J g ⁻¹)	131	
Corrected results	T _{ARC} , Exothermic temperature (°C)	103.20
	Time of maximum rate at T _{ARC} (min)	110.11
	Self heating rate at T _{ARC} (K min ⁻¹)	0.02
	Maximum self heating rate (K min ⁻¹)	4.8492 × 10 ⁸
	Maximum temperature (°C)	172.60
	Adiabatic temperature rise (°C)	143.75
	Heat of decomposition (J g ⁻¹)	145

b) Weight: 0.305 g

	Date	2009/7/17
Measuring conditions	ARC device	NewARC (TIAX, LLC)
	Operating Institute	AIST
	Operator	Y. S.
	Material of Bomb	Ti

	Weight of Bomb (g)	10.2220
	Volume of Bomb (mL)	about 9
	Weight of sample (g)	0.3048
	Weight of residue (g)	–
	Specific heat of Bomb ($\text{J K}^{-1} \text{g}^{-1}$)	0.544
	Specific heat of sample ($\text{J K}^{-1} \text{g}^{-1}$)	2.093
	ϕ facotr	9.717
	Start temperature ($^{\circ}\text{C}$)	80
	End temperature ($^{\circ}\text{C}$)	220
	Temperature increment (K)	5
	Waiting time (min)	15
	Searching time (min)	15
	Exothermic threshold (K min^{-1})	0.02
	Logging intervals ($^{\circ}\text{C}$)	0.15 $^{\circ}\text{C}$
	Pressure limit (kPa)	20000
	Atmosphere	Air, atmospheric pressure
Results	T_o , Exothermic temperature ($^{\circ}\text{C}$)	105.32
	Self heating rate at T_o (K min^{-1})	0.025
	Pressure at T_o (kPa)	272.51
	Temperature at maximum self heating rate ($^{\circ}\text{C}$)	154.47
	Maximum self heating rate (K min^{-1})	0.229
	Pressure at maximum self heating rate (kPa)	1383.1
	Pressure rising rate at maximum self heating rate (kPa min^{-1})	5.9113
	Maximum pressure (kPa)	1605.5
	Maximum pressure rising rate (kPa min^{-1})	6.3918
	Temperature at maximum pressure rising rate ($^{\circ}\text{C}$)	150.56
	Time to maximum rate (min)	783.49
	Maximum temperature ($^{\circ}\text{C}$)	164.16
	Adiabatic temperature rise ($^{\circ}\text{C}$)	58.84
	Activation energy (kJ mol^{-1})	106
Heat of decomposition (J g^{-1})	1197	
Corrected	T_{ARC} , Exothermic temperature ($^{\circ}\text{C}$)	77.44

results	Time of maximum rate at T _{ARC} (min)	528.56
	Self heating rate at T _{ARC} (K min ⁻¹)	0.02
	Maximum self heating rate (K min ⁻¹)	8.7472 × 10 ⁶
	Maximum temperature (°C)	676.39
	Adiabatic temperature rise (°C)	143.75
	Heat of decomposition (J g ⁻¹)	1254

c) Weight: 0.446 g

	Date	2009/6/18
Measuring conditions	ARC device	NewARC (TIAX, LLC)
	Operating Institute	AIST
	Operator	Y. S.
	Material of Bomb	Ti
	Weight of Bomb (g)	10.1658
	Volume of Bomb (mL)	about 9
	Weight of sample (g)	0.4462
	Weight of residue (g)	—
	Specific heat of Bomb (J K ⁻¹ g ⁻¹)	0.544
	Specific heat of sample (J K ⁻¹ g ⁻¹)	2.093
	φ facotr	6.922
	Start temperature (°C)	80
	End temperature (°C)	220
	Temperature increment (K)	5
	Waiting time (min)	15
	Searching time (min)	15
	Exothermic threshold (K min ⁻¹)	0.02
	Logging intervals (°C)	0.15 °C
	Pressure limit (kPa)	20000
	Atmosphere	Air, atmospheric pressure
Results	T _o , Exothermic temperature (°C)	105.48
	Self heating rate at T _o (K min ⁻¹)	0.034
	Pressure at T _o (kPa)	249.99
	Temperature at maximum self heating rate (°C)	170.67
	Maximum self heating rate (K min ⁻¹)	1.281
	Pressure at maximum self heating rate	2011.2

	(kPa)	
	Pressure rising rate at maximum self heating rate (kPa min ⁻¹)	40.533
	Maximum pressure (kPa)	2339.8
	Maximum pressure rising rate (kPa min ⁻¹)	43.048
	Temperature at maximum pressure rising rate (°C)	166.82
	Time to maximum rate (min)	491.60
	Maximum temperature (°C)	181.98
	Adiabatic temperature rise (°C)	76.50
	Activation energy (kJ mol ⁻¹)	118
	Heat of decomposition (J g ⁻¹)	1108
Corrected results	T _{ARC} , Exothermic temperature (°C)	80.32
	Time of maximum rate at T _{ARC} (min)	501.09
	Self heating rate at T _{ARC} (K min ⁻¹)	0.02
	Maximum self heating rate (K min ⁻¹)	3.0392 × 10 ⁷
	Maximum temperature (°C)	633.08
	Adiabatic temperature rise (°C)	552.76
	Heat of decomposition (J g ⁻¹)	1157

d) Weight: 0.693 g

	Date	2009/6/29
Measuring conditions	ARC device	NewARC (TIAX, LLC)
	Operating Institute	AIST
	Operator	Y. S.
	Material of Bomb	Ti
	Weight of Bomb (g)	10.1759
	Volume of Bomb (mL)	about 9
	Weight of sample (g)	0.6926
	Weight of residue (g)	—
	Specific heat of Bomb (J K ⁻¹ g ⁻¹)	0.544
	Specific heat of sample (J K ⁻¹ g ⁻¹)	2.093
	φ facotr	4.819
	Start temperature (°C)	80
	End temperature (°C)	300
	Temperature increment (K)	5

	Waiting time (min)	15
	Searching time (min)	15
	Exothermic threshold ($K \text{ min}^{-1}$)	0.02
	Logging intervals ($^{\circ}\text{C}$)	0.15 $^{\circ}\text{C}$
	Pressure limit (kPa)	20000
	Atmosphere	Air, atmospheric pressure
Results	T_o , Exothermic temperature ($^{\circ}\text{C}$)	105.55
	Self heating rate at T_o ($K \text{ min}^{-1}$)	0.043
	Pressure at T_o (kPa)	246.23
	Temperature at maximum self heating rate ($^{\circ}\text{C}$)	185.38
	Maximum self heating rate ($K \text{ min}^{-1}$)	30.498
	Pressure at maximum self heating rate (kPa)	2639.7
	Pressure rising rate at maximum self heating rate (kPa min^{-1})	918.43
	Maximum pressure (kPa)	3639.1
	Maximum pressure rising rate (kPa min^{-1})	996.55
	Temperature at maximum pressure rising rate ($^{\circ}\text{C}$)	189.74
	Time to maximum rate (min)	432.35
	Maximum temperature ($^{\circ}\text{C}$)	209.57
	Adiabatic temperature rise ($^{\circ}\text{C}$)	104.02
	Activation energy (kJ mol^{-1})	138
Heat of decomposition (J g^{-1})	1049	
Corrected results	T_{ARC} , Exothermic temperature ($^{\circ}\text{C}$)	89.56
	Time of maximum rate at T_{ARC} (min)	449.30
	Self heating rate at T_{ARC} ($K \text{ min}^{-1}$)	0.02
	Maximum self heating rate ($K \text{ min}^{-1}$)	2.7888×10^8
	Maximum temperature ($^{\circ}\text{C}$)	604.90
	Adiabatic temperature rise ($^{\circ}\text{C}$)	552.76
	Heat of decomposition (J g^{-1})	1079

e) Weight: 1.008 g

	Date	2009/7/22
Measuring	ARC device	NewARC (TIAX, LLC)

conditions	Operating Institute	AIST
	Operator	Y. S.
	Material of Bomb	Ti
	Weight of Bomb (g)	10.2220
	Volume of Bomb (mL)	about 9
	Weight of sample (g)	1.0077
	Weight of residue (g)	—
	Specific heat of Bomb ($\text{J K}^{-1} \text{g}^{-1}$)	0.544
	Specific heat of sample ($\text{J K}^{-1} \text{g}^{-1}$)	2.093
	ϕ facotr	3.637
	Start temperature ($^{\circ}\text{C}$)	80
	End temperature ($^{\circ}\text{C}$)	300
	Temperature increment (K)	5
	Waiting time (min)	15
	Searching time (min)	15
	Exothermic threshold (K min^{-1})	0.02
	Logging intervals ($^{\circ}\text{C}$)	0.15 $^{\circ}\text{C}$
	Pressure limit (kPa)	20000
	Atmosphere	Air, atmospheric pressure
	Results	T_o , Exothermic temperature ($^{\circ}\text{C}$)
Self heating rate at T_o (K min^{-1})		0.022
Pressure at T_o (kPa)		251.68
Temperature at maximum self heating rate ($^{\circ}\text{C}$)		203.01
Maximum self heating rate (K min^{-1})		288.30
Pressure at maximum self heating rate (kPa)		4349.9
Pressure rising rate at maximum self heating rate (kPa min^{-1})		15835
Maximum pressure (kPa)		4495.6
Maximum pressure rising rate (kPa min^{-1})		26100
Temperature at maximum pressure rising rate ($^{\circ}\text{C}$)		194.29
Time to maximum rate (min)		601.70
Maximum temperature ($^{\circ}\text{C}$)		228.34
Adiabatic temperature rise ($^{\circ}\text{C}$)		133.11

	Activation energy (kJ mol ⁻¹)	138
	Heat of decomposition (J g ⁻¹)	1013
Corrected results	T _{ARC} , Exothermic temperature (°C)	84.37
	Time of maximum rate at T _{ARC} (min)	469.21
	Self heating rate at T _{ARC} (K min ⁻¹)	0.02
	Maximum self heating rate (K min ⁻¹)	8.5415 × 10 ⁷
	Maximum temperature (°C)	580.10
	Adiabatic temperature rise (°C)	495.73
	Heat of decomposition (J g ⁻¹)	1038