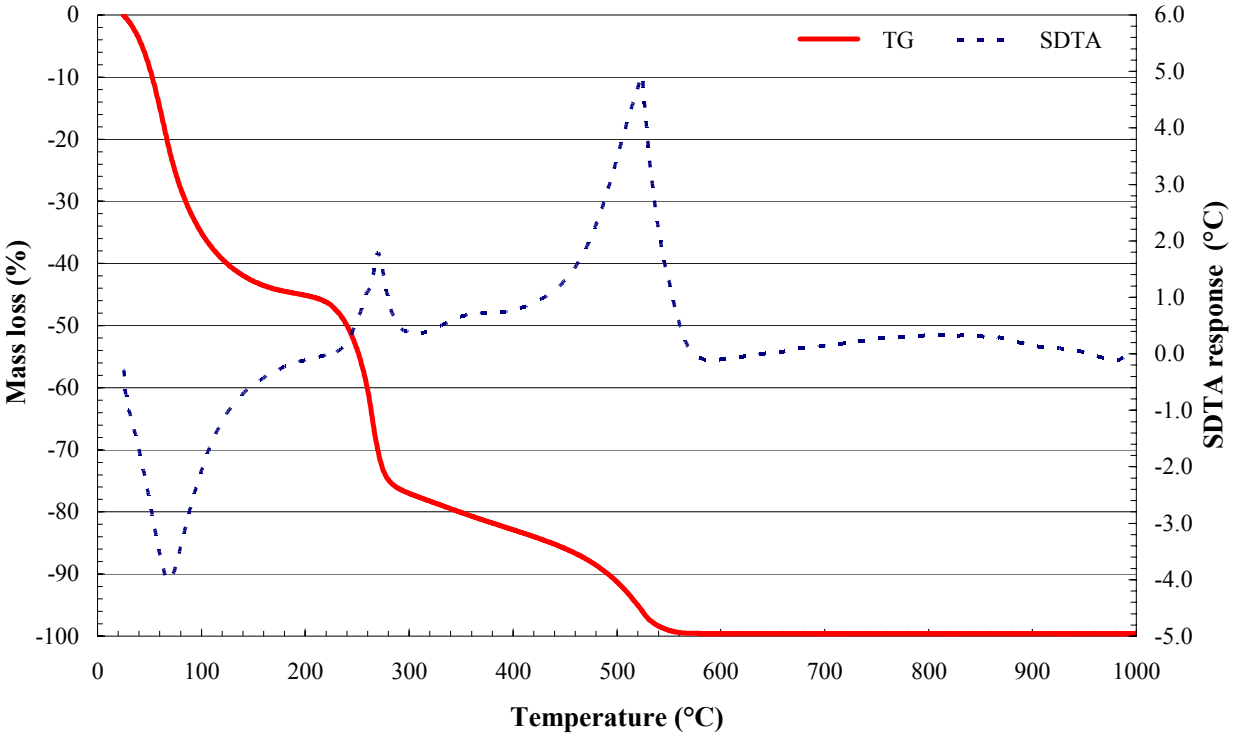
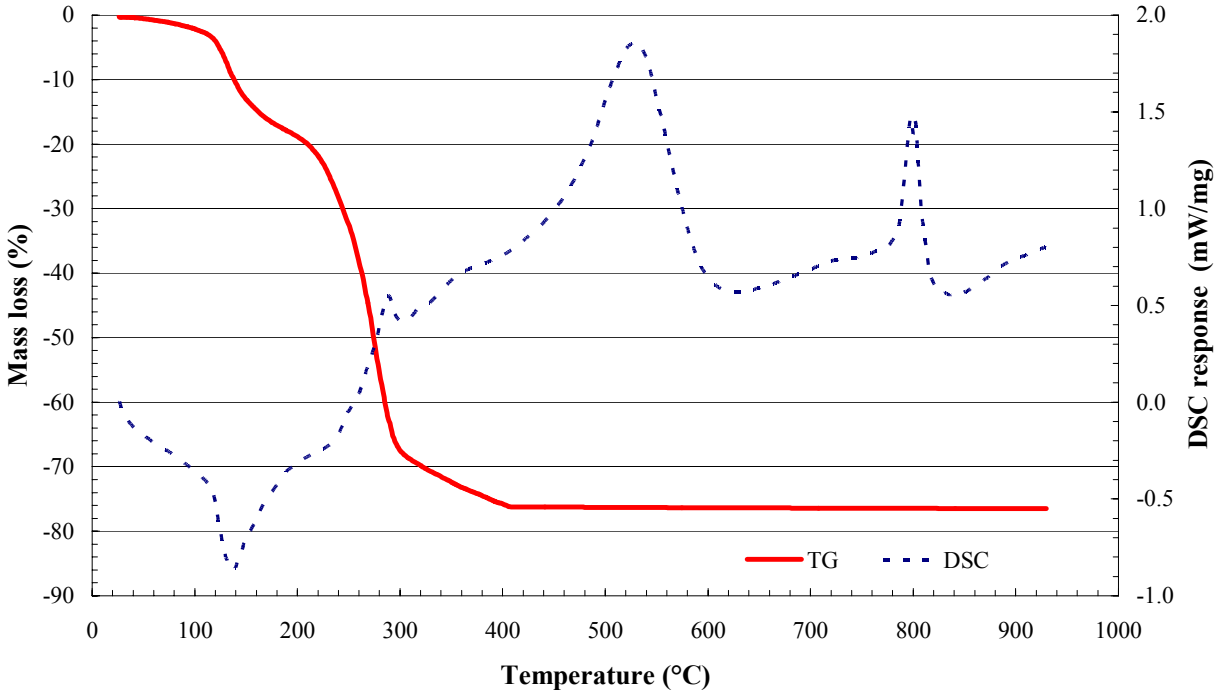
7.15. Appendix O

7.15.1. Thermal decomposition analysis of gluconic acid

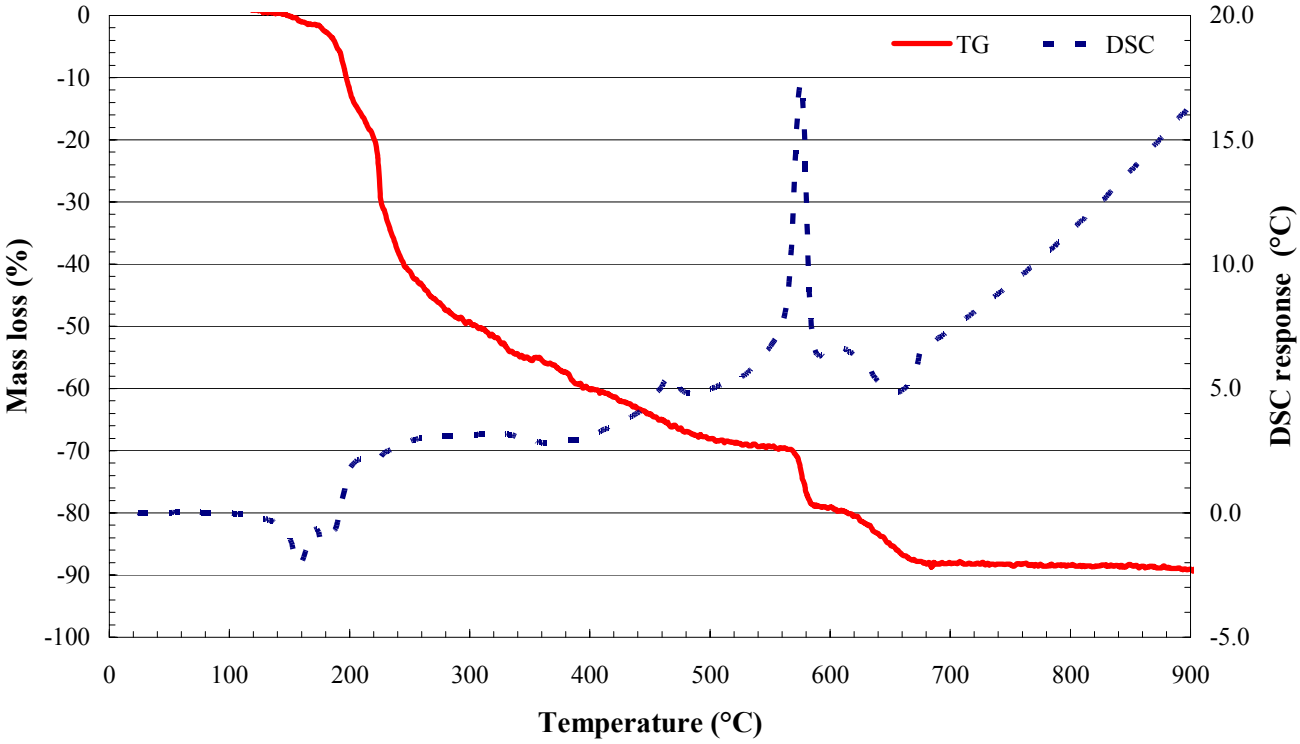


SDTA/TGA analysis of gluconic acid solution in water (50%) in air

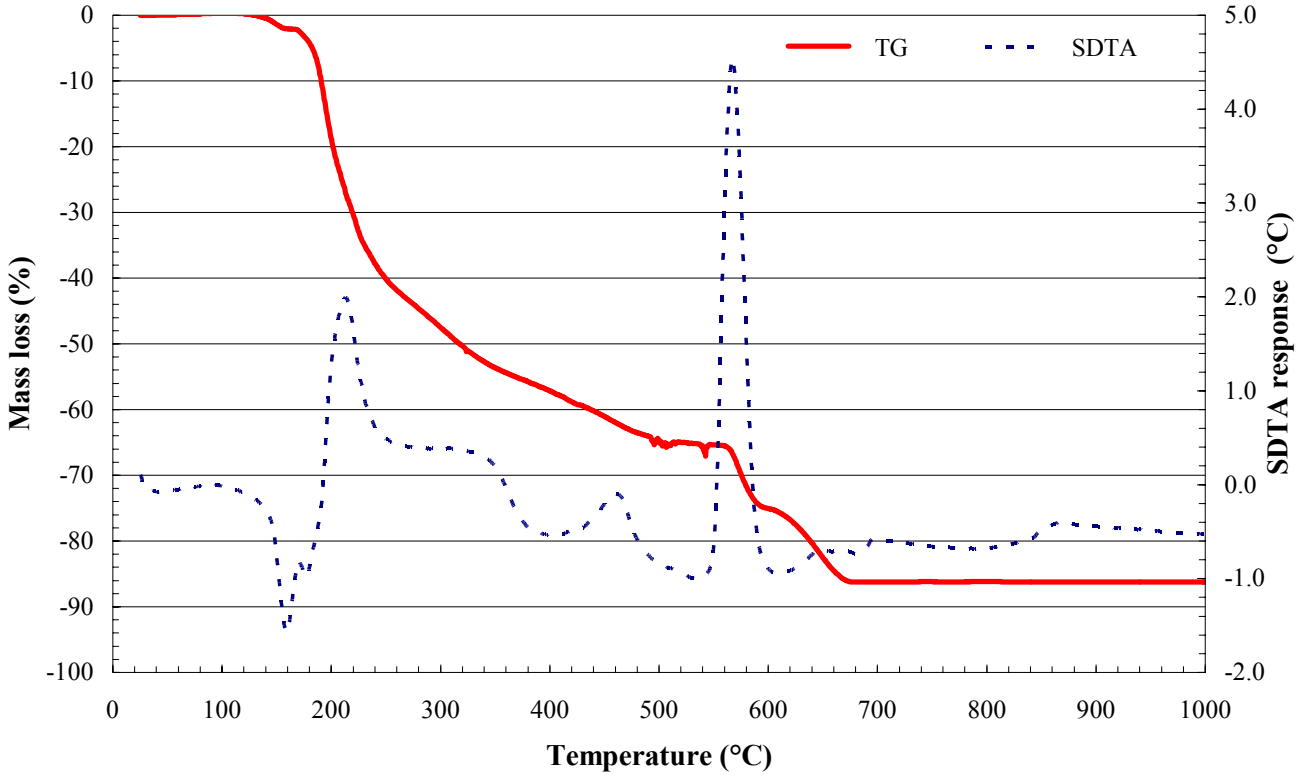


DSC/TGA analysis of gluconic acid solution in water (50%) in air

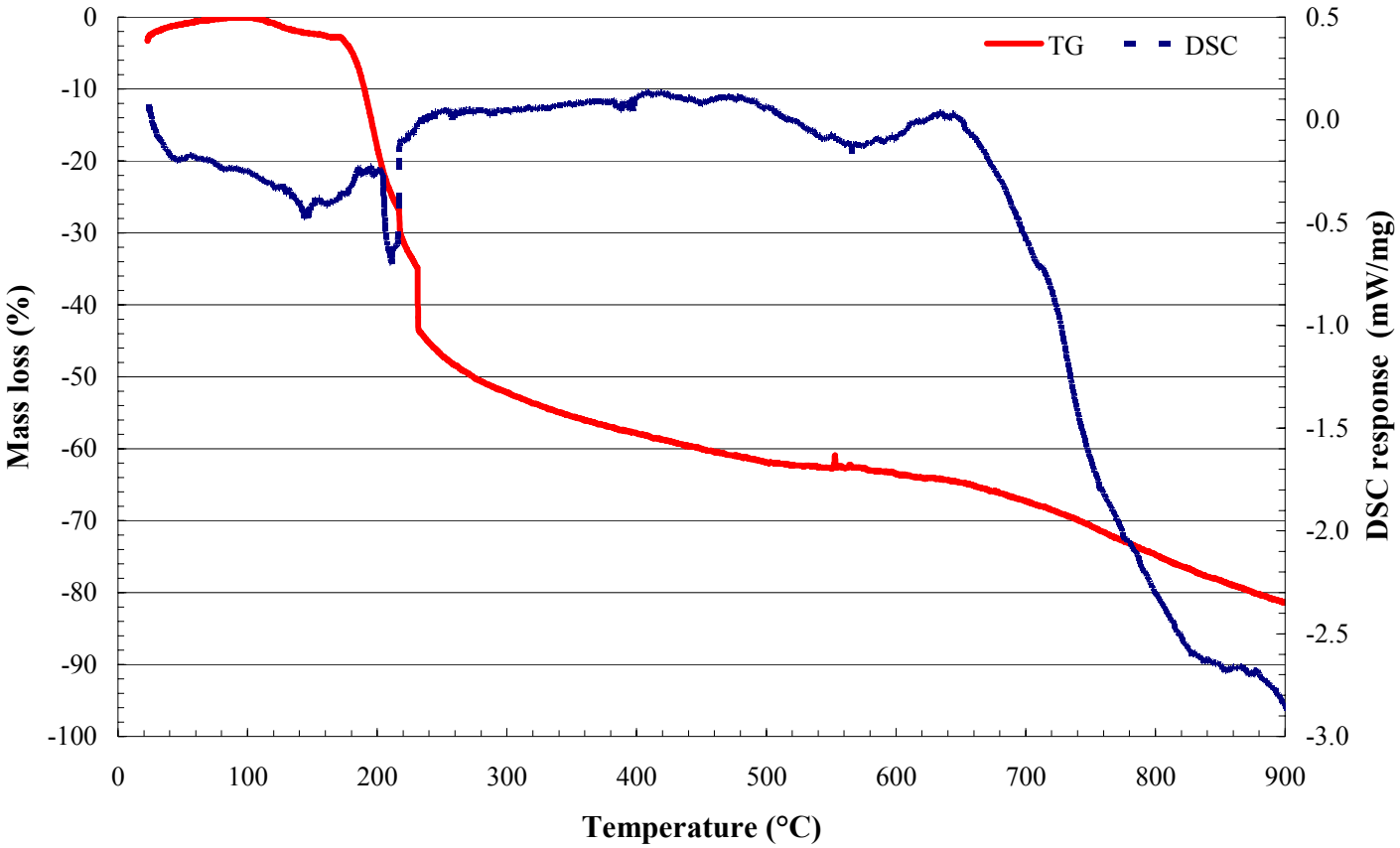
7.15.2. Thermal decomposition analysis of calcium gluconate monohydrate



DSC/TGA analysis of calcium gluconate monohydrate in air

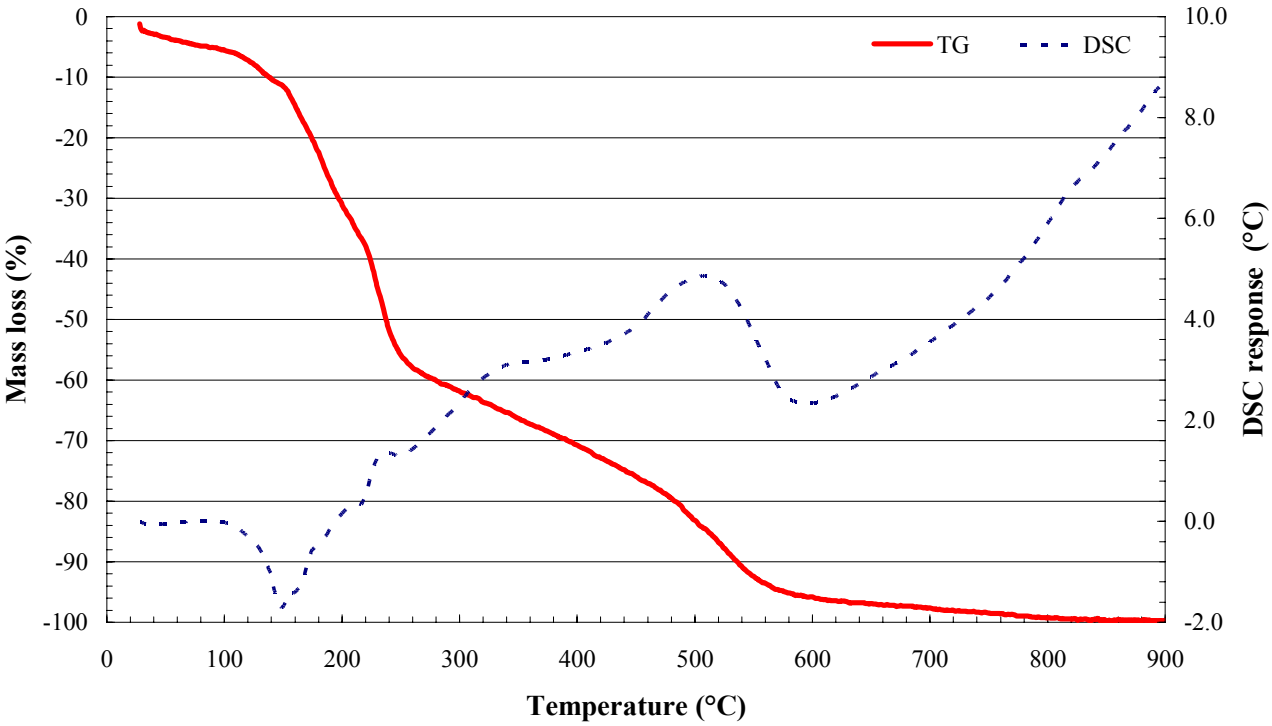


SDTA/TGA analysis of calcium gluconate monohydrate in air

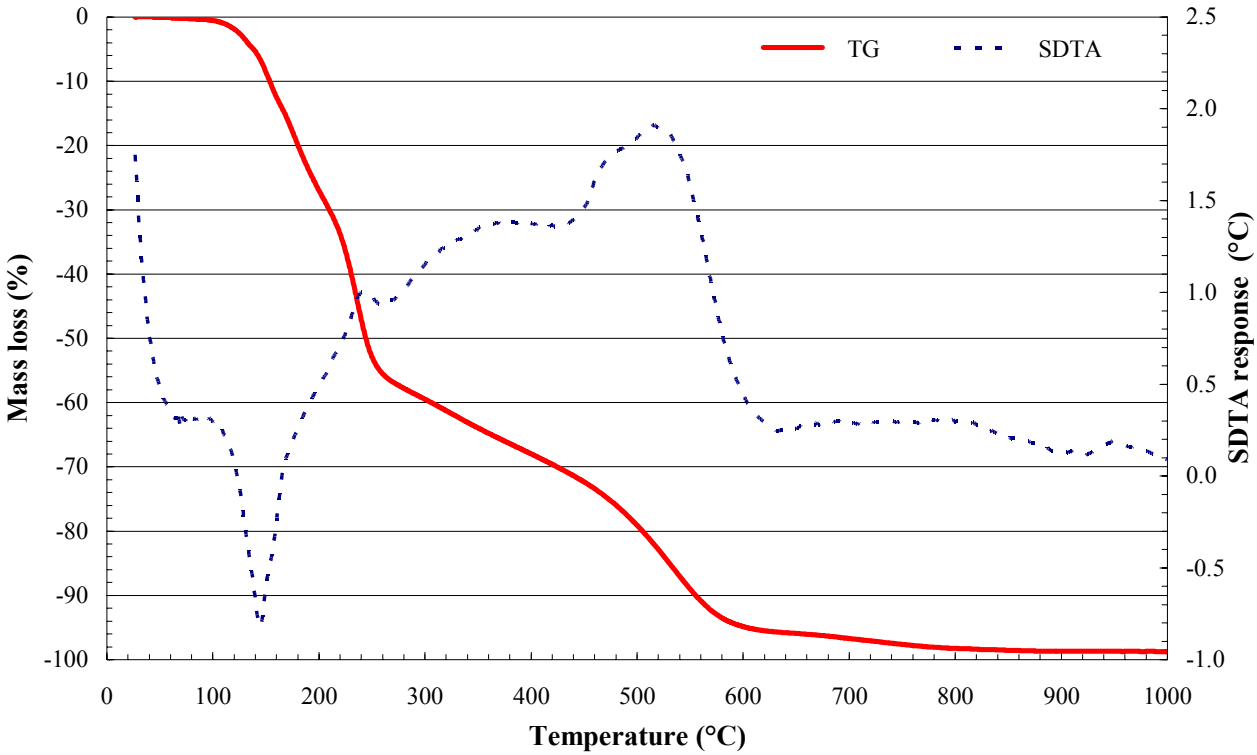


DSC/TGA analysis of calcium gluconate monohydrate in argon

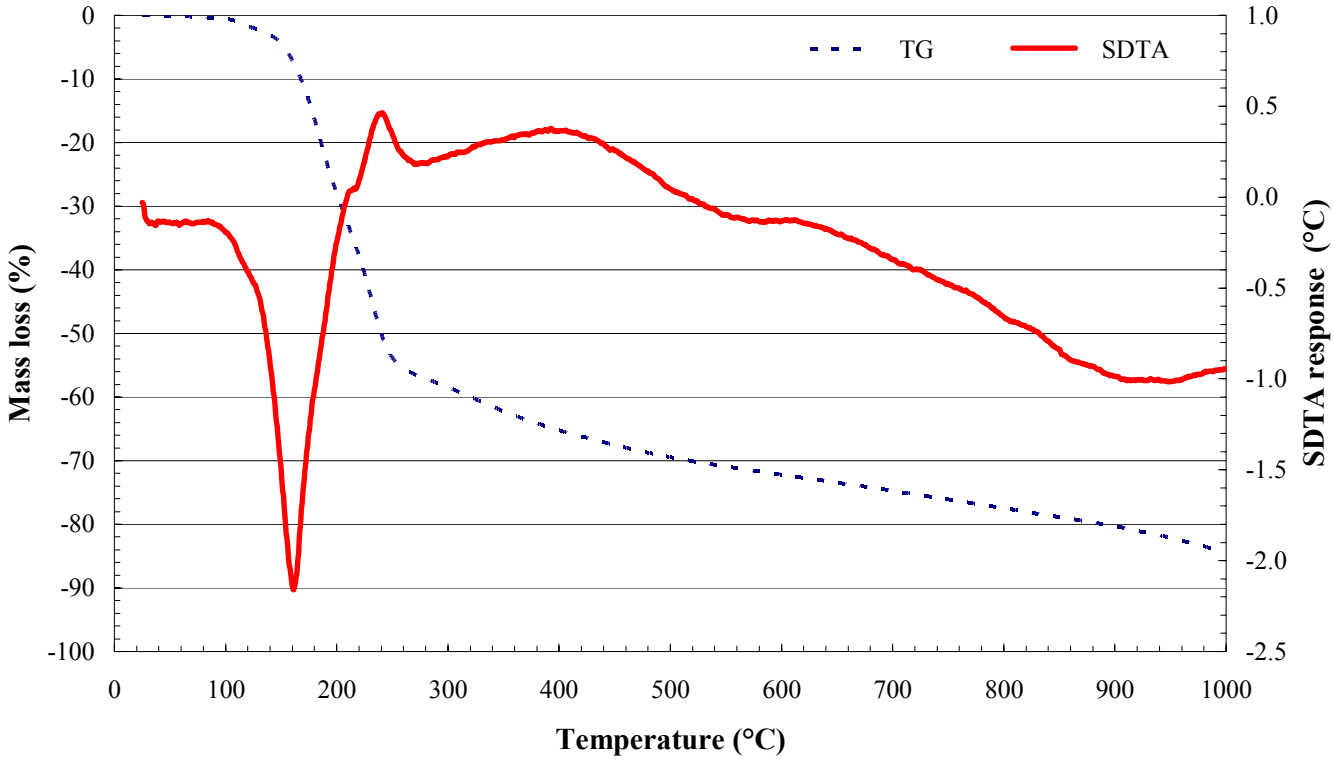
7.15.3. Thermal decomposition analysis of ammonium gluconate hydrate



DSC/TGA analysis of ammonium gluconate hydrate in air

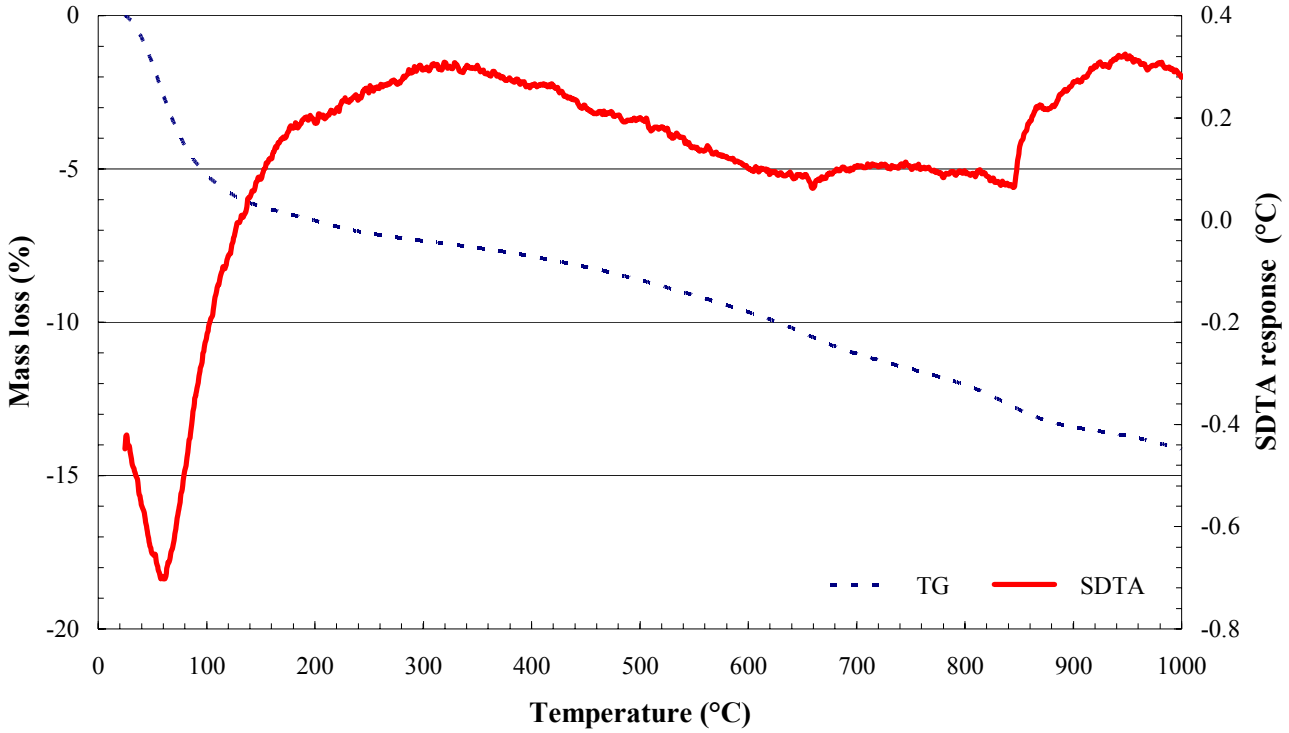


SDTA/TGA analysis of ammonium gluconate hydrate in air



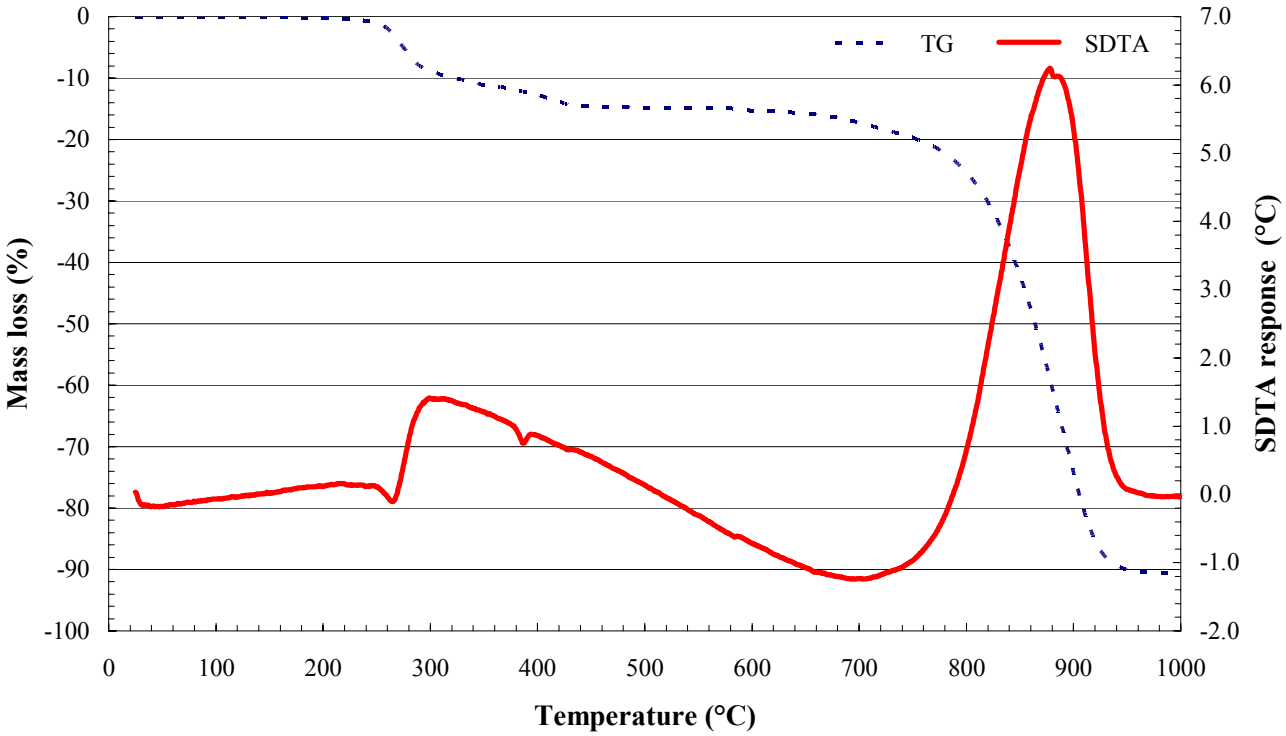
SDTA/TGA analysis of ammonium gluconate hydrate in nitrogen

7.15.4. Thermal decomposition analysis of the leached silica (ex Foskor)



SDTA/TGA analysis of the leached silica in air

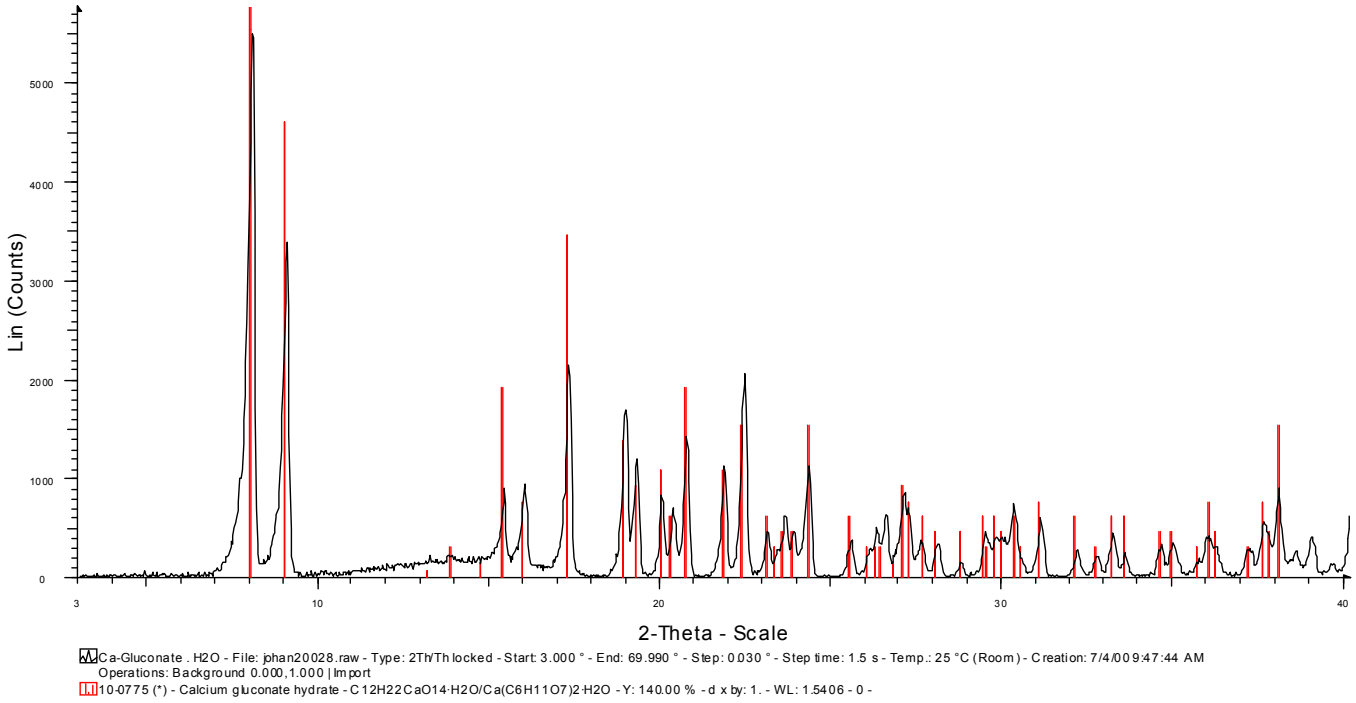
7.15.5. Thermal decomposition analysis of the expandable graphite (ex Fedmis)



SDTA/TGA analysis of the expandable graphite in air

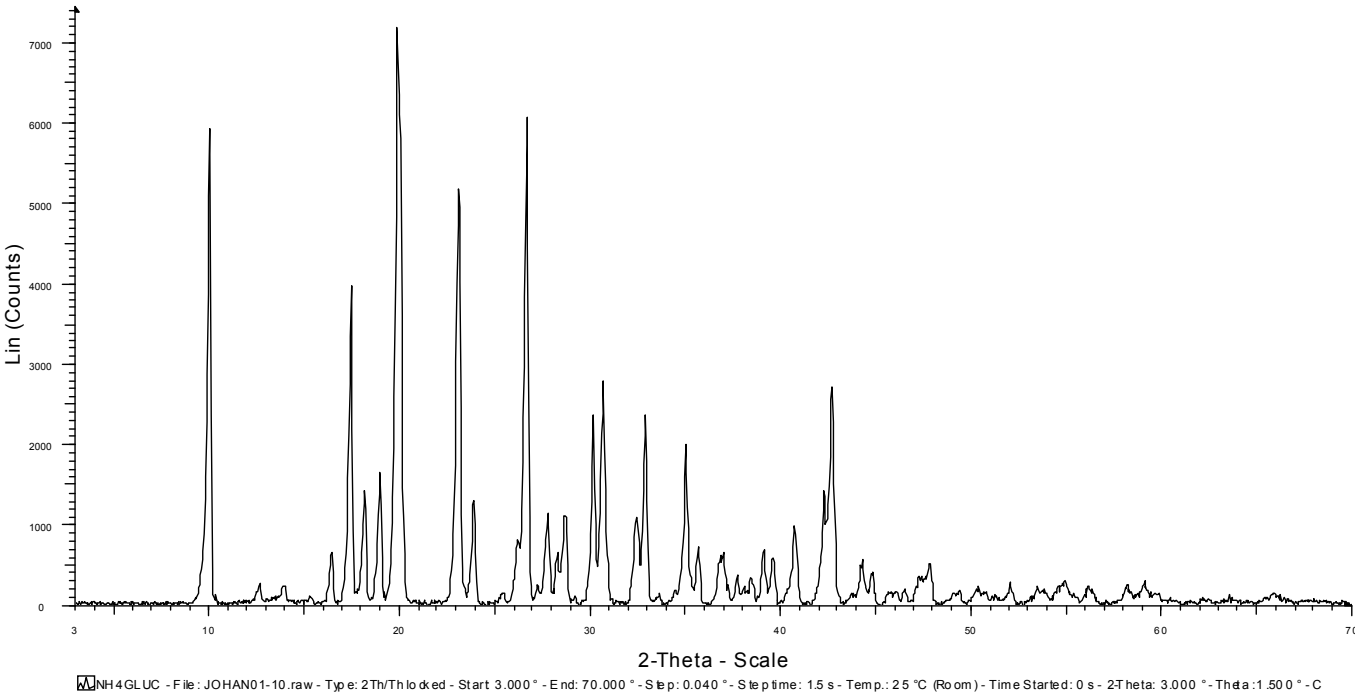
7.16. Appendix P

7.16.1. XRD pattern of calcium gluconate monohydrate



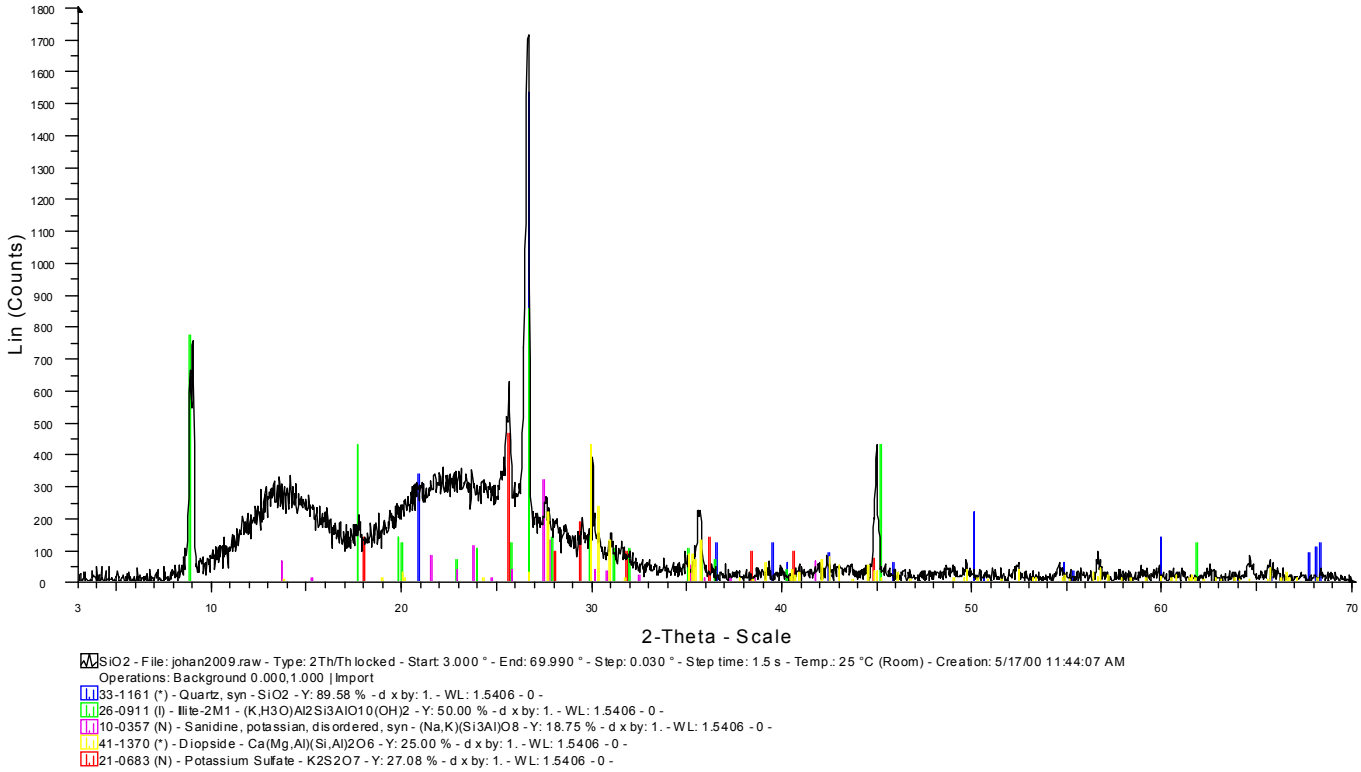
XRD spectrum of calcium gluconate monohydrate

7.16.2. XRD pattern of ammonium gluconate hydrate



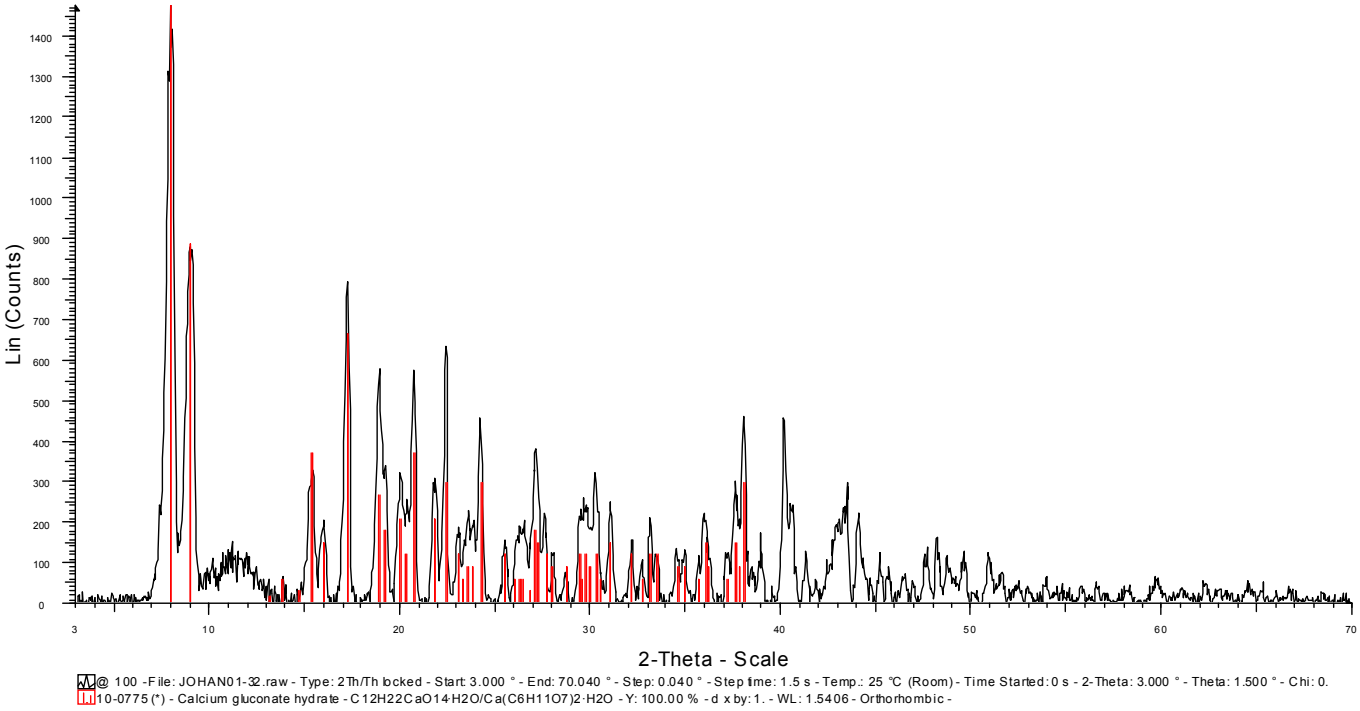
XRD spectrum of ammonium gluconate

7.16.3. XRD pattern of Leached silica from Foskor Pty. Ltd.

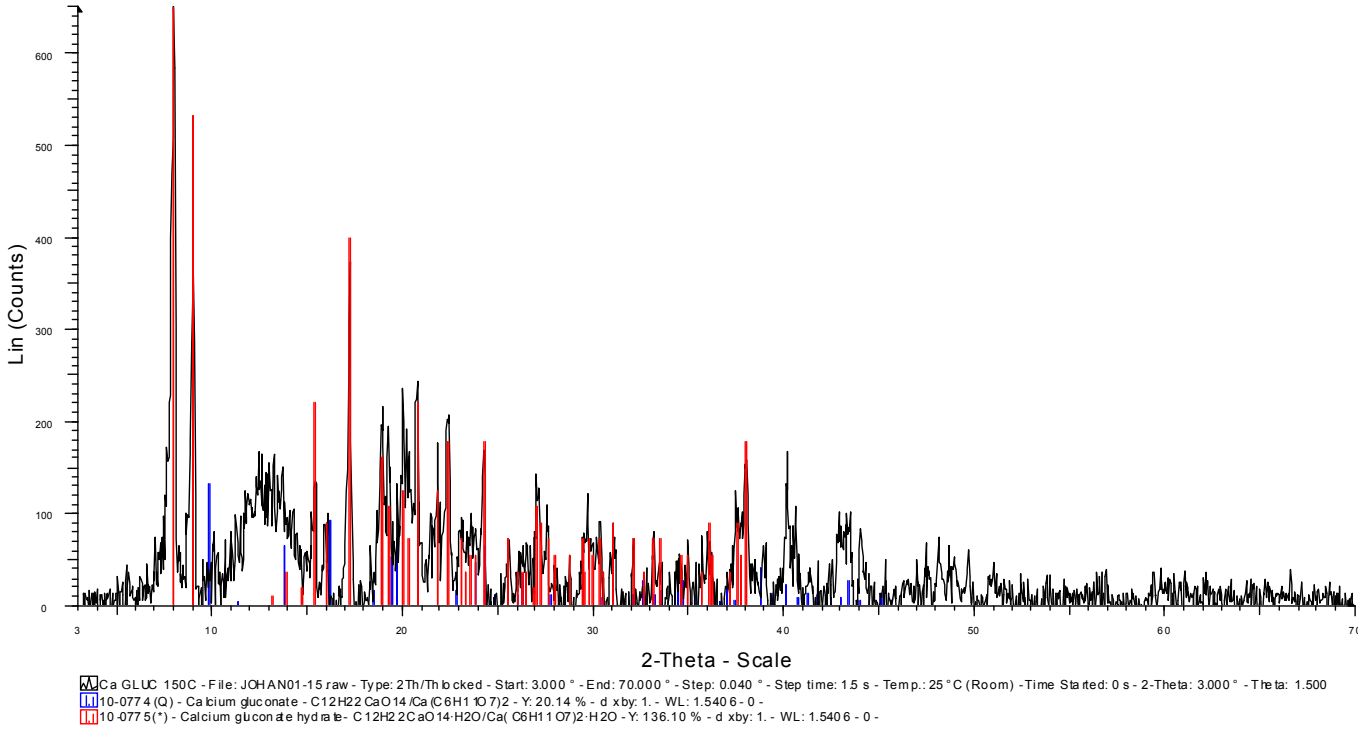


XRD spectrum of Leached silica from Foskor Pty. Ltd.

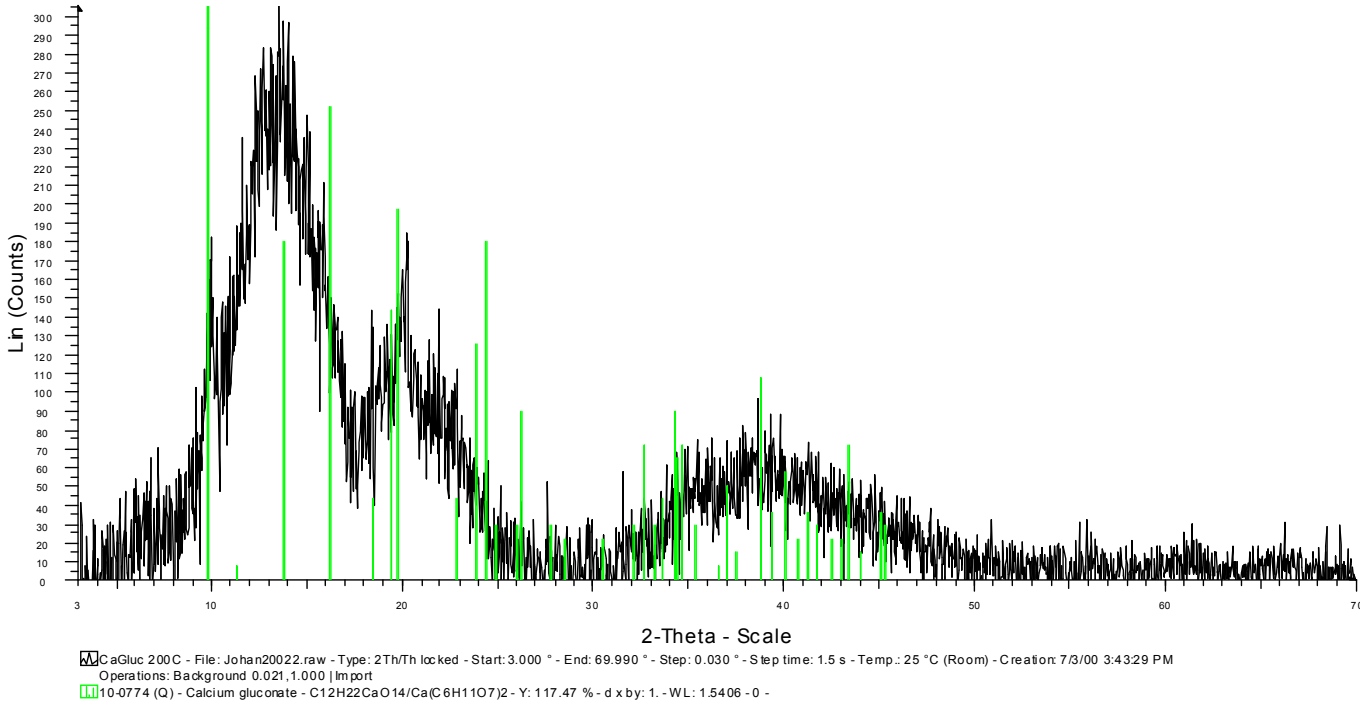
7.16.4. XRD pattern of calcium gluconate monohydrate pyrolised in air



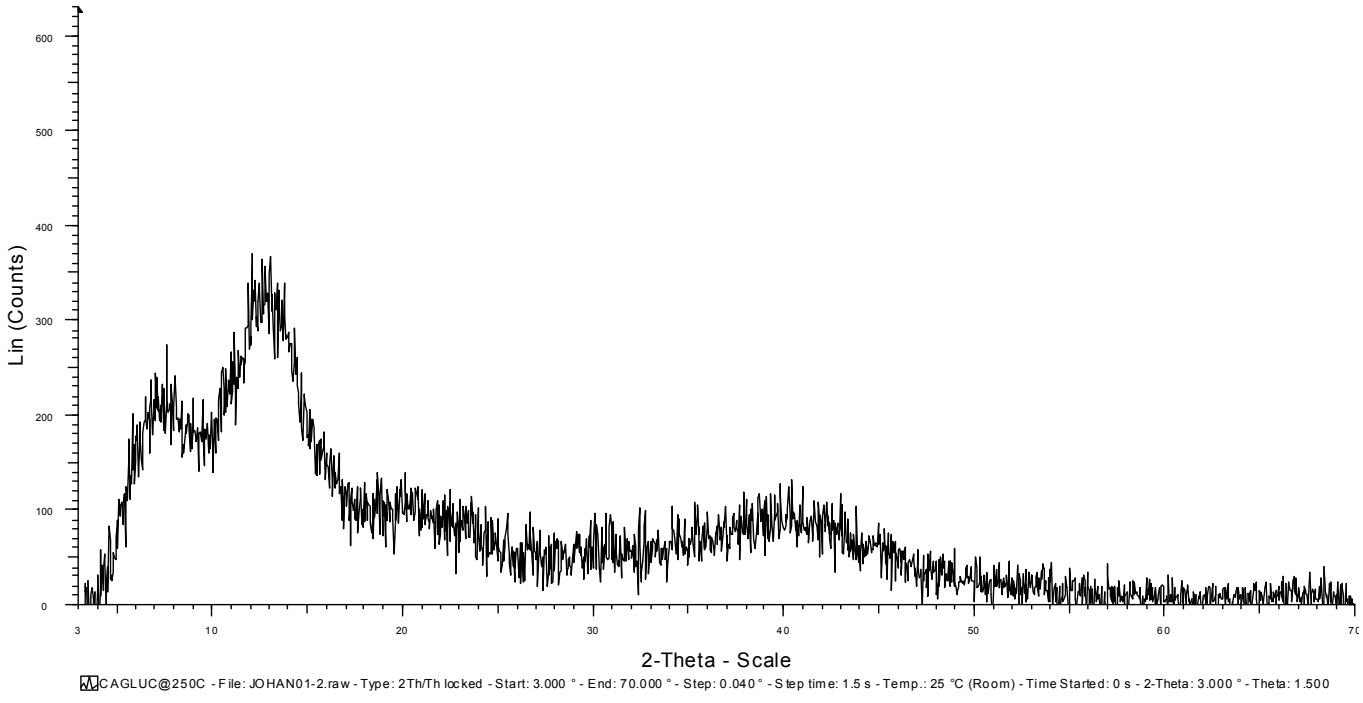
XRD spectrum of calcium gluconate pyrolysed at 100°C for 5 min in air.



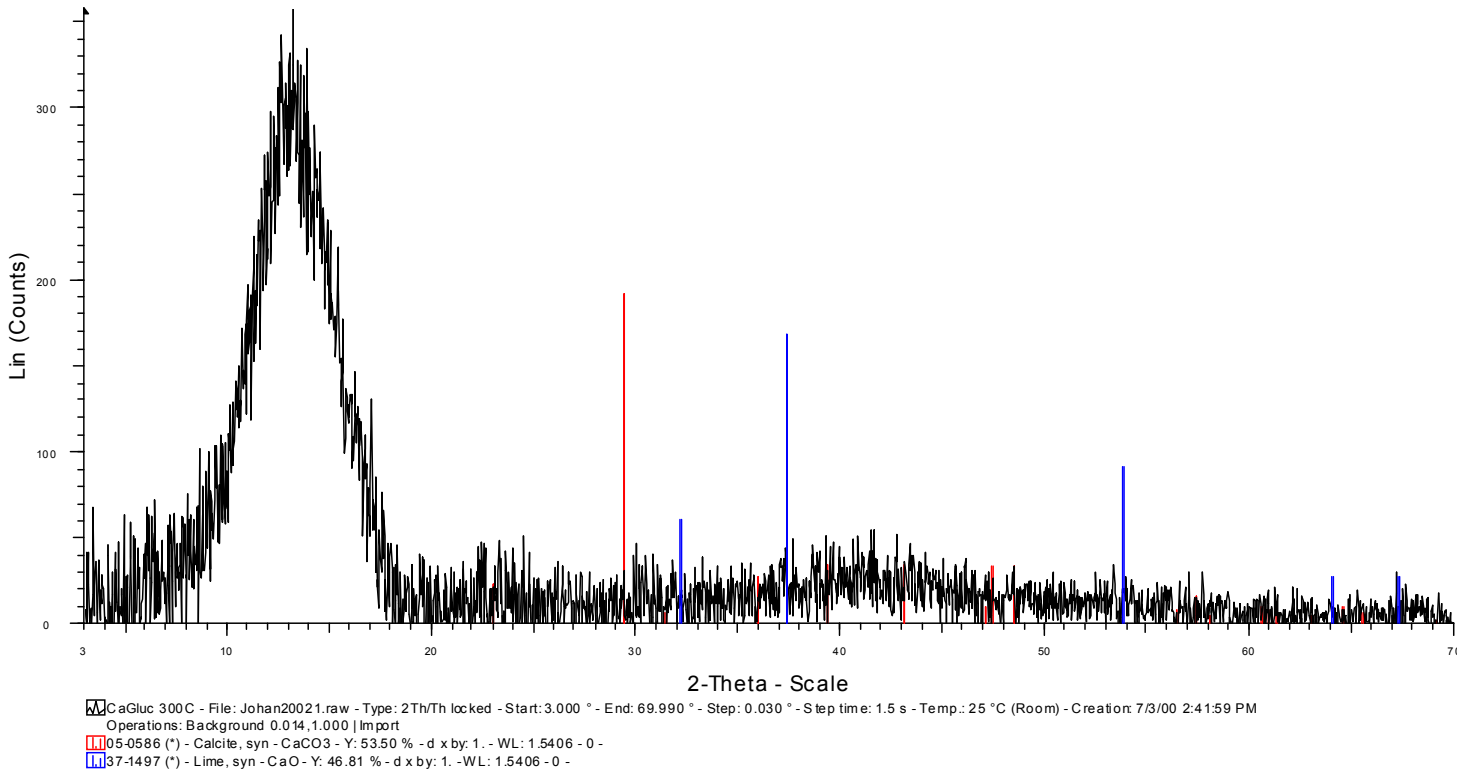
XRD spectrum of calcium gluconate pyrolysed at 150°C for 5 min in air



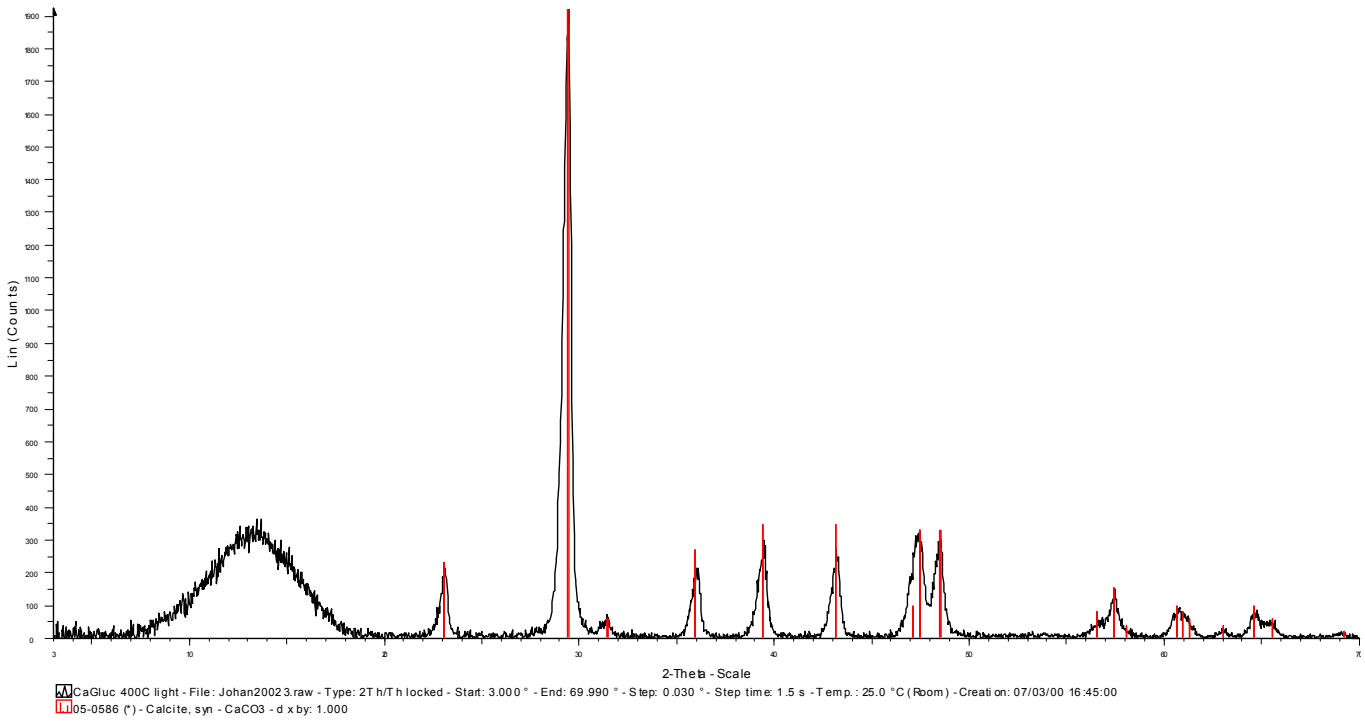
XRD spectrum of calcium gluconate pyrolysed at 200°C for 5 min in air



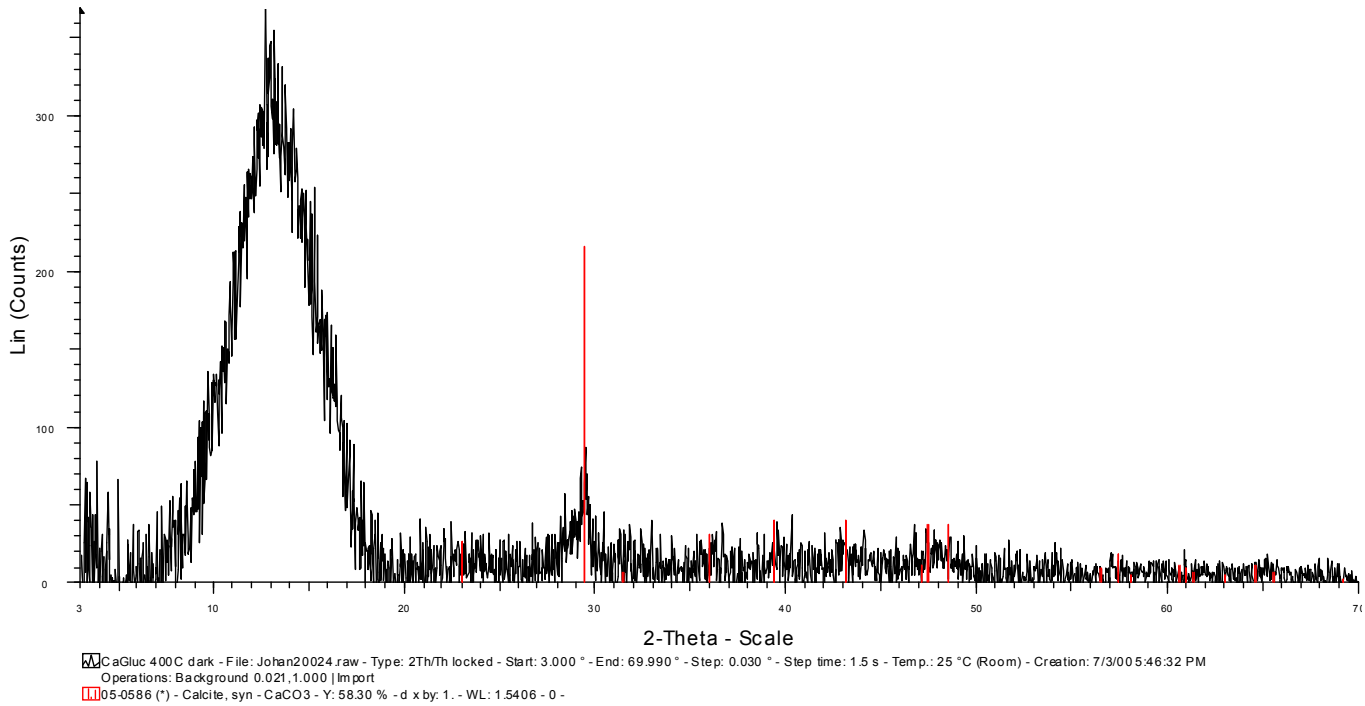
XRD spectrum of calcium gluconate pyrolysed at 250°C for 5 min in air



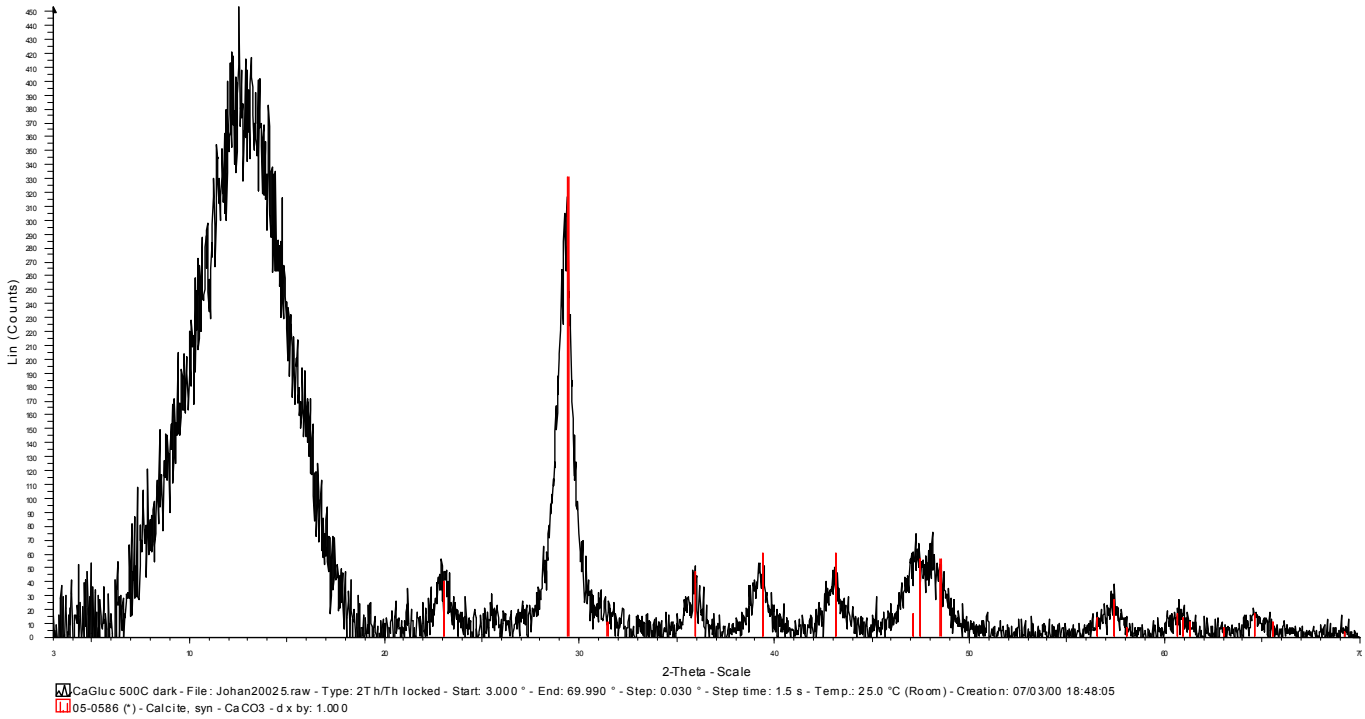
XRD spectrum of calcium gluconate pyrolysed at 300°C for 5 min in air



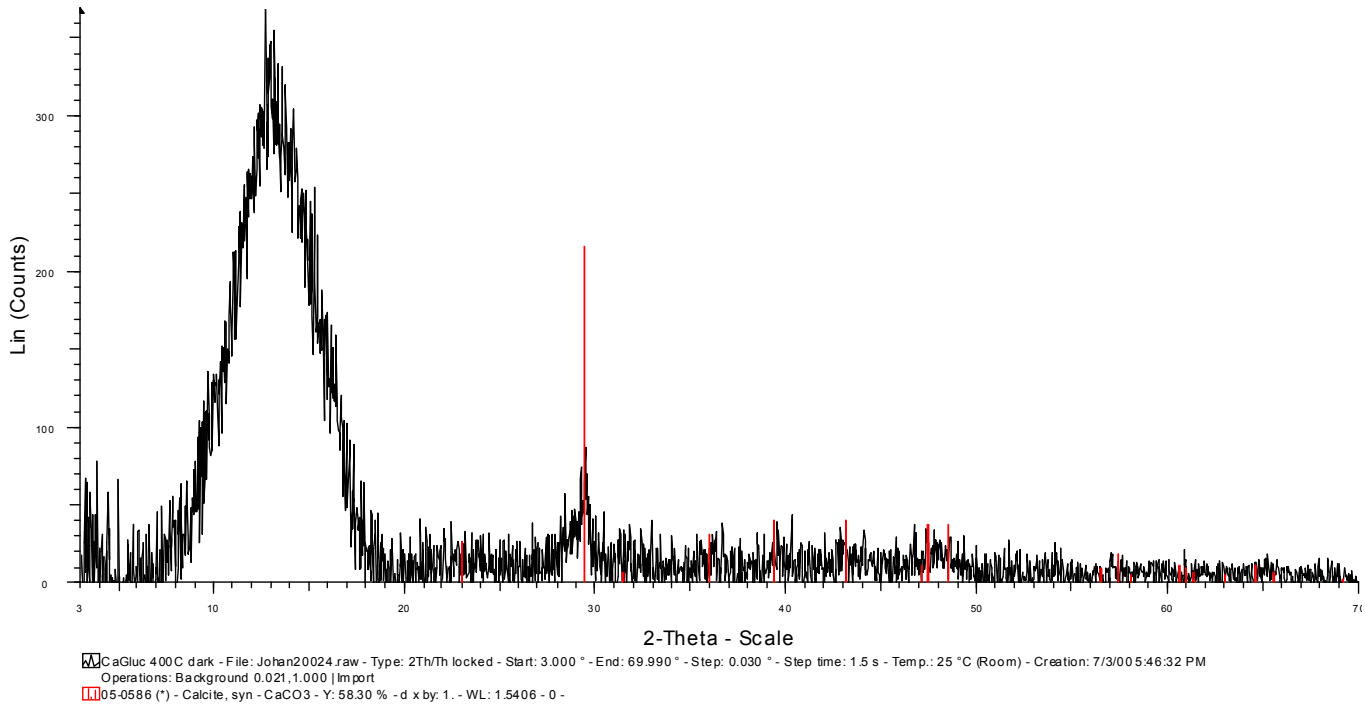
XRD spectrum of calcium gluconate pyrolysed at 400°C for 5 min in air – light material (top of polytop™)



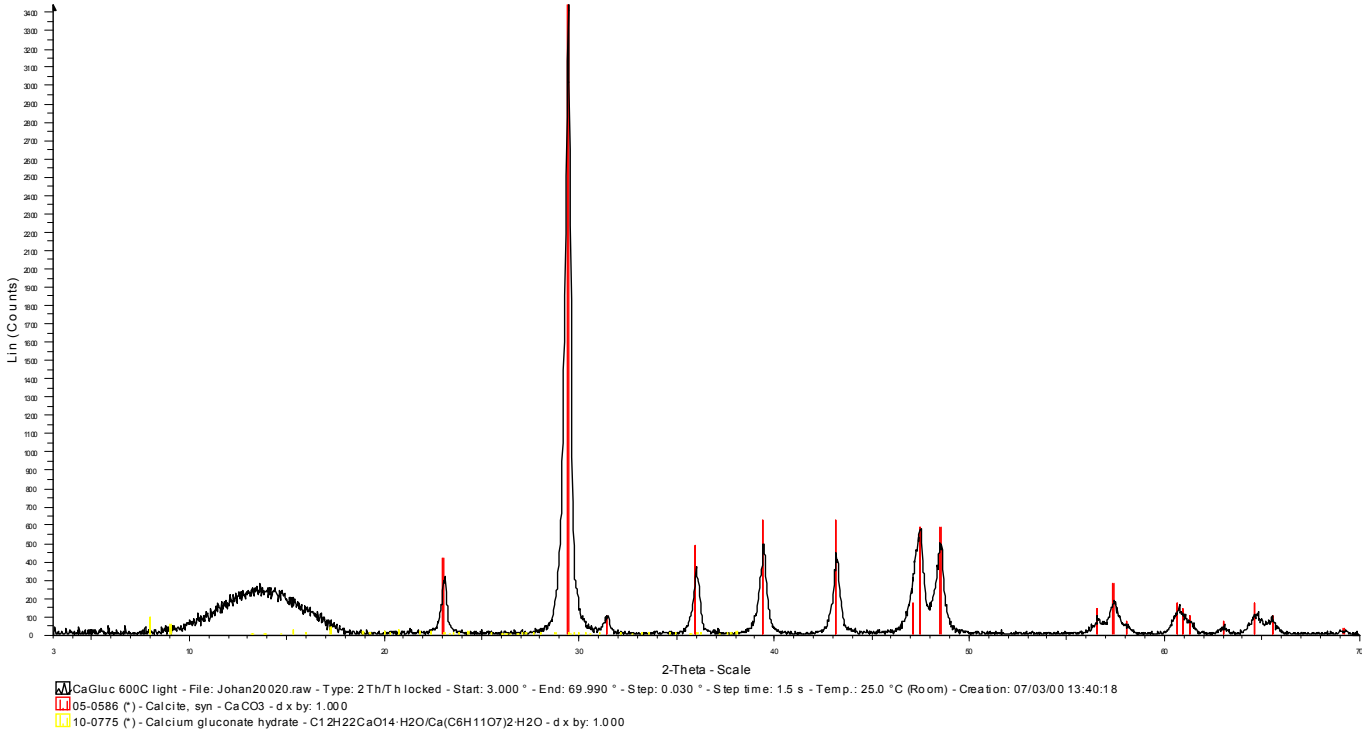
XRD spectrum of calcium gluconate pyrolysed at 400°C for 5 min in air – dark material (bottom of polytop™)



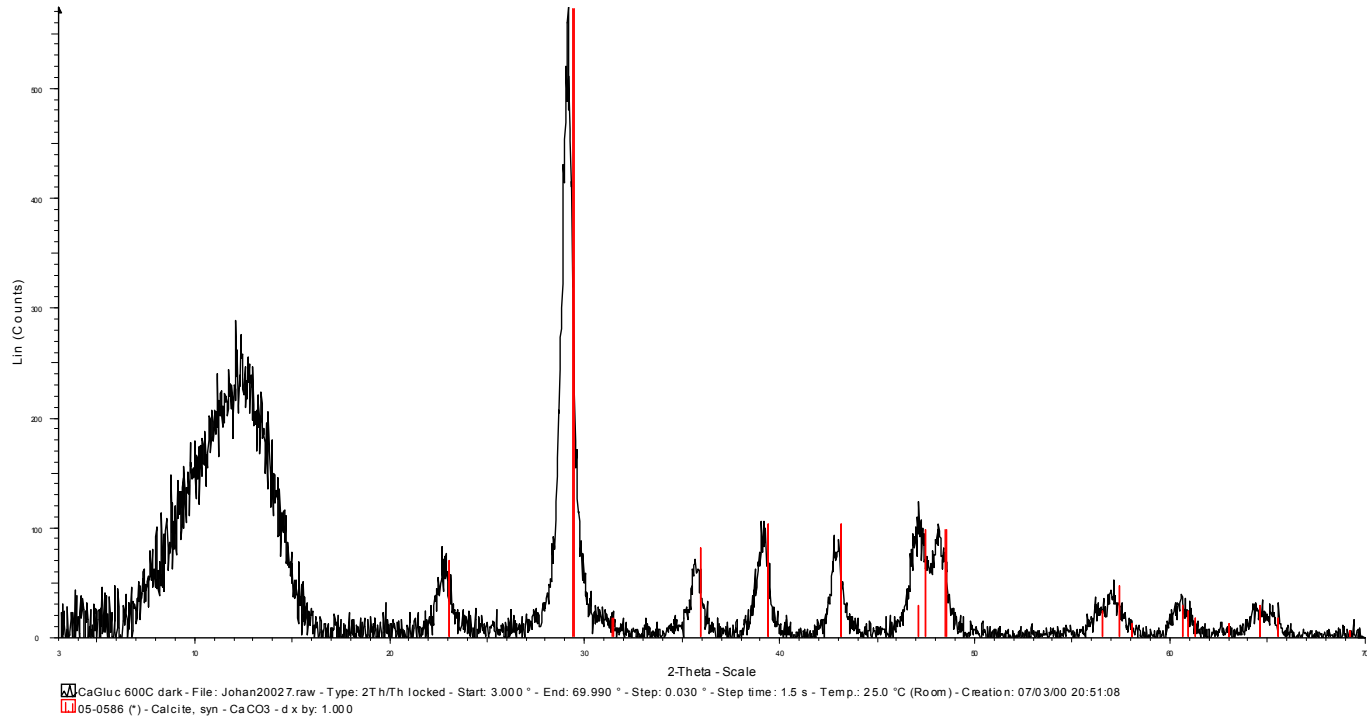
XRD spectrum of calcium gluconate pyrolysed at 500°C for 5 min in air – light material (top of polytop™)



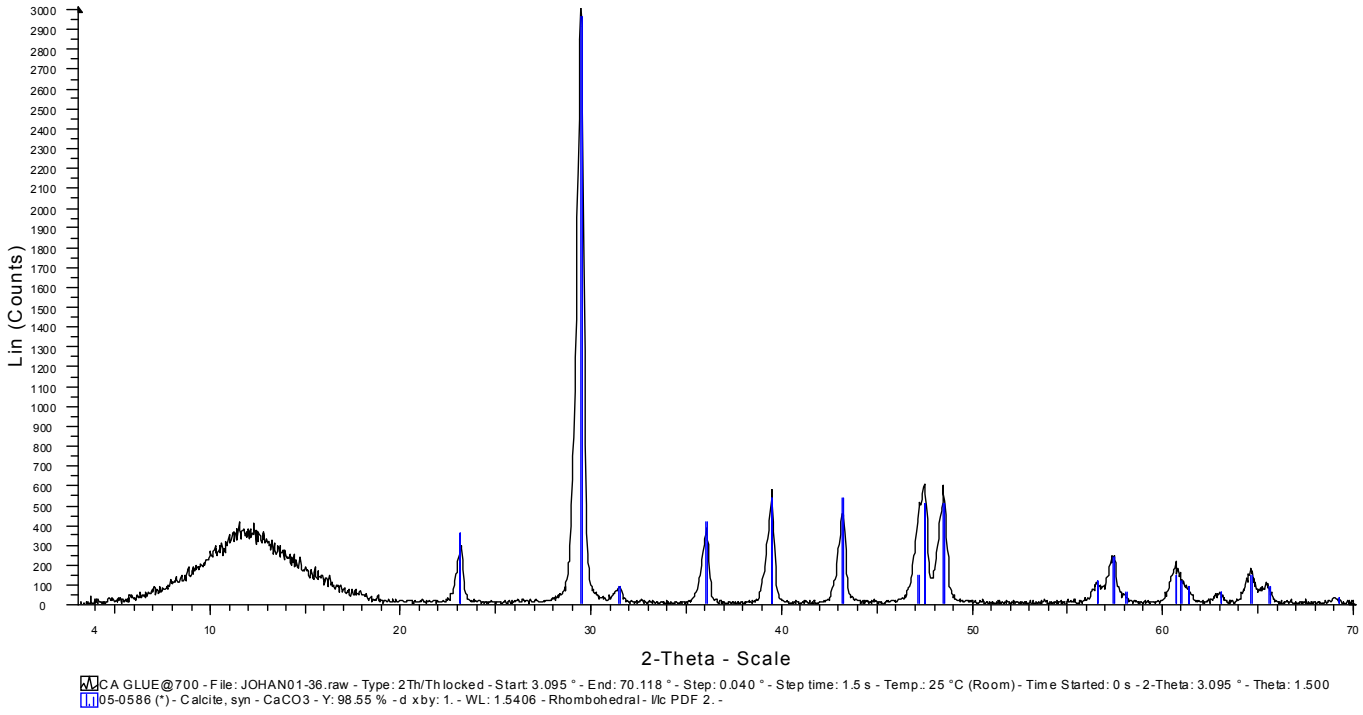
XRD spectrum of calcium gluconate pyrolysed at 500°C for 5 min in air – dark material (bottom of polytop™)



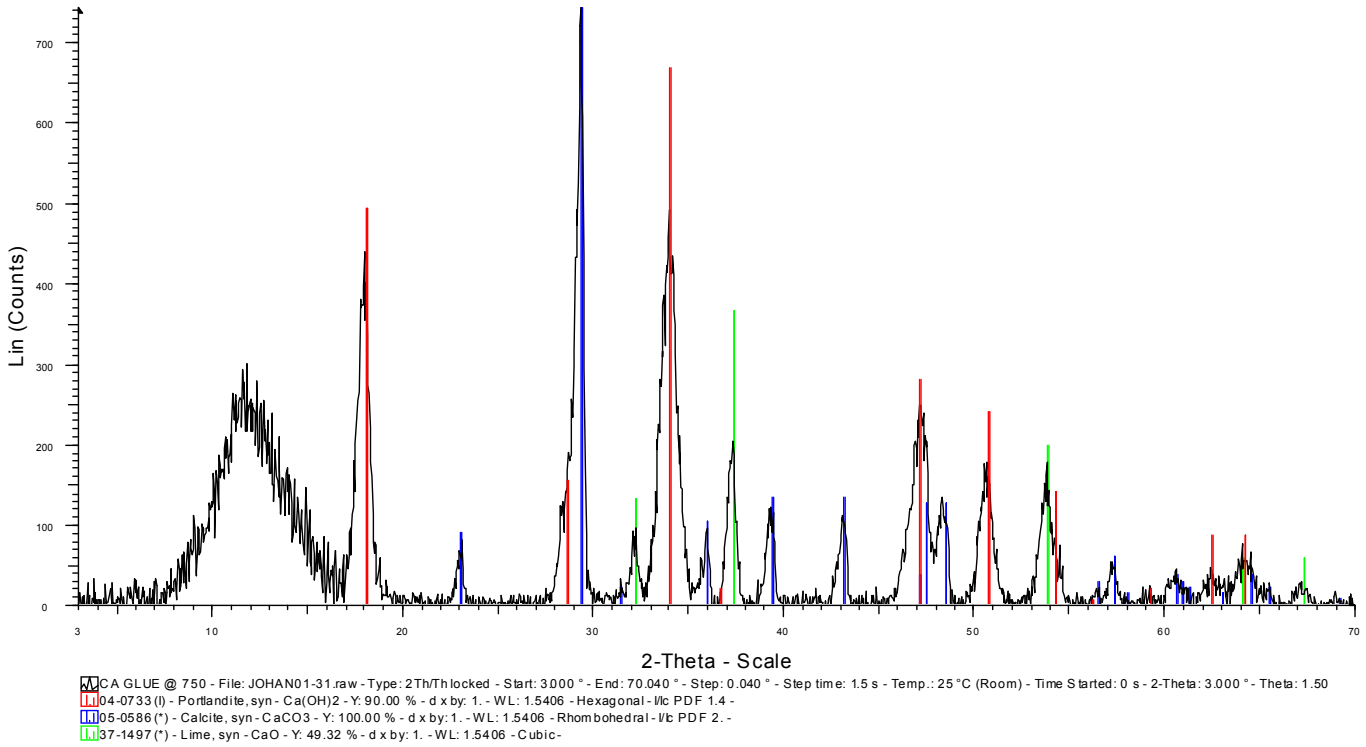
XRD spectrum of calcium gluconate pyrolysed at 600°C for 5 min in air – light material (top of polytop™)



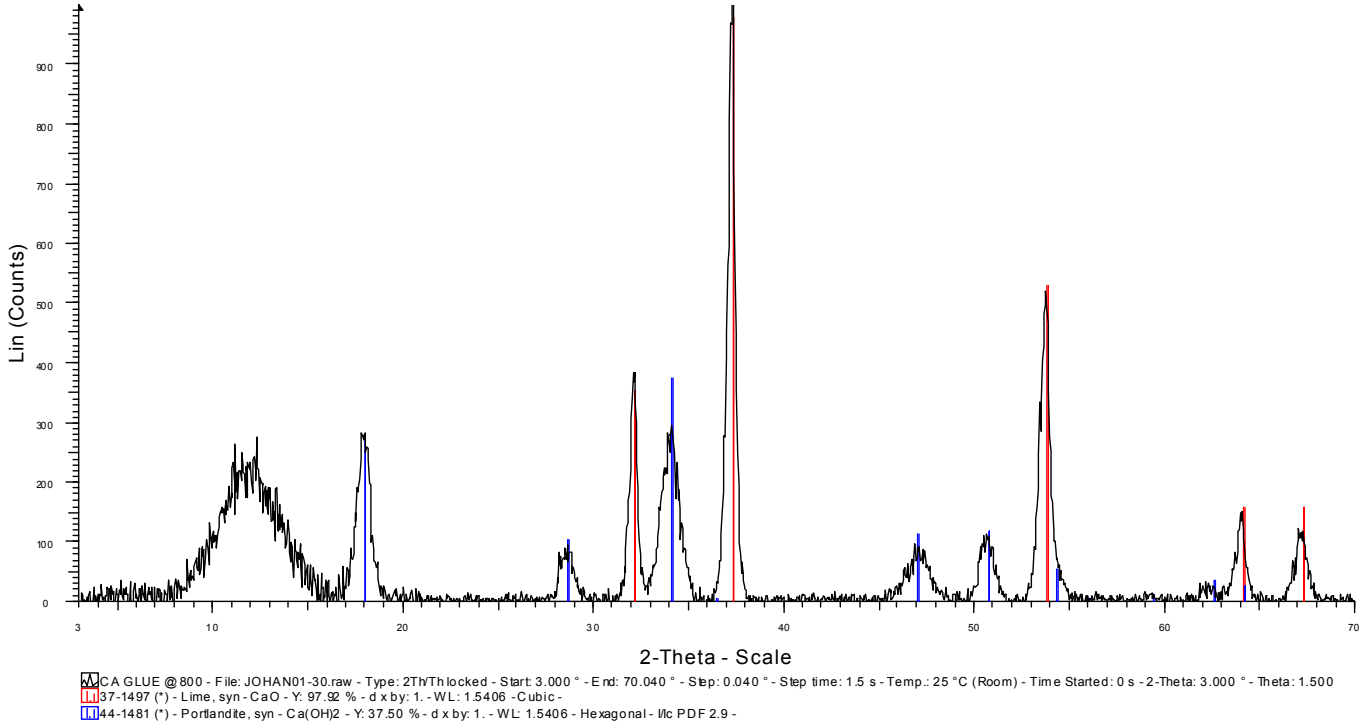
XRD spectrum of calcium gluconate pyrolysed at 600°C for 5 min in air – dark material (bottom of polytop™)



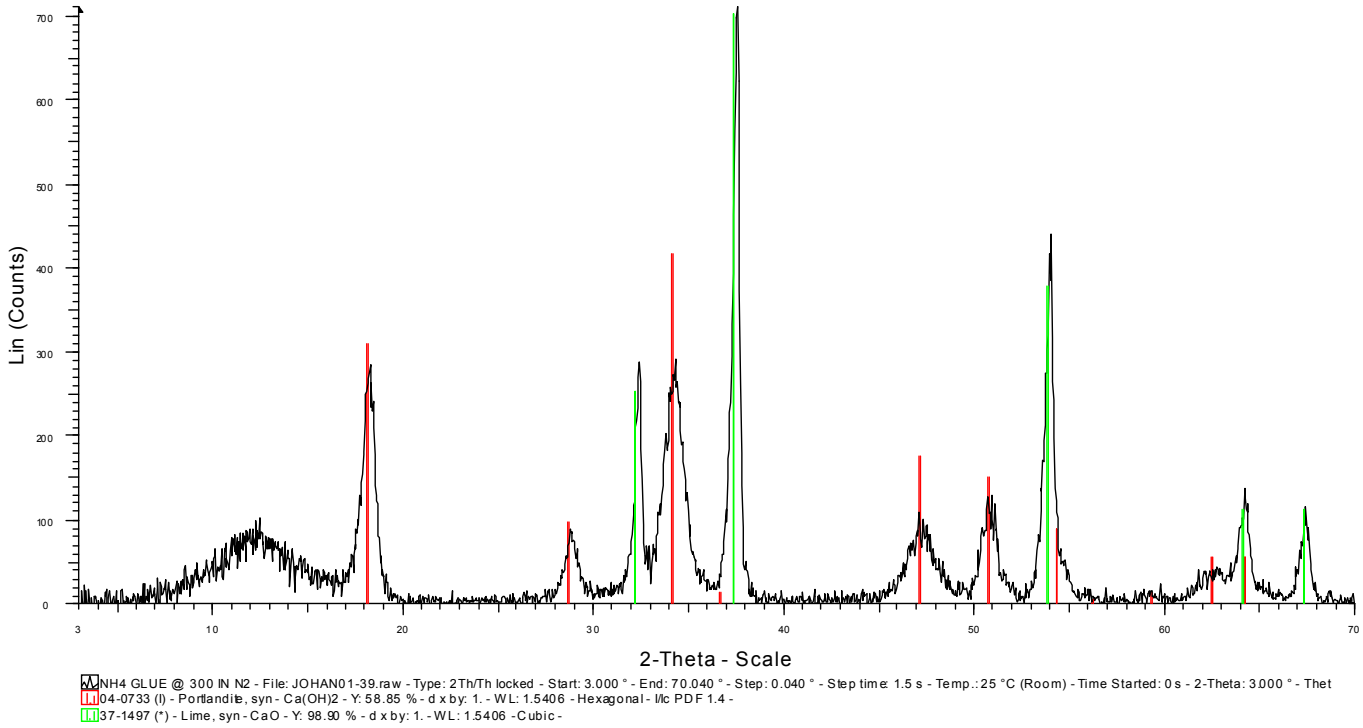
XRD spectrum of calcium gluconate pyrolysed at 700°C for 5 min in air



XRD spectrum of calcium gluconate pyrolysed at 750°C for 5 min in air

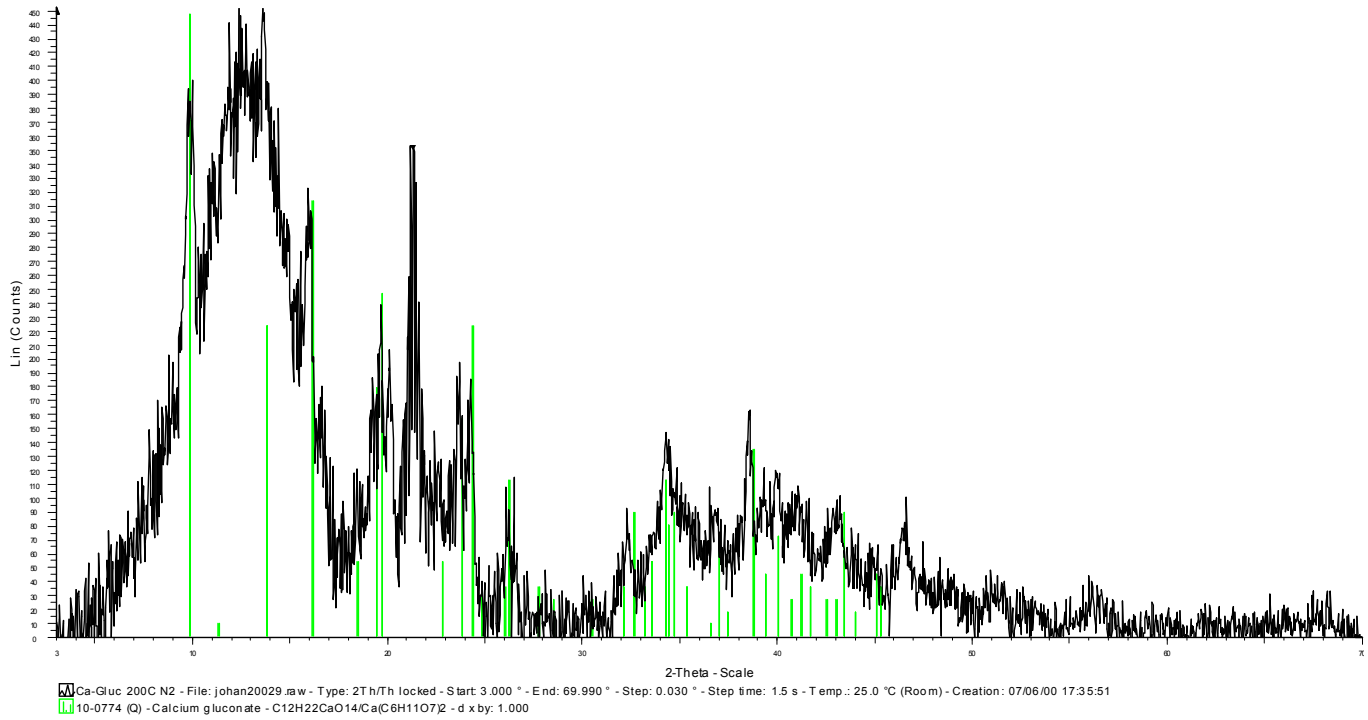


XRD spectrum of calcium gluconate pyrolysed at 800°C for 5 min in air

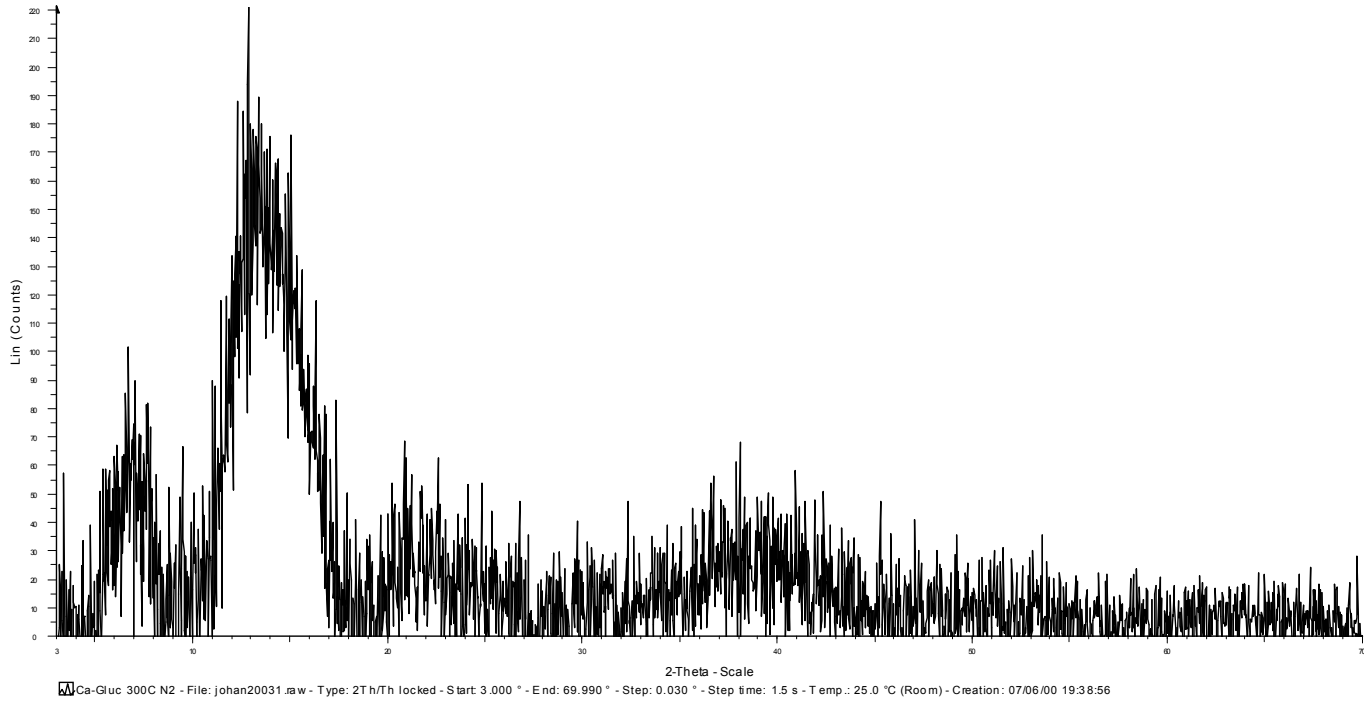


XRD spectrum of calcium gluconate pyrolysed at 1000°C for 5 min in air

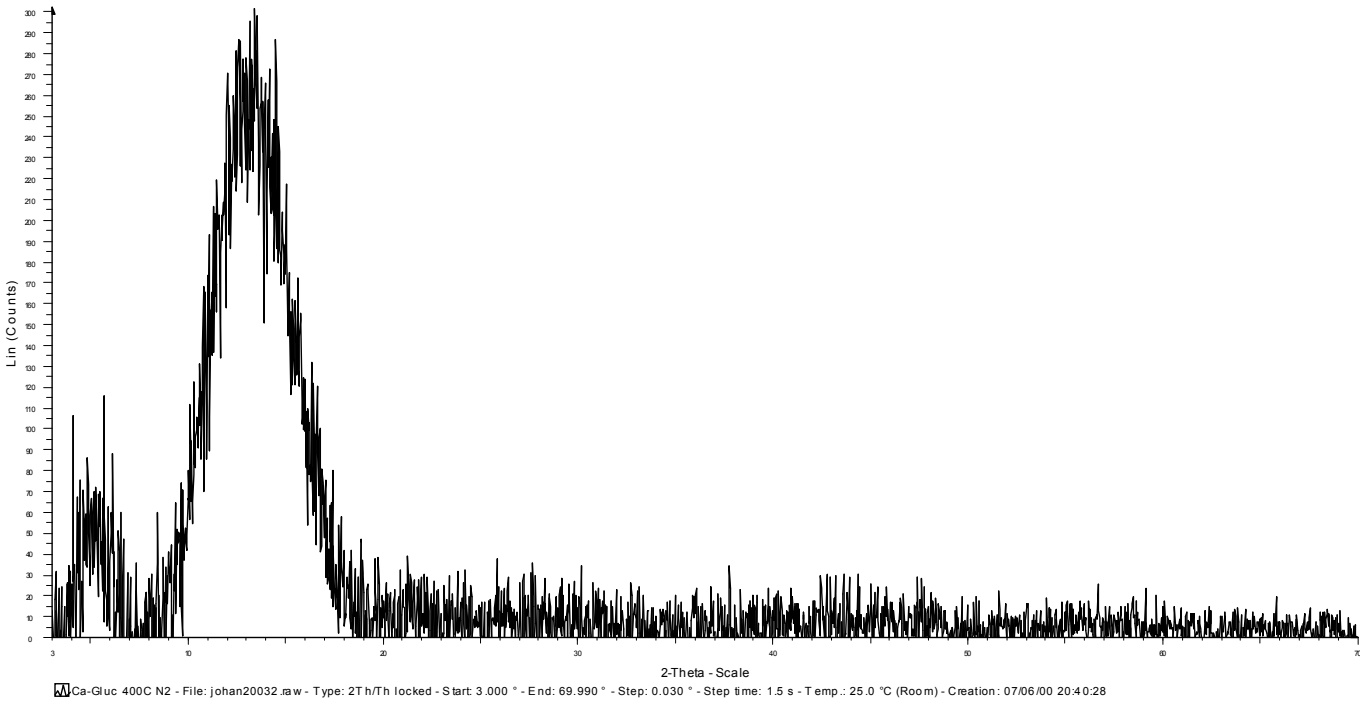
7.16.5. XRD pattern of calcium gluconate pyrolised in nitrogen



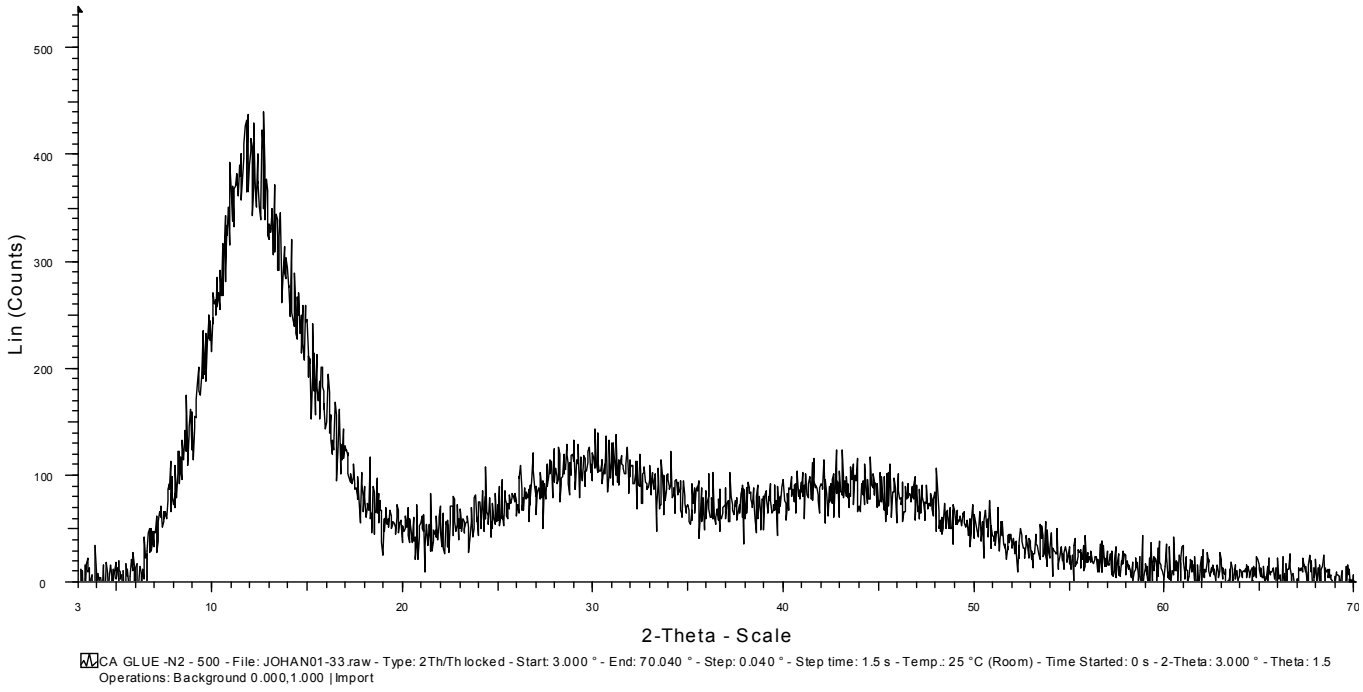
XRD spectrum of calcium gluconate pyrolysed at 200°C for 5 min in nitrogen



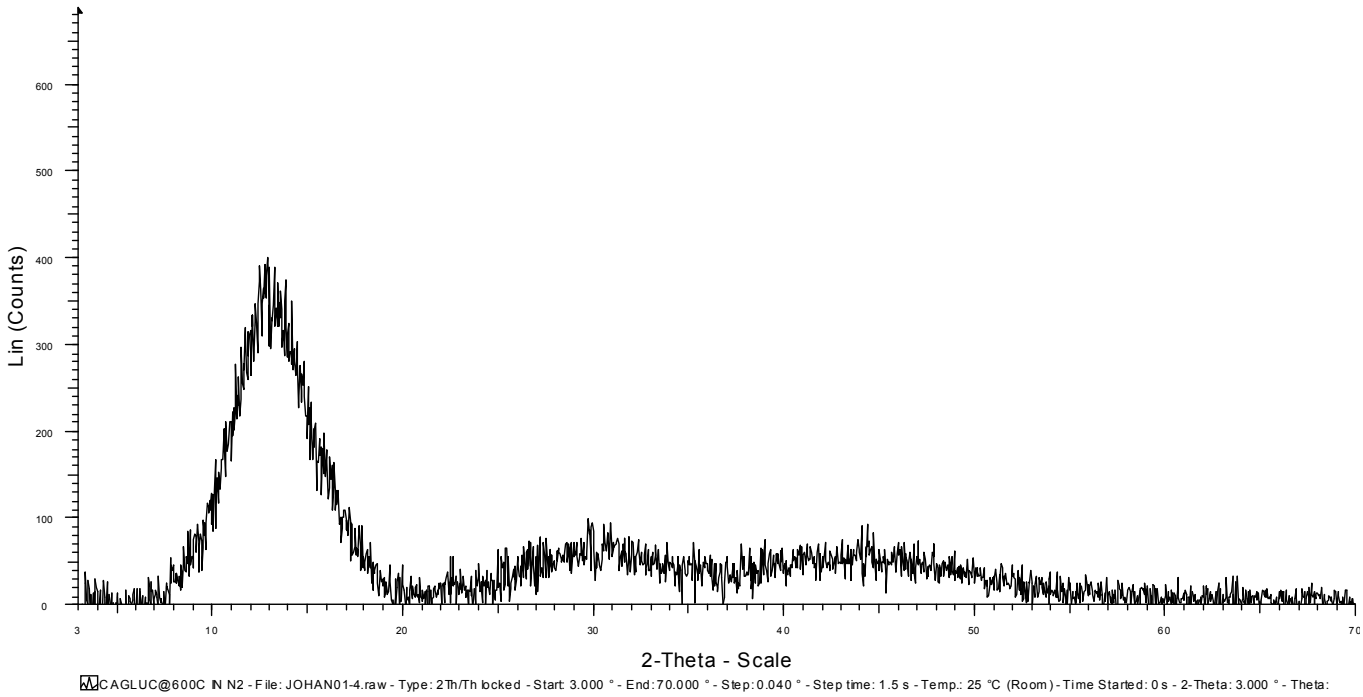
XRD spectrum of calcium gluconate pyrolysed at 300°C for 5 min in nitrogen



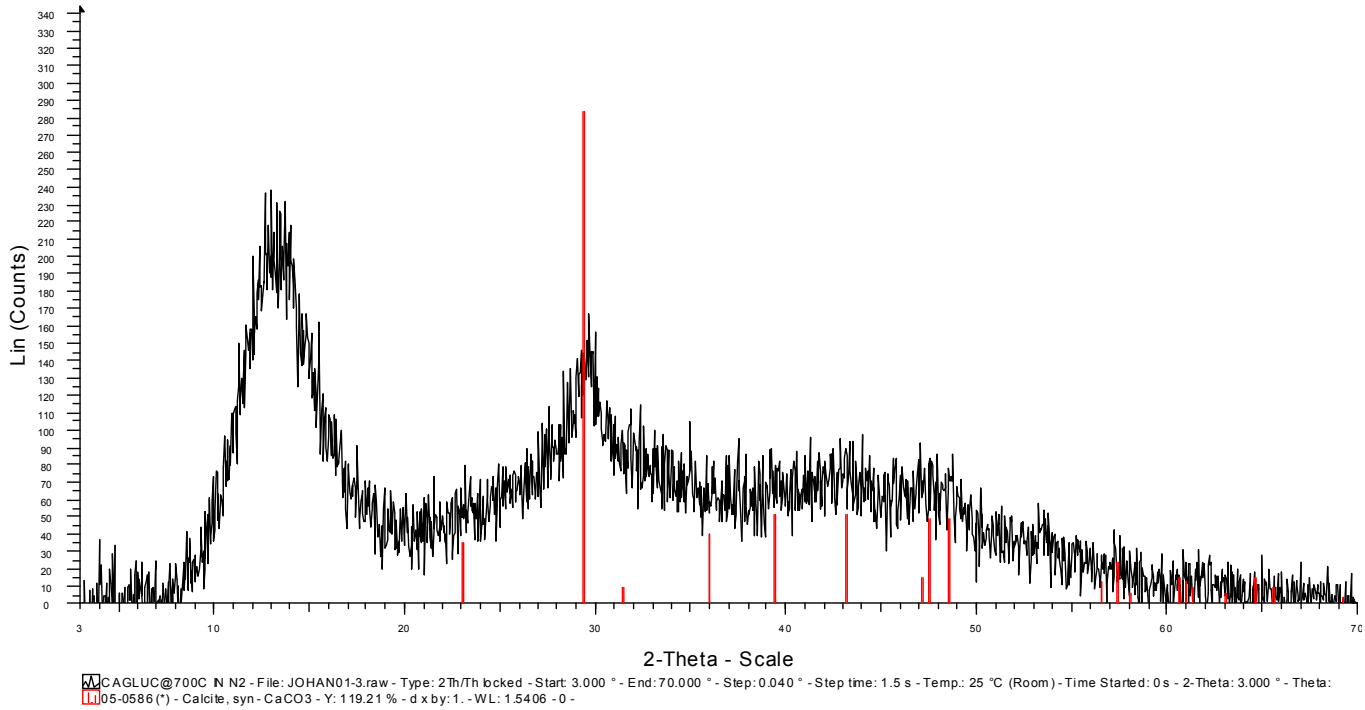
XRD spectrum of calcium gluconate pyrolysed at 400°C for 5 min in nitrogen



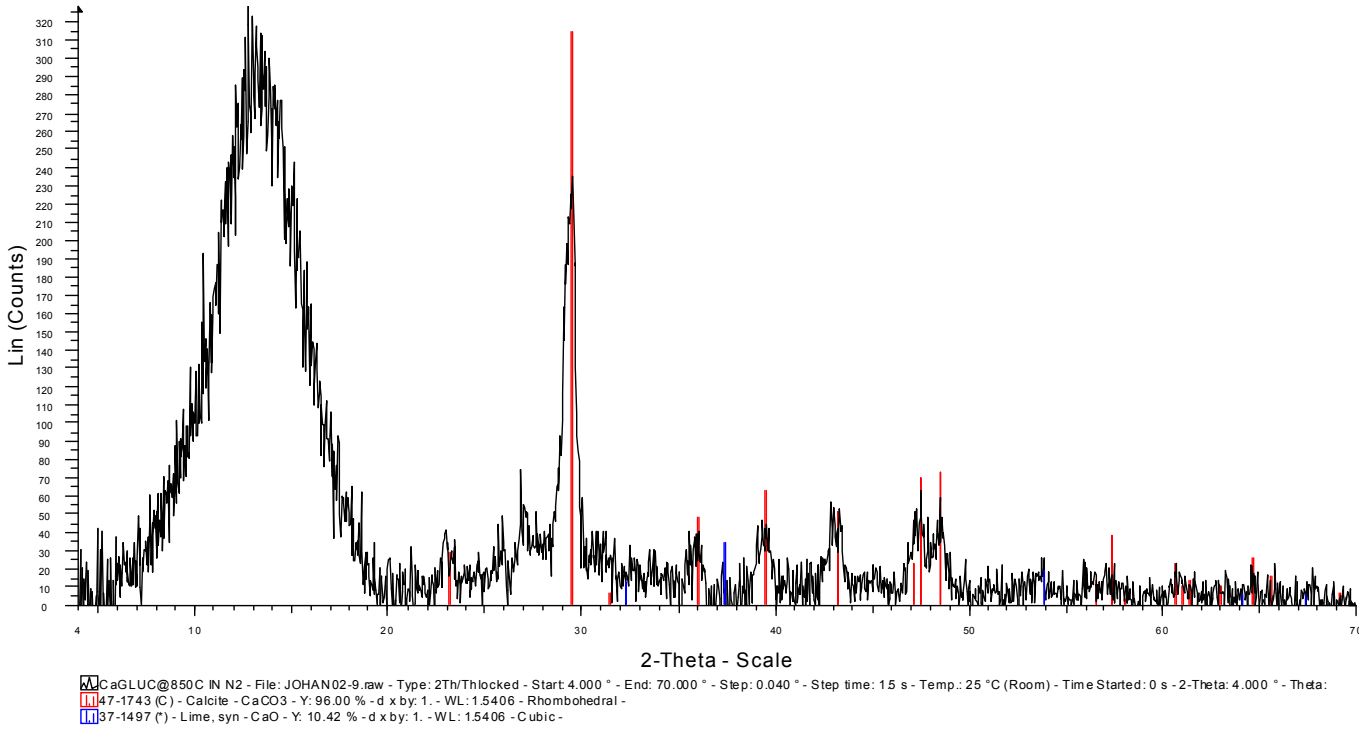
XRD spectrum of calcium gluconate pyrolysed at 500°C for 5 min in nitrogen



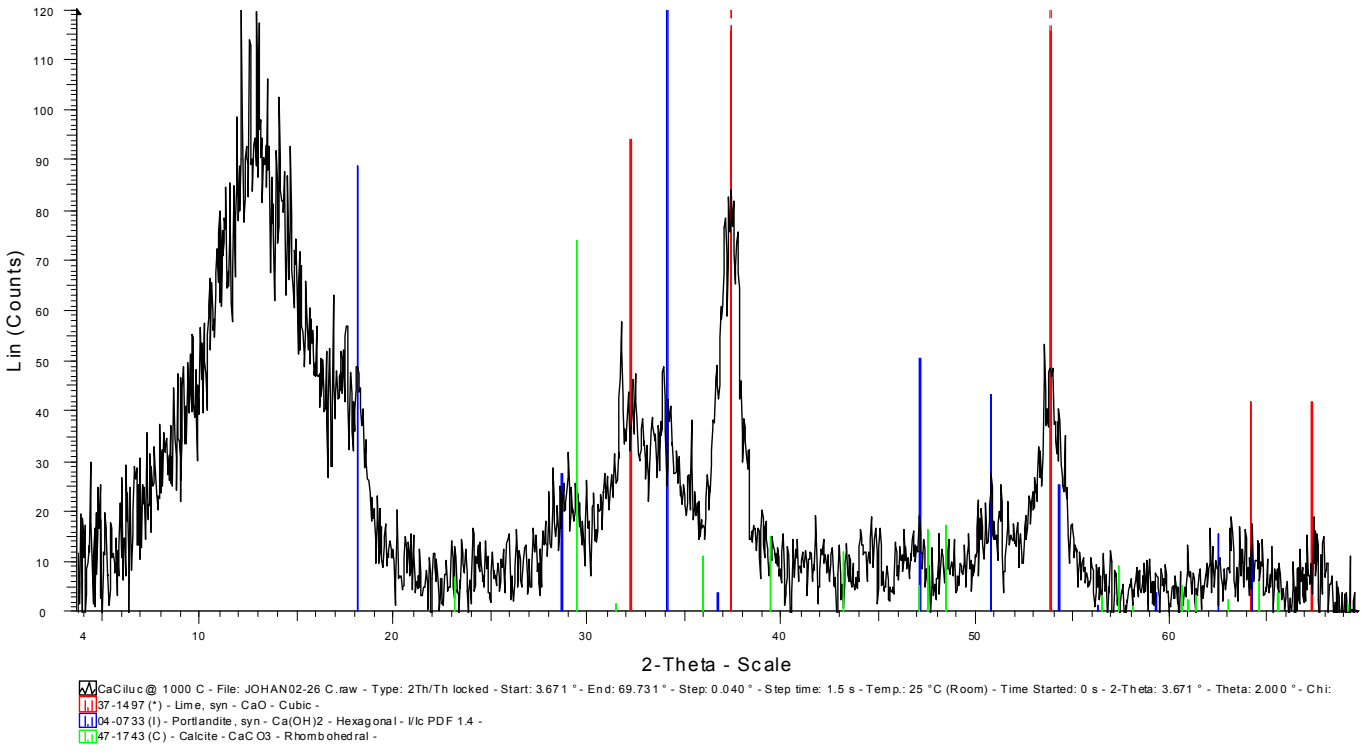
XRD spectrum of calcium gluconate pyrolysed at 600°C for 5 min in nitrogen



XRD spectrum of calcium gluconate pyrolysed at 700°C for 5 min in nitrogen

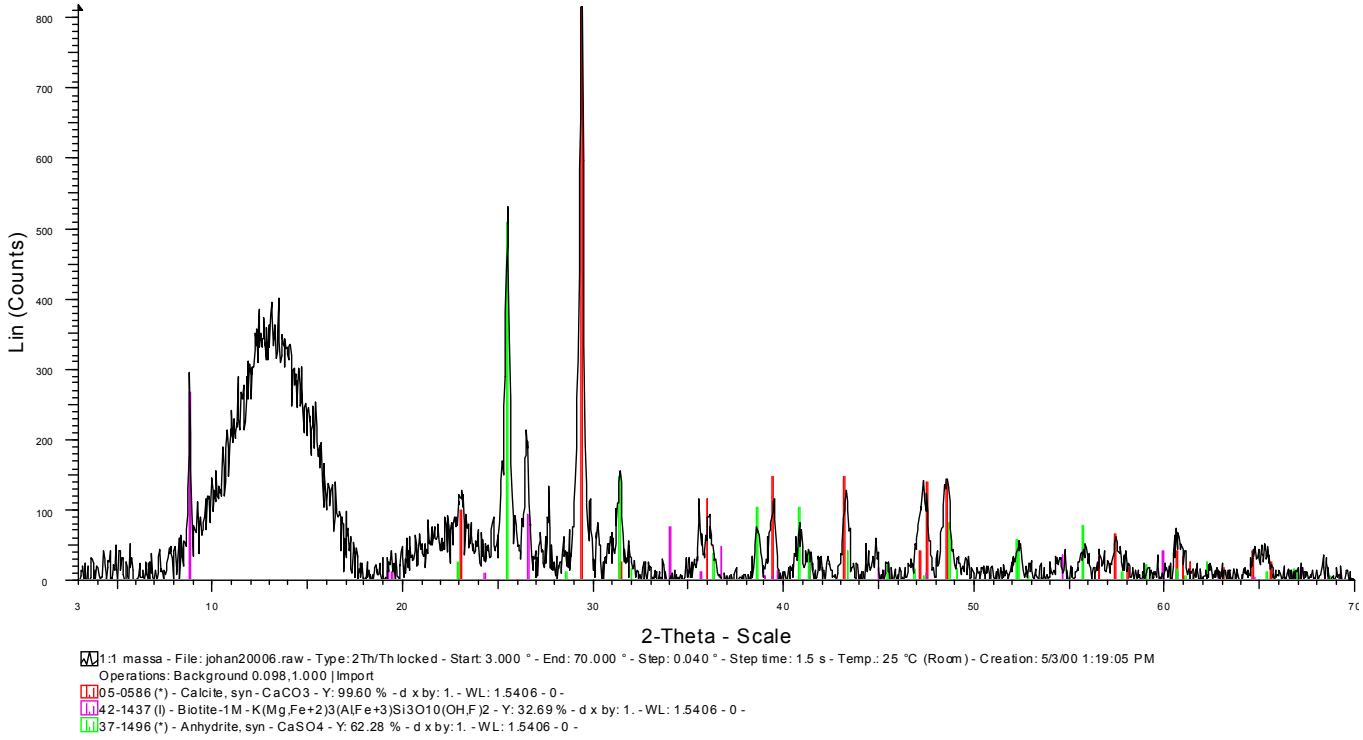


XRD spectrum of calcium gluconate pyrolysed at 850°C for 5 min in nitrogen

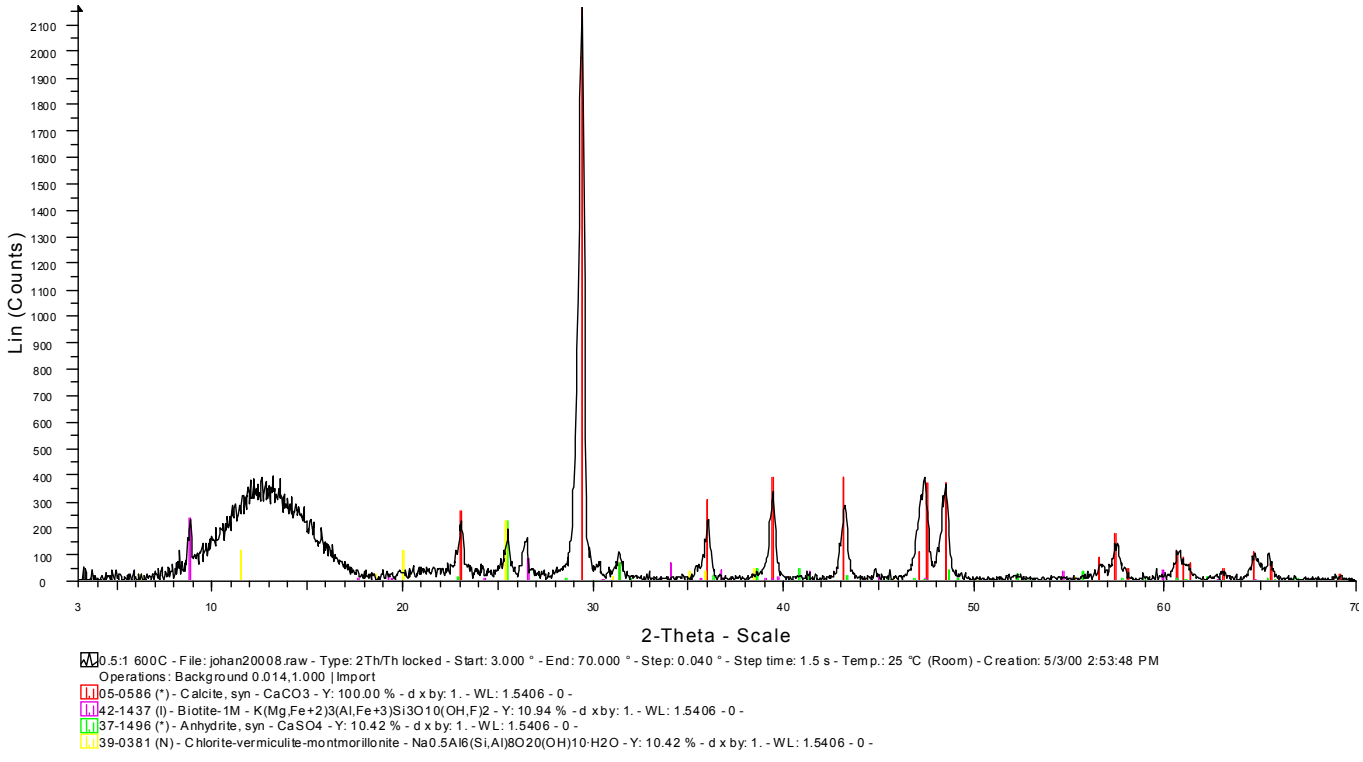


XRD spectrum of calcium gluconate pyrolysed at 1000°C for 5 min in nitrogen

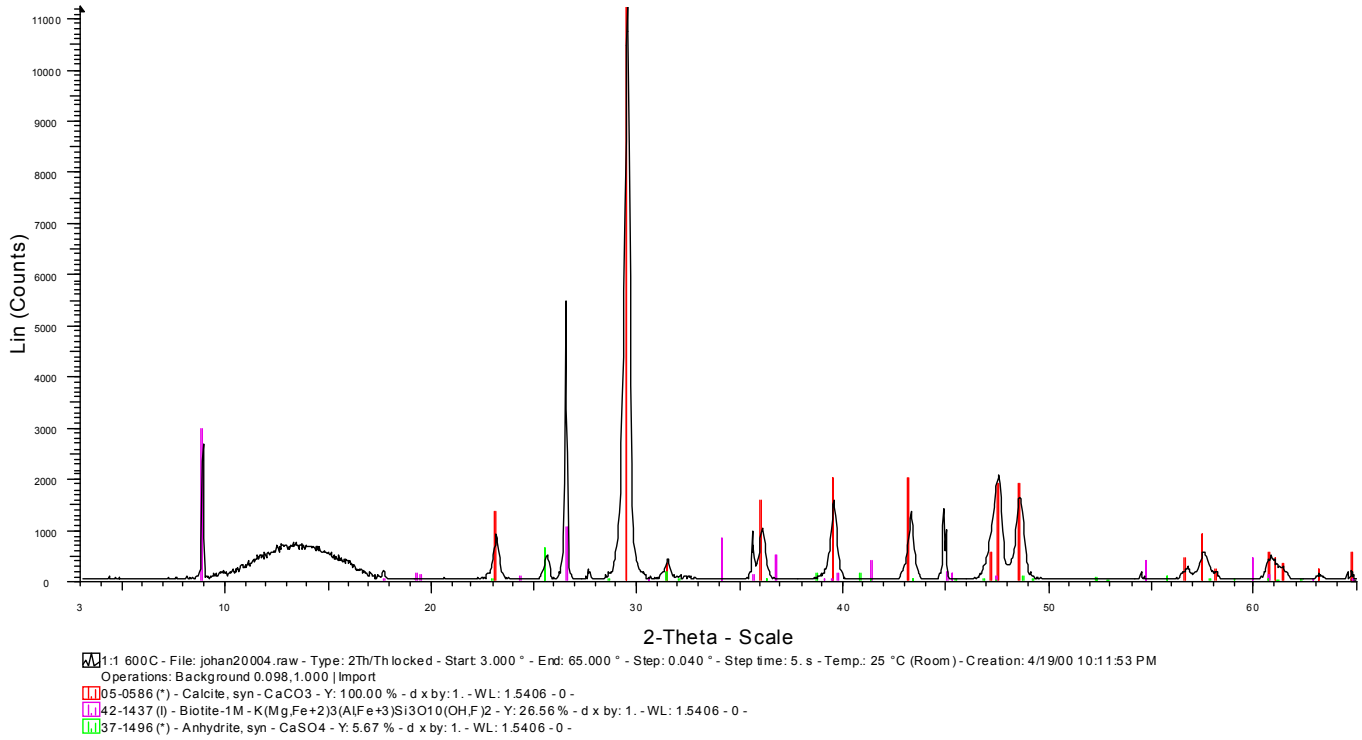
7.16.6. XRD pattern of calcium gluconate monohydrate – leached silica mixtures pyrolised in air



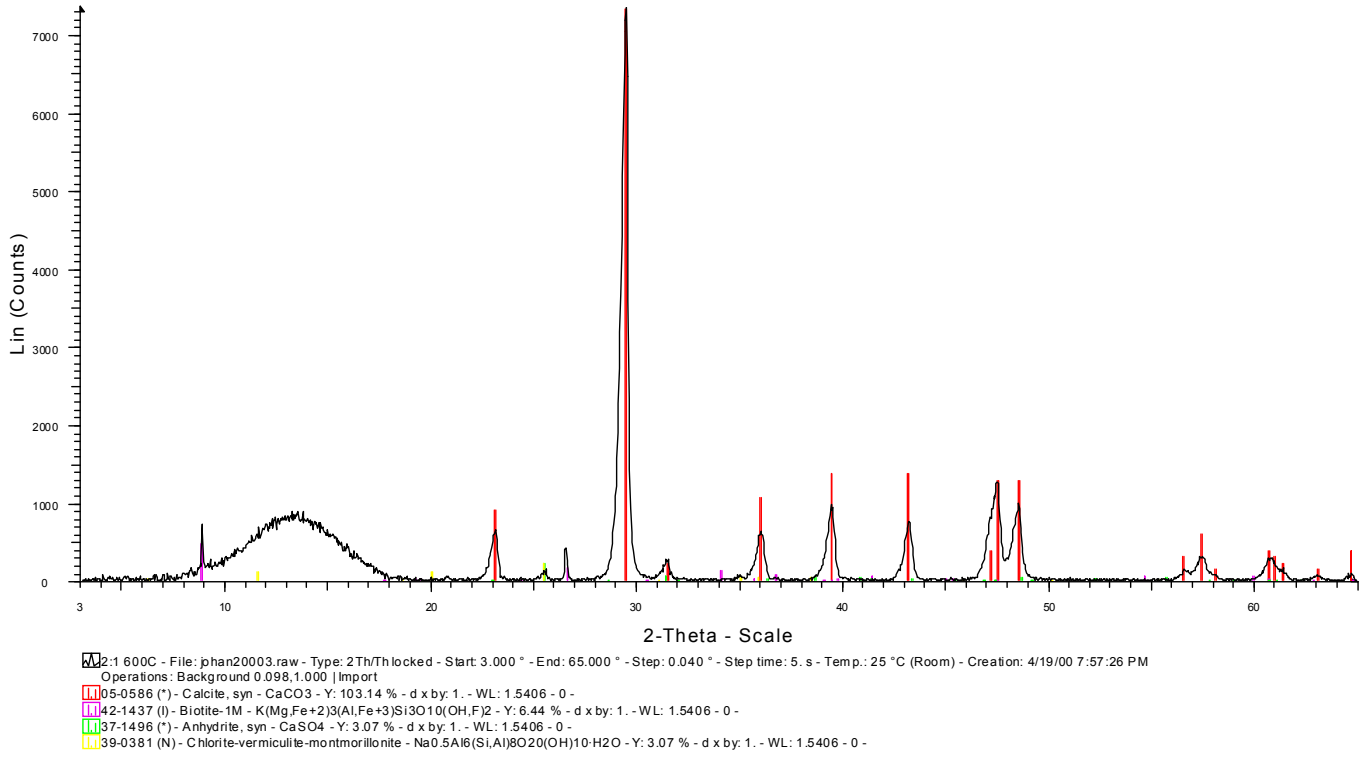
XRD spectrum of 1:1 mass ratio calcium gluconate and leached silica pyrolysed at 600°C for 5 min in air



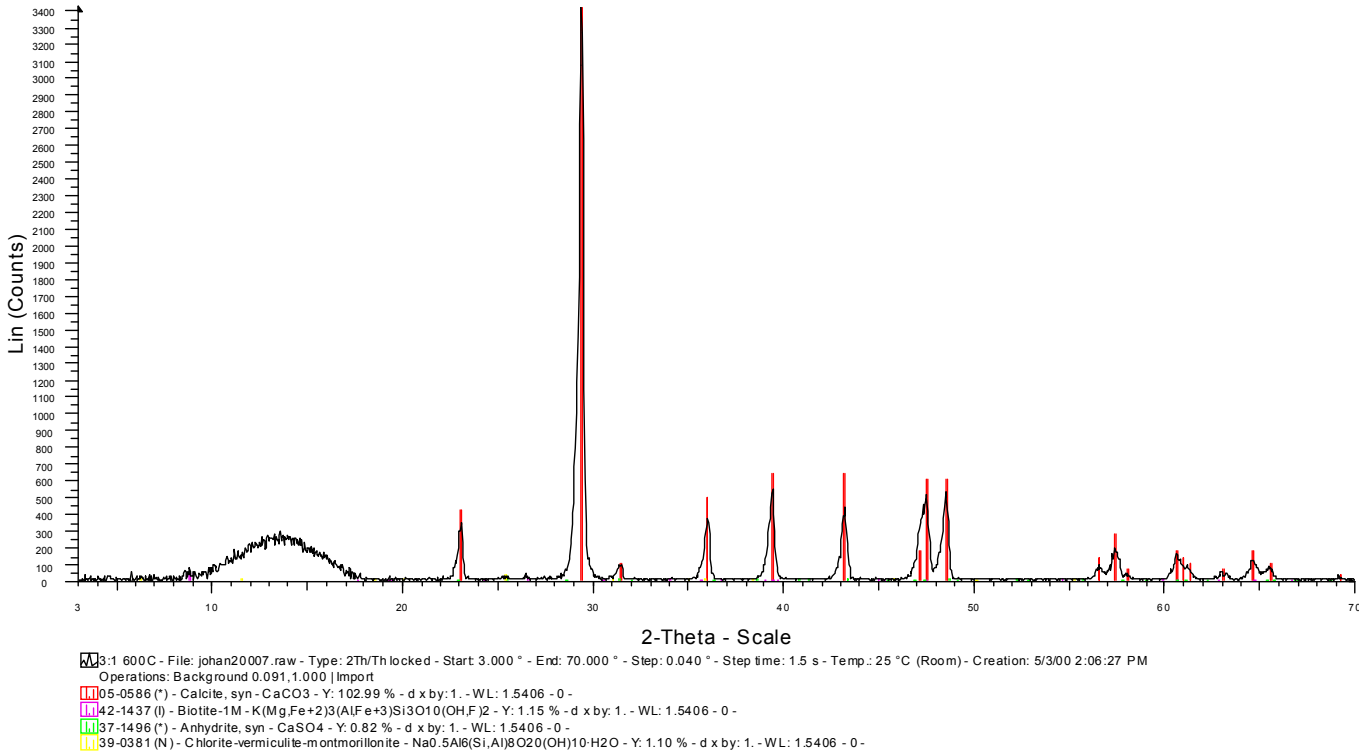
XRD spectrum of 0.5:1 mole ratio calcium gluconate and leached silica pyrolysed at 600°C for 5 min in air



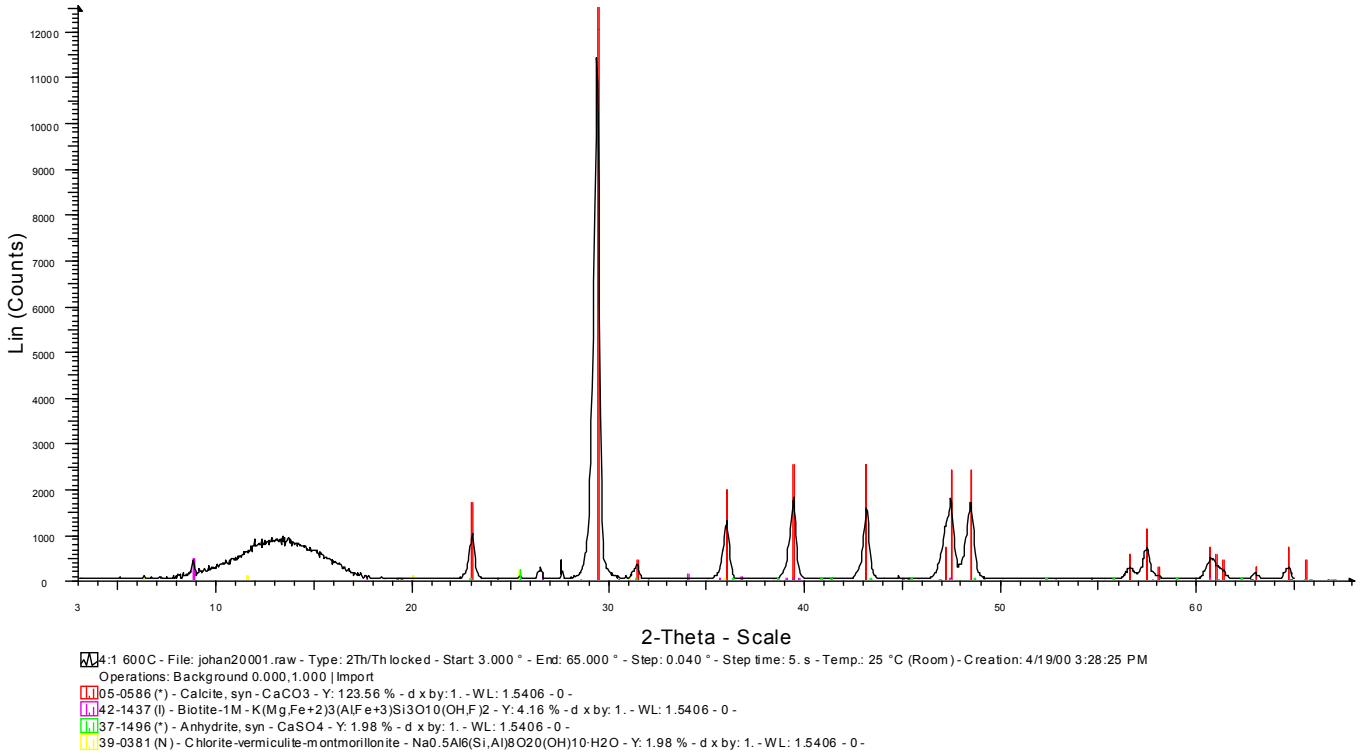
XRD spectrum of 1:1 mole ratio calcium gluconate and leached silica pyrolysed at 600°C for 5 min in air



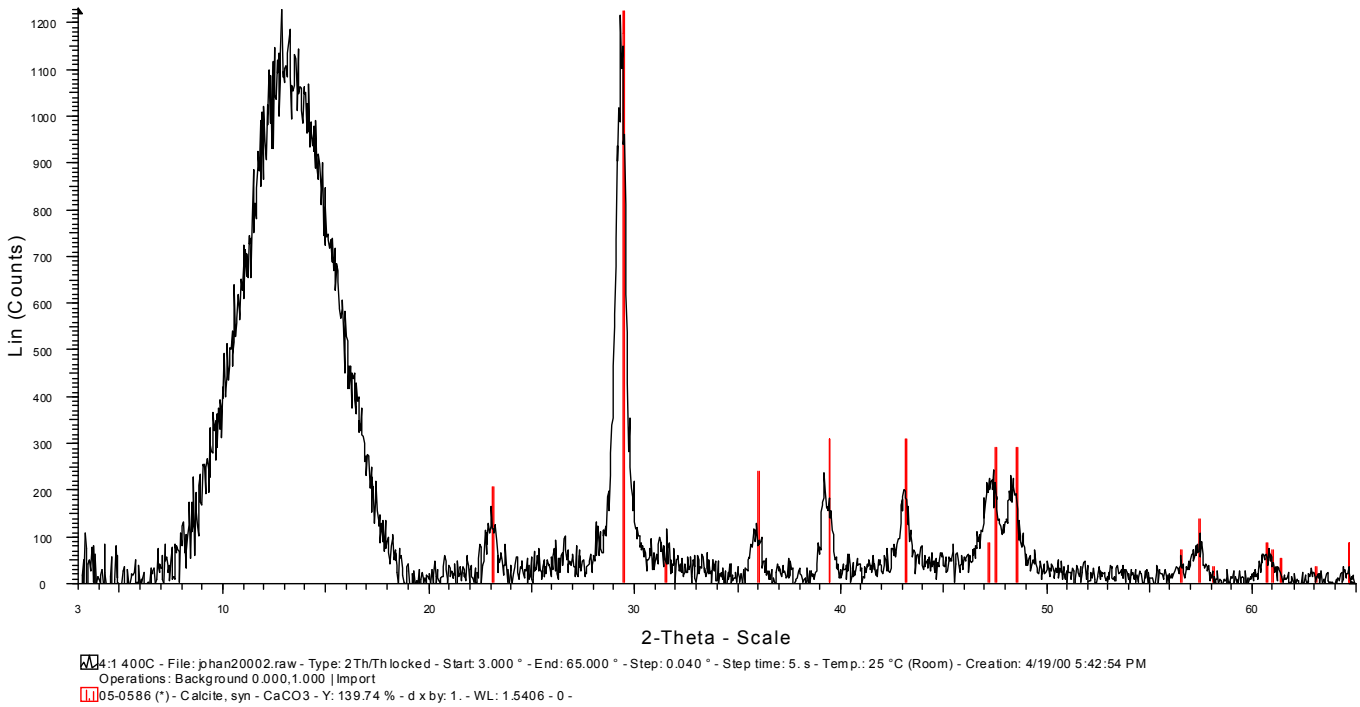
XRD spectrum of 2:1 mole ratio calcium gluconate and leached silica pyrolysed at 600°C for 5 min in air



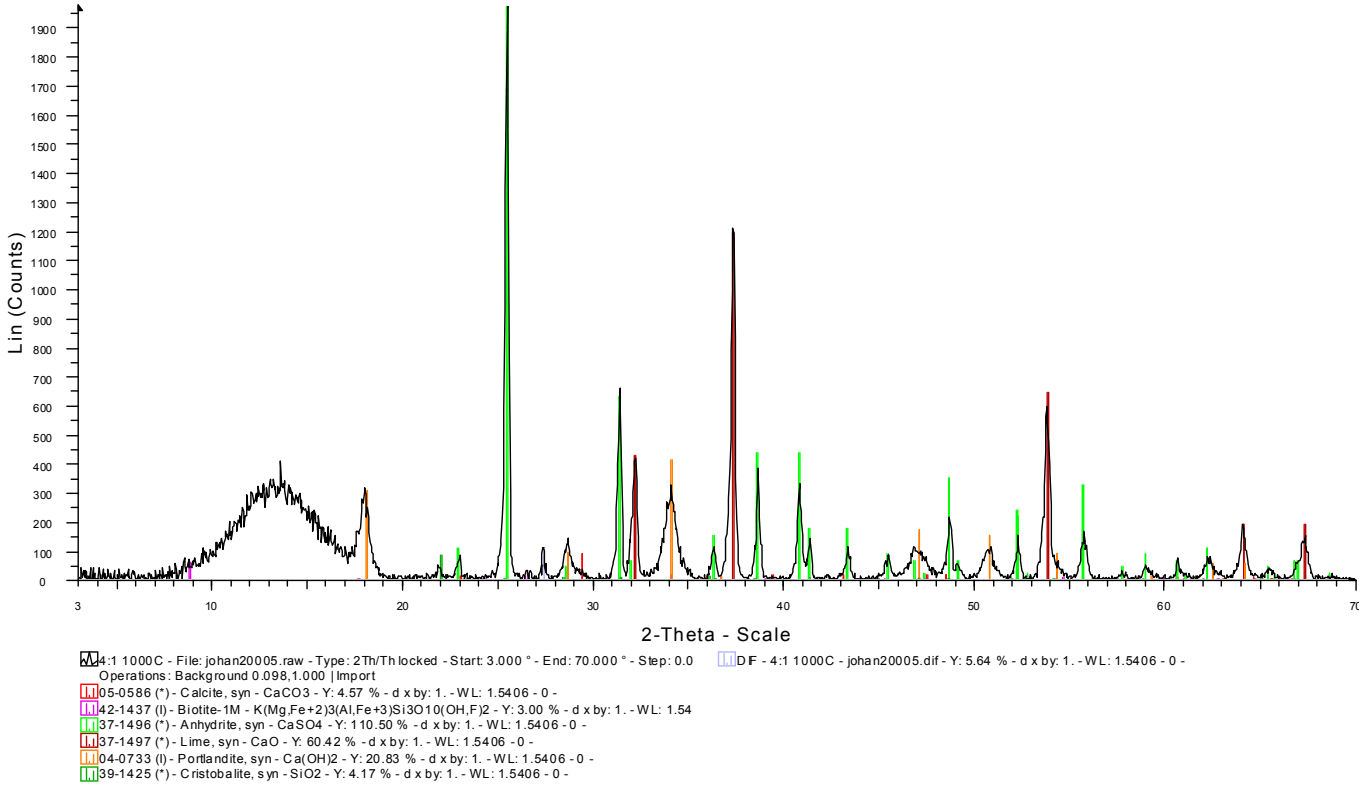
XRD spectrum of 3:1 mole ratio calcium gluconate and leached silica pyrolysed at 600°C for 5 min in air



XRD spectrum of 4:1 mole ratio calcium gluconate and leached silica pyrolysed at 600°C for 5 min in air

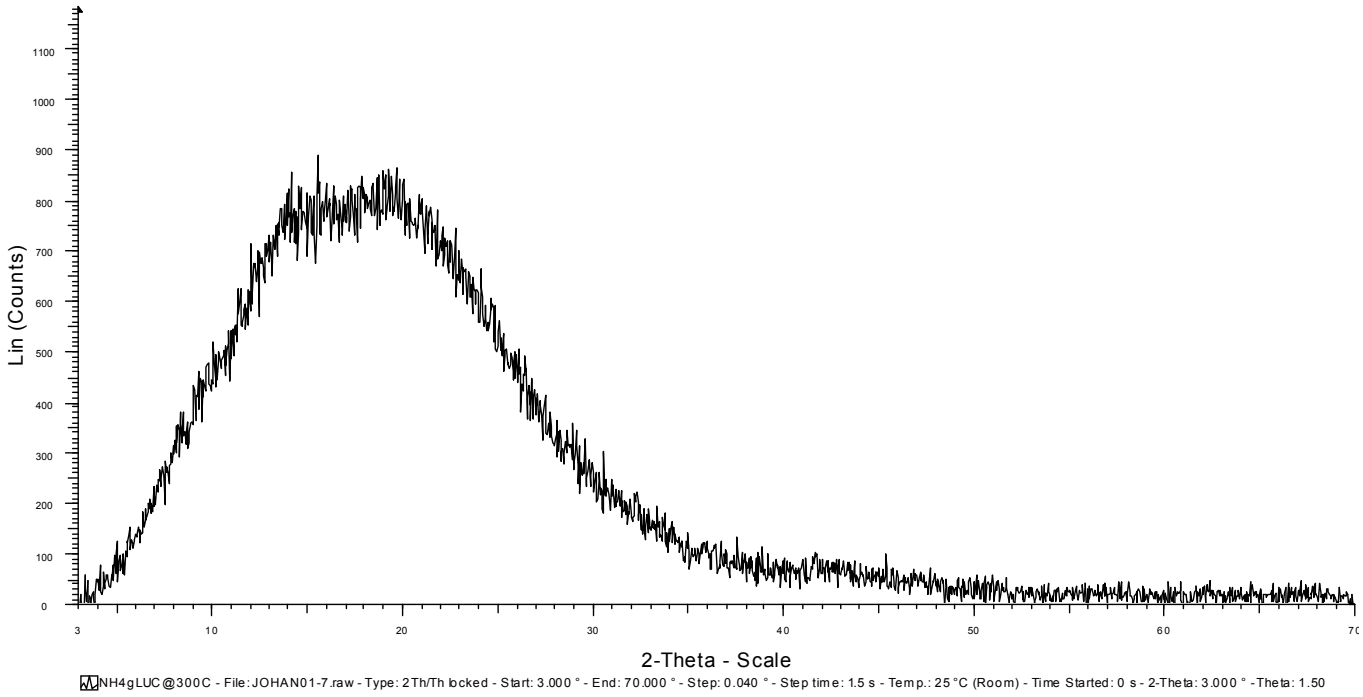


XRD spectrum of 4:1 mole ratio calcium gluconate and leached silica pyrolysed at 400°C for 5 min in air

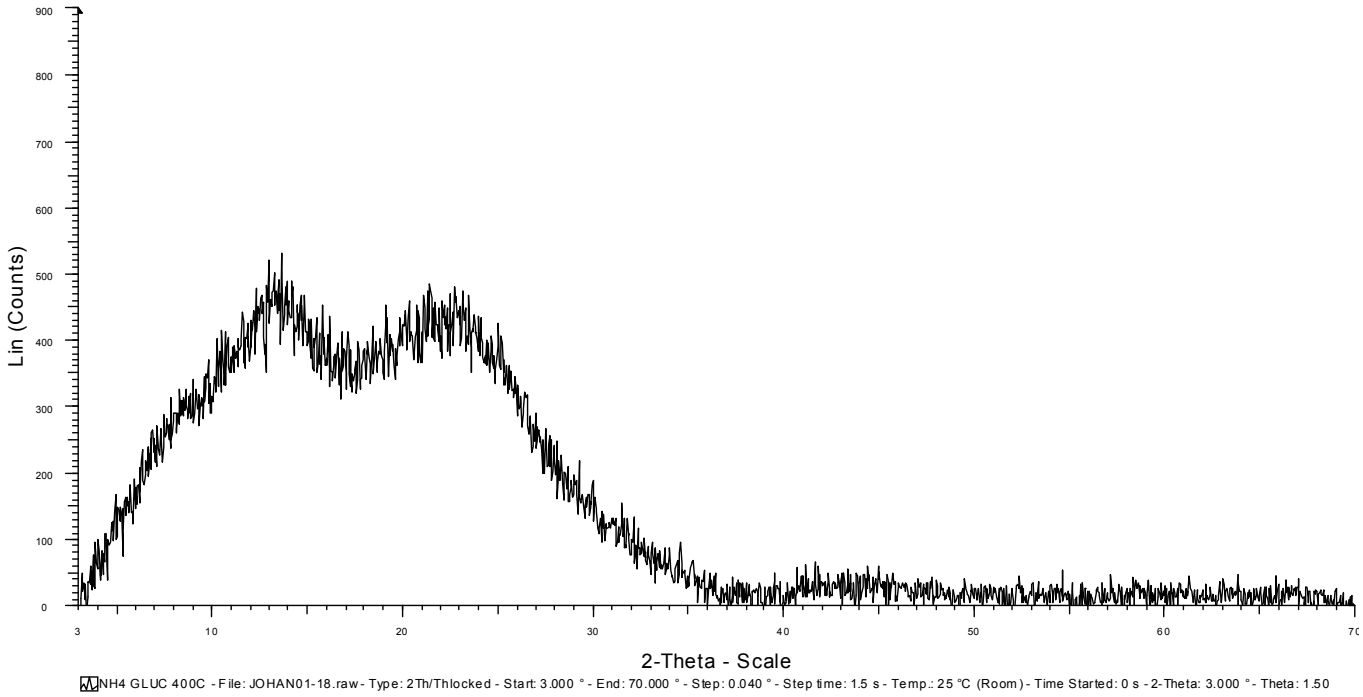


XRD spectrum of 4:1 mole ratio calcium gluconate and leached silica pyrolysed at 1000°C for 5 min in air

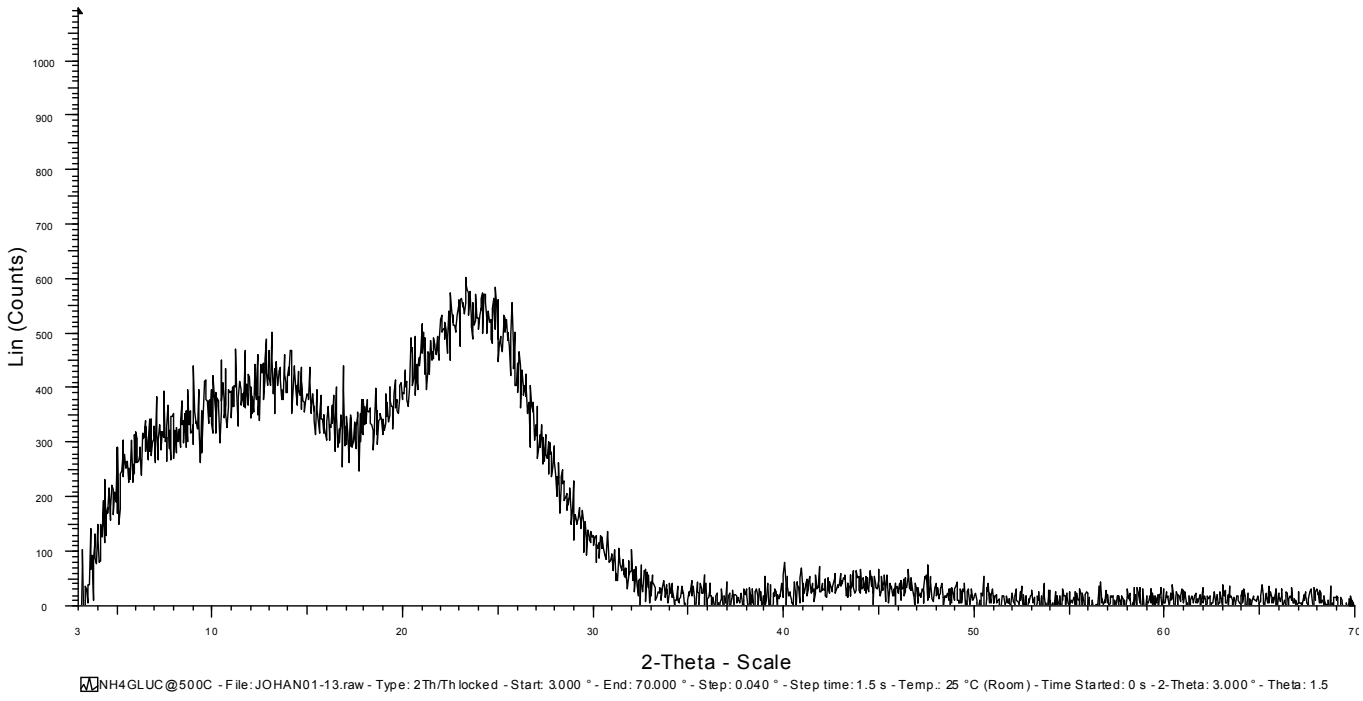
7.16.7. XRD pattern of ammonium gluconate hydrate pyrolised in air



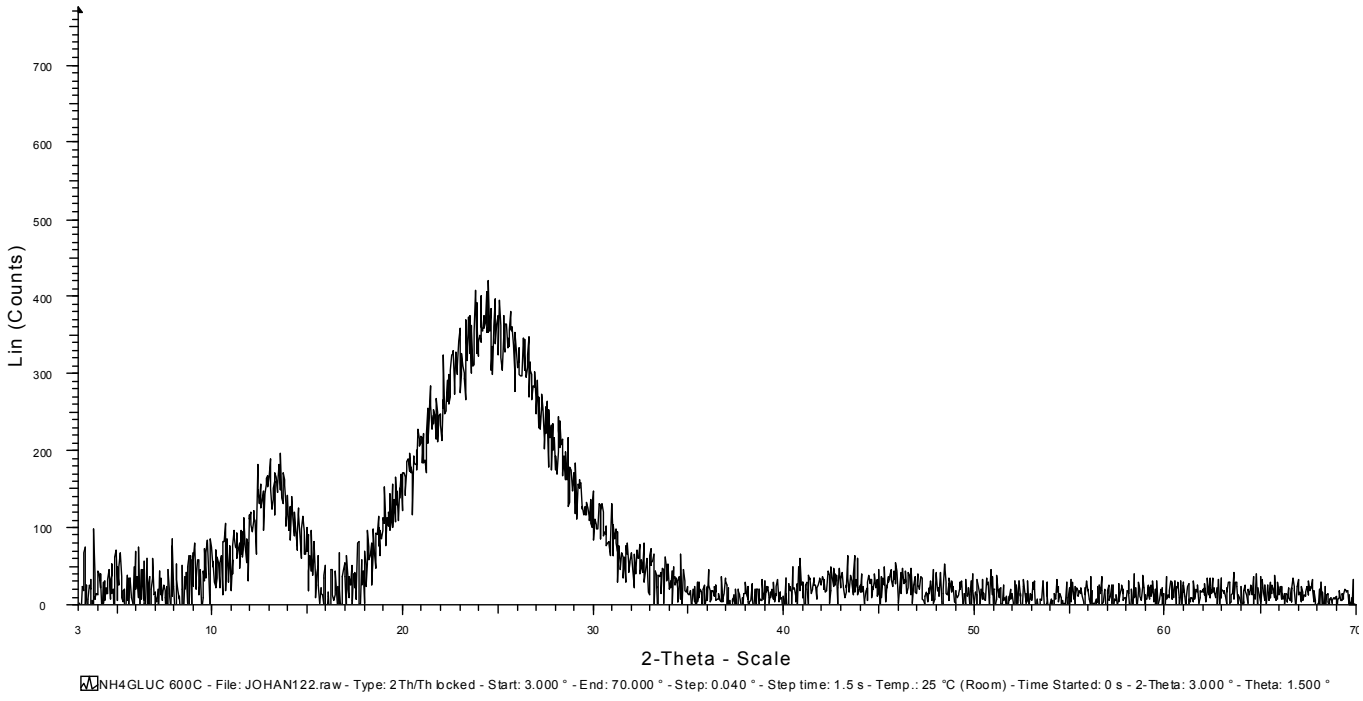
XRD spectrum of ammonium gluconate pyrolysed at 300°C for 5 min in air



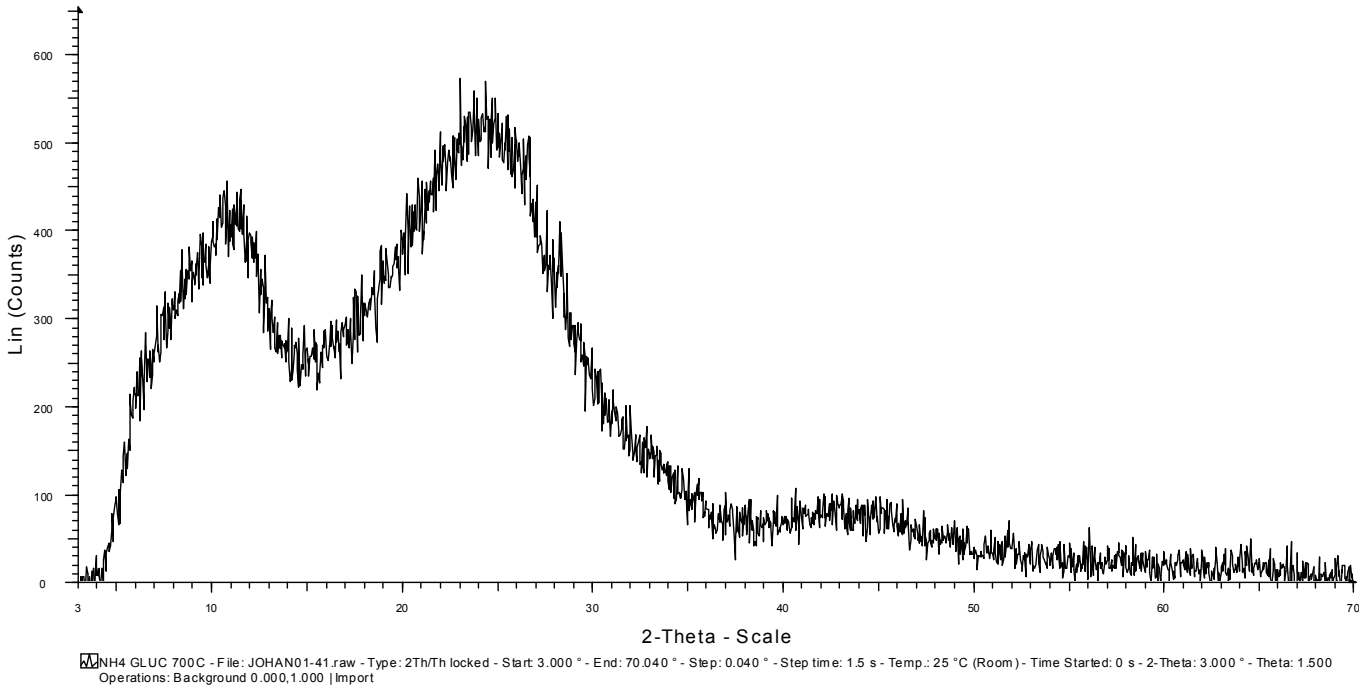
XRD spectrum of ammonium gluconate pyrolysed at 400°C for 5 min in air



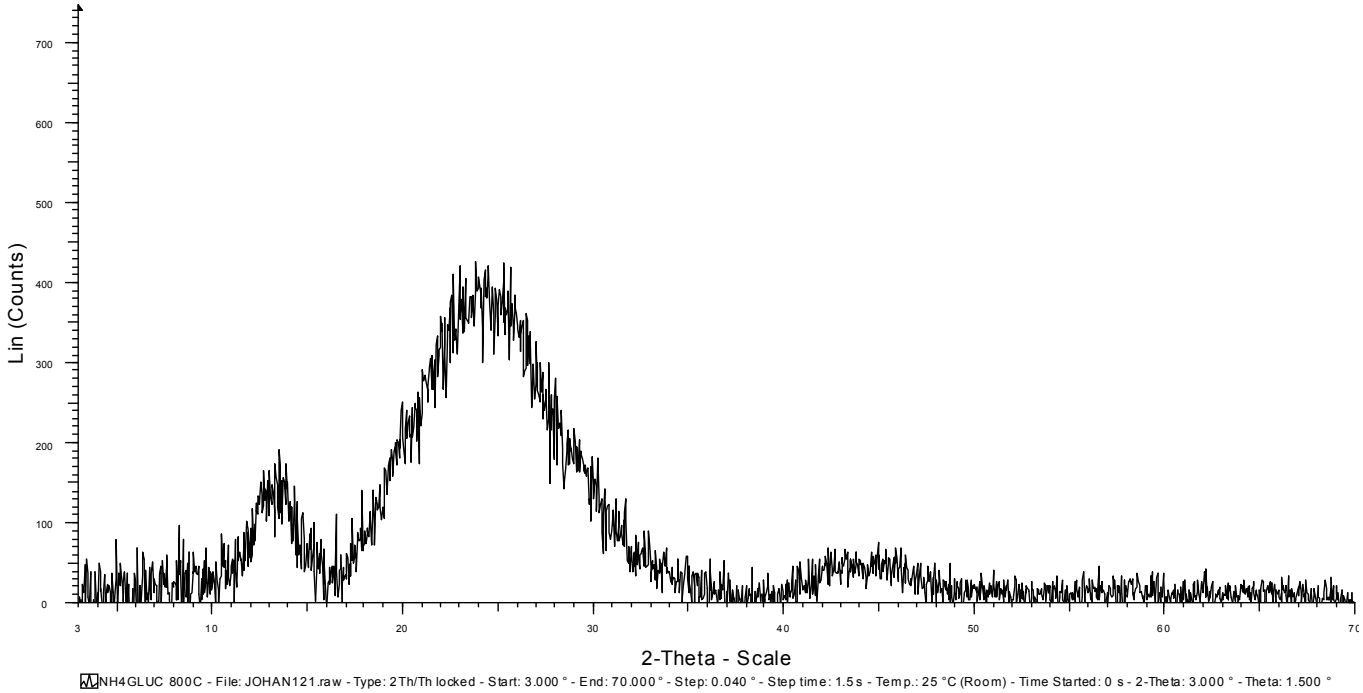
XRD spectrum of ammonium gluconate pyrolysed at 500°C for 5 min in air



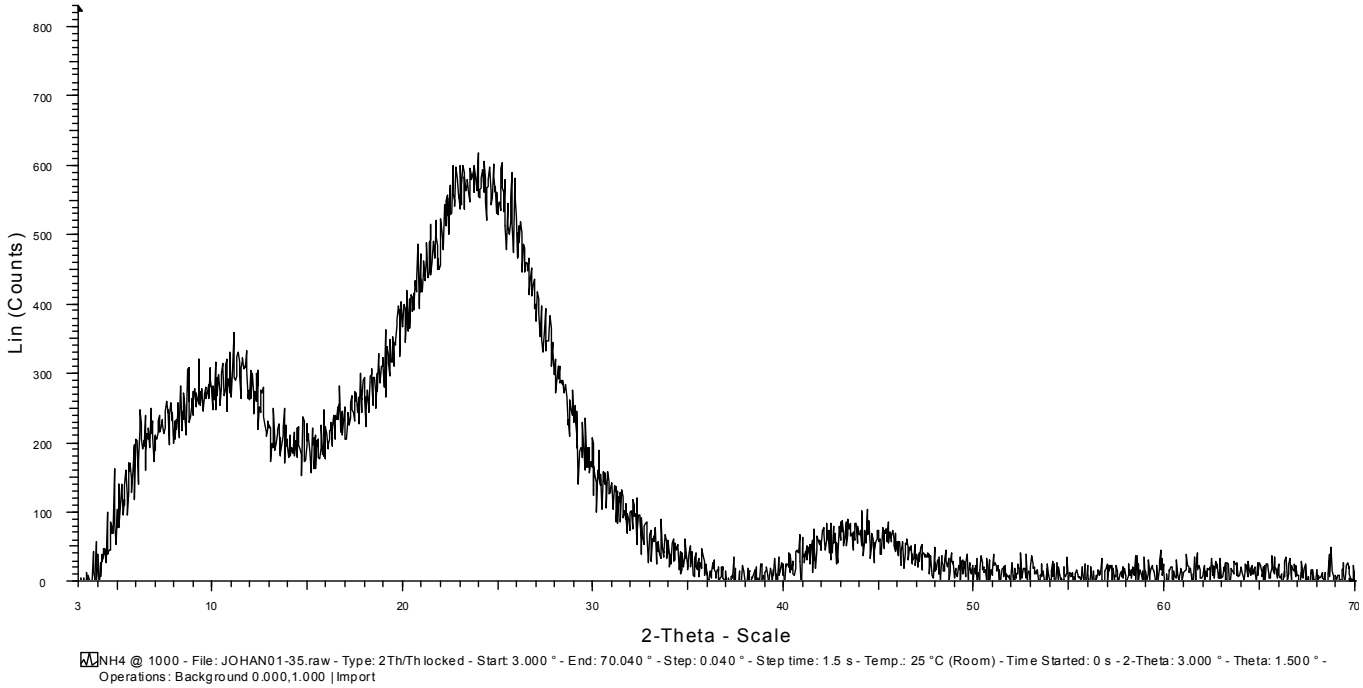
XRD spectrum of ammonium gluconate pyrolysed at 600°C for 5 min in air



XRD spectrum of ammonium gluconate pyrolysed at 700°C for 5 min in air

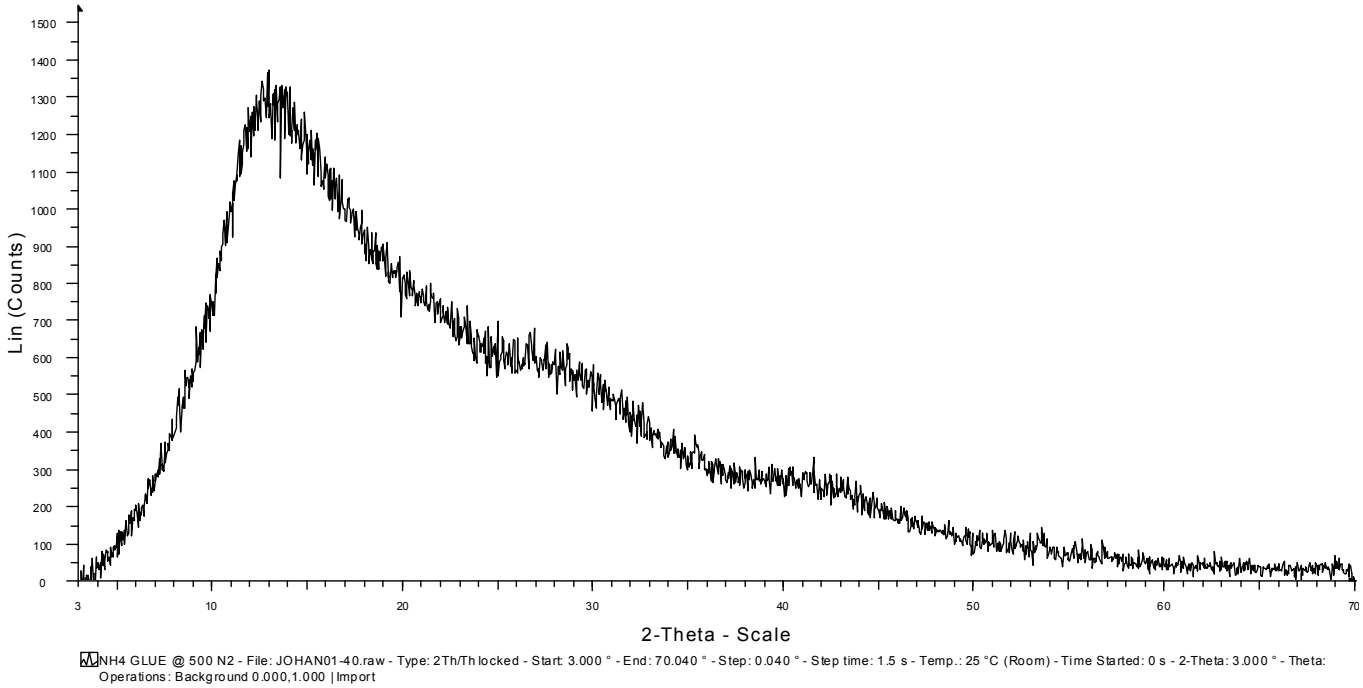


XRD spectrum of ammonium gluconate pyrolysed at 800°C for 5 min in air

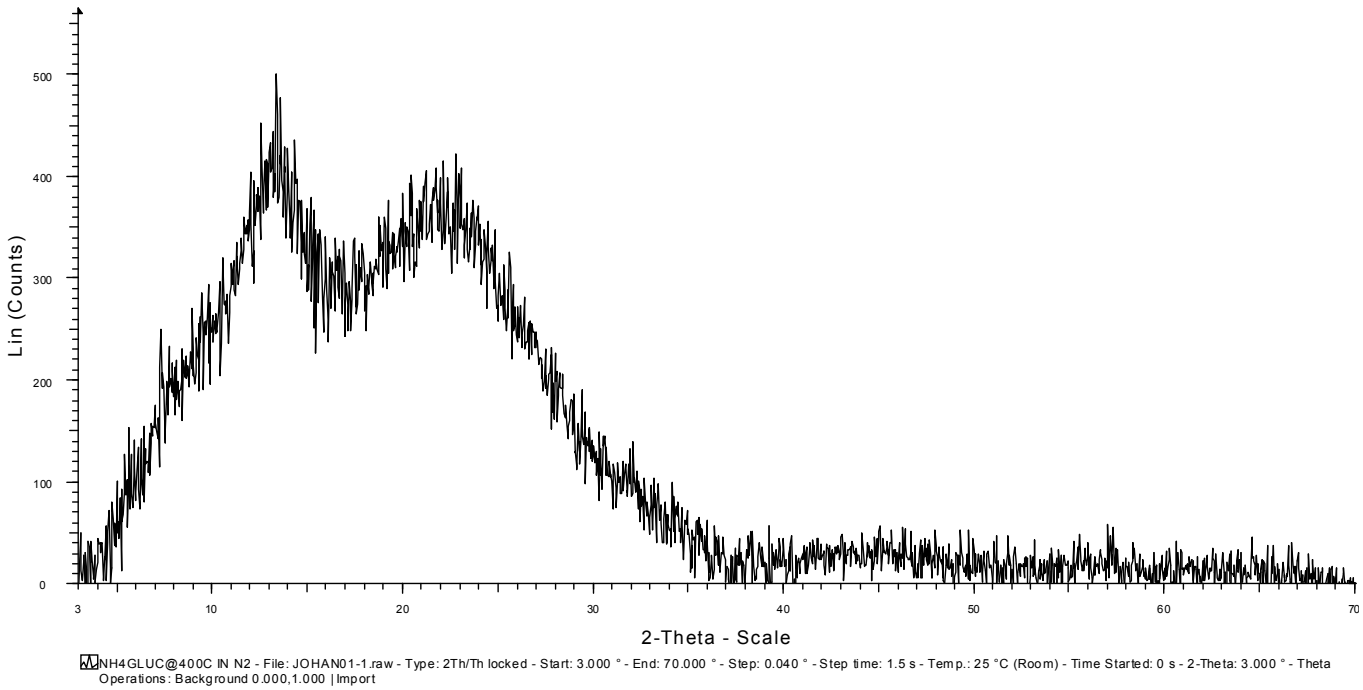


XRD spectrum of ammonium gluconate pyrolysed at 1000°C for 5 min in air

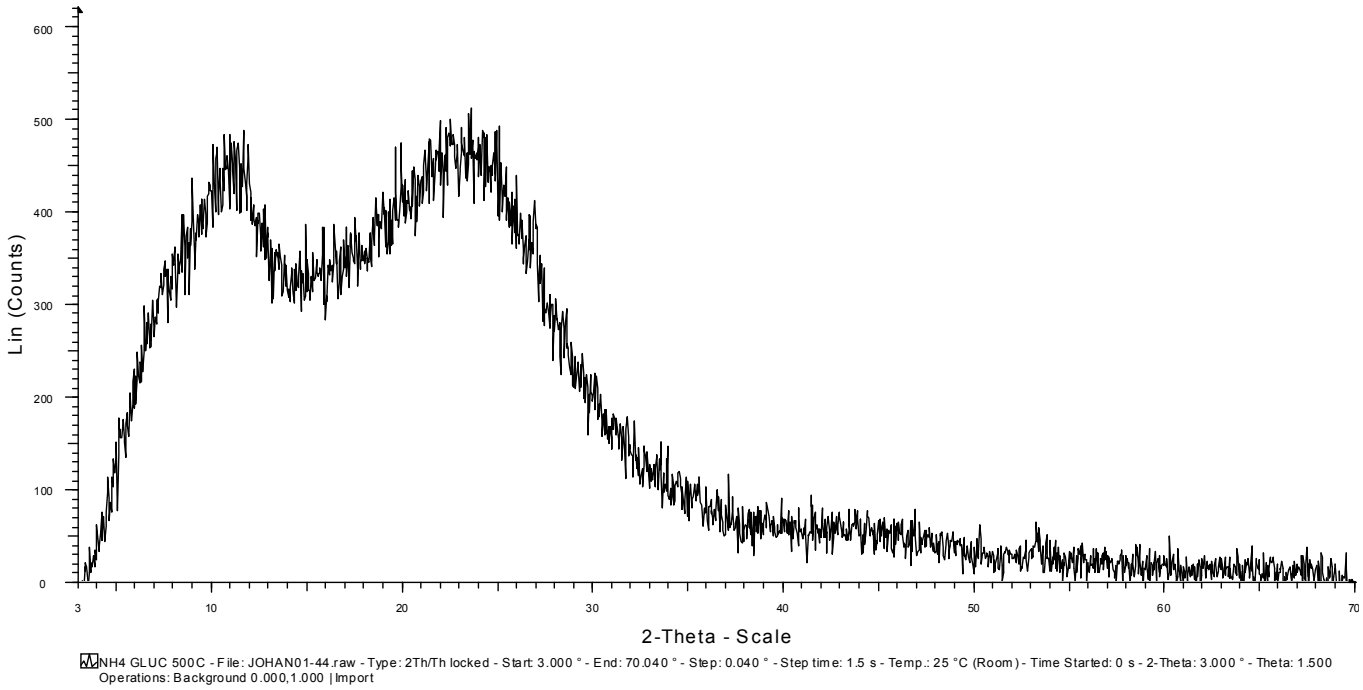
7.16.8. XRD pattern of ammonium gluconate pyrolised in nitrogen



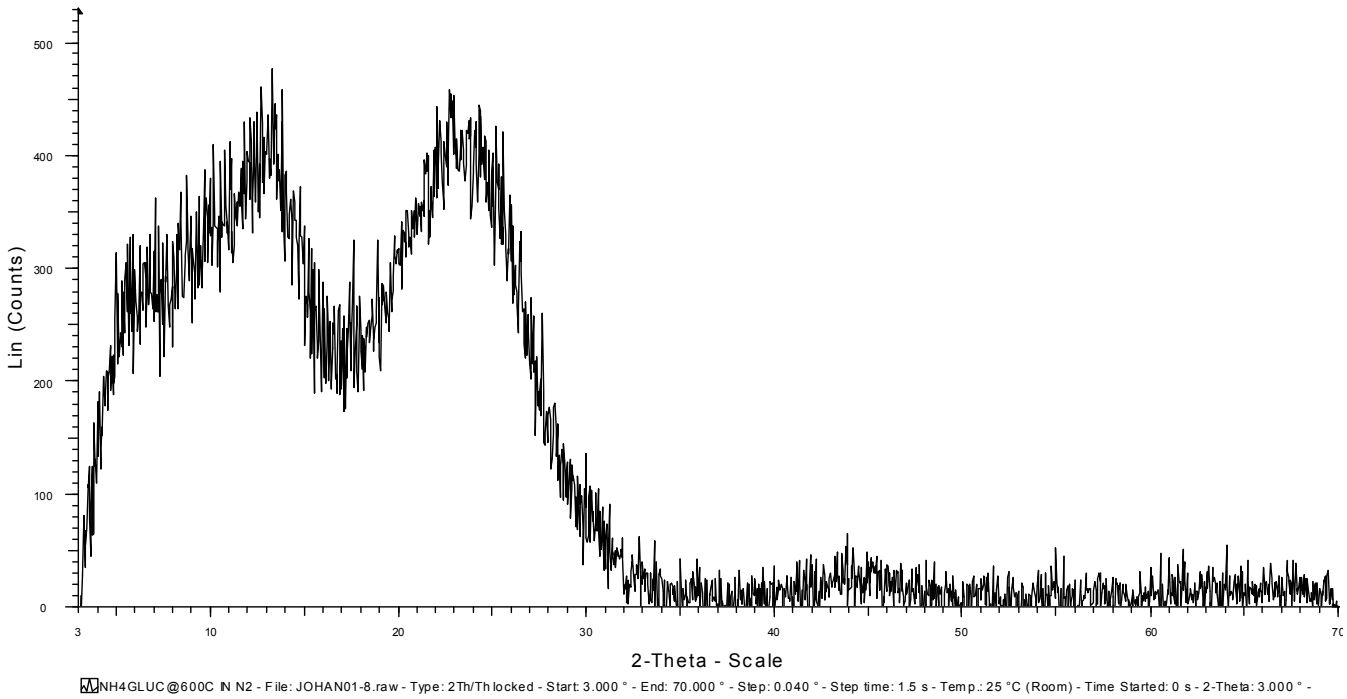
XRD spectrum of ammonium gluconate pyrolysed at 300°C for 5 min in nitrogen



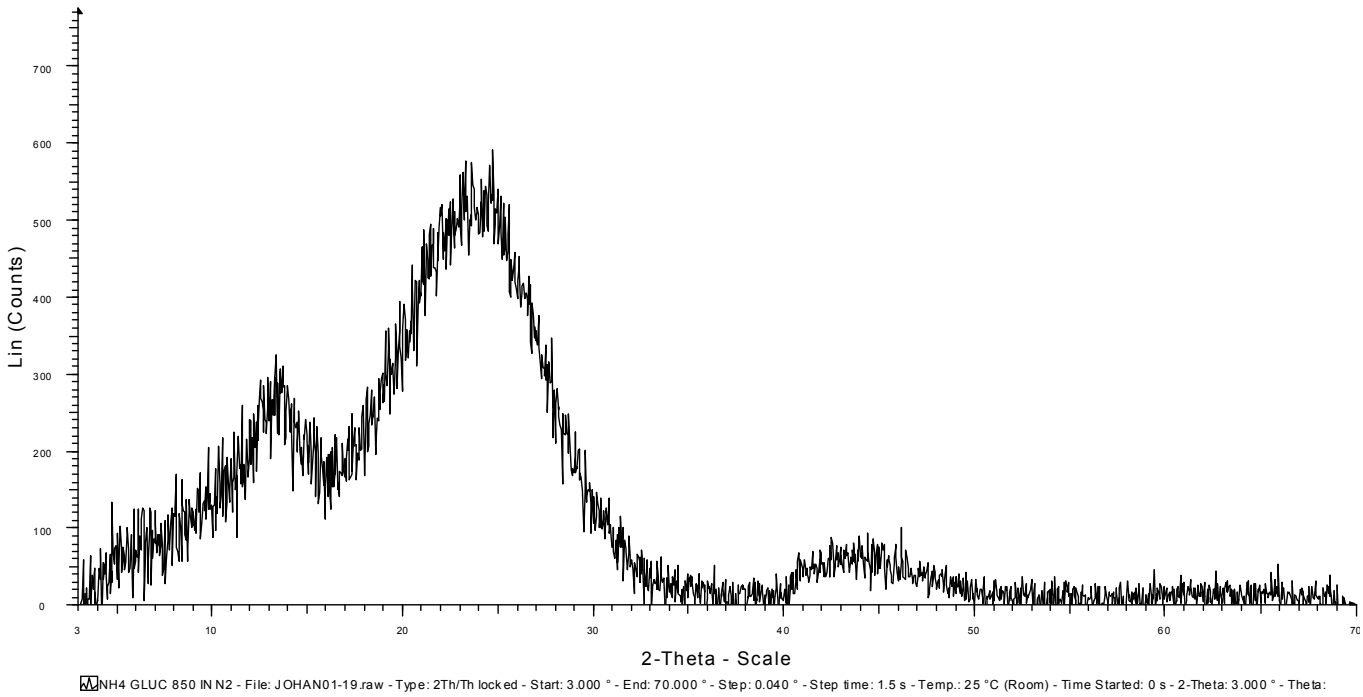
XRD spectrum of ammonium gluconate pyrolysed at 400°C for 5 min in nitrogen



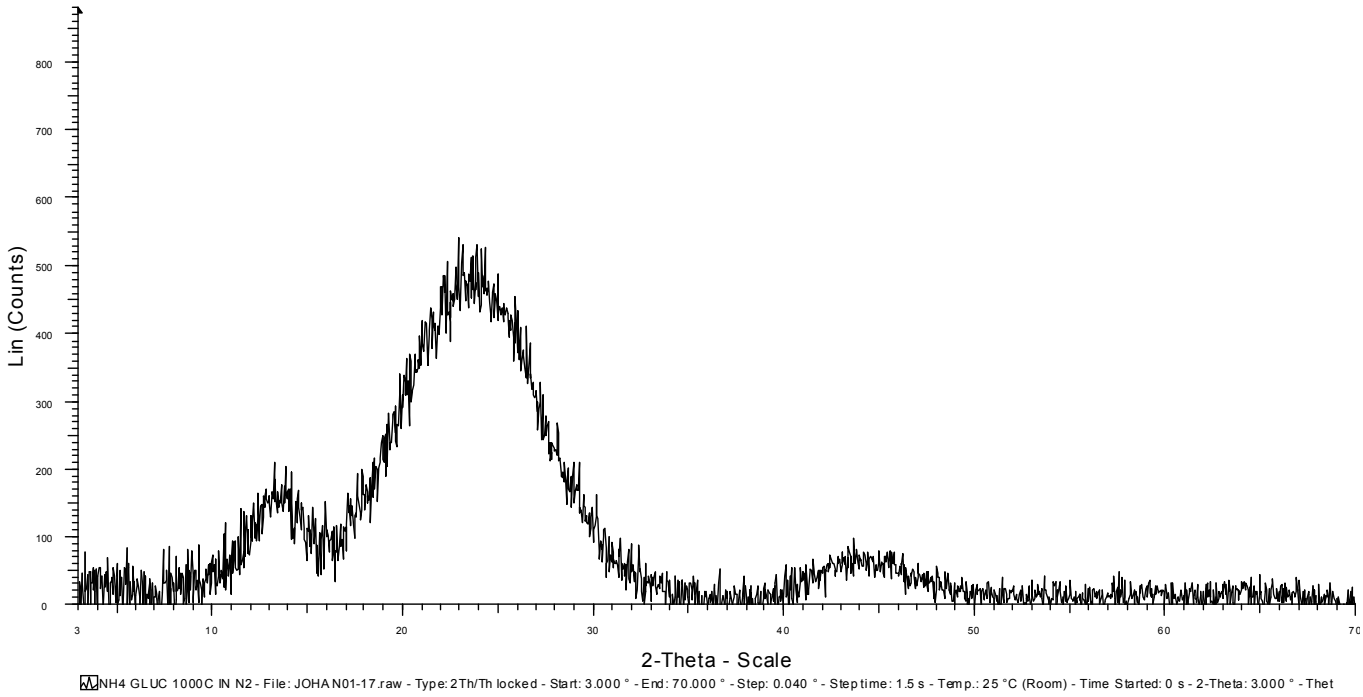
XRD spectrum of ammonium gluconate pyrolysed at 500°C for 5 min in nitrogen



XRD spectrum of ammonium gluconate pyrolysed at 600°C for 5 min in nitrogen

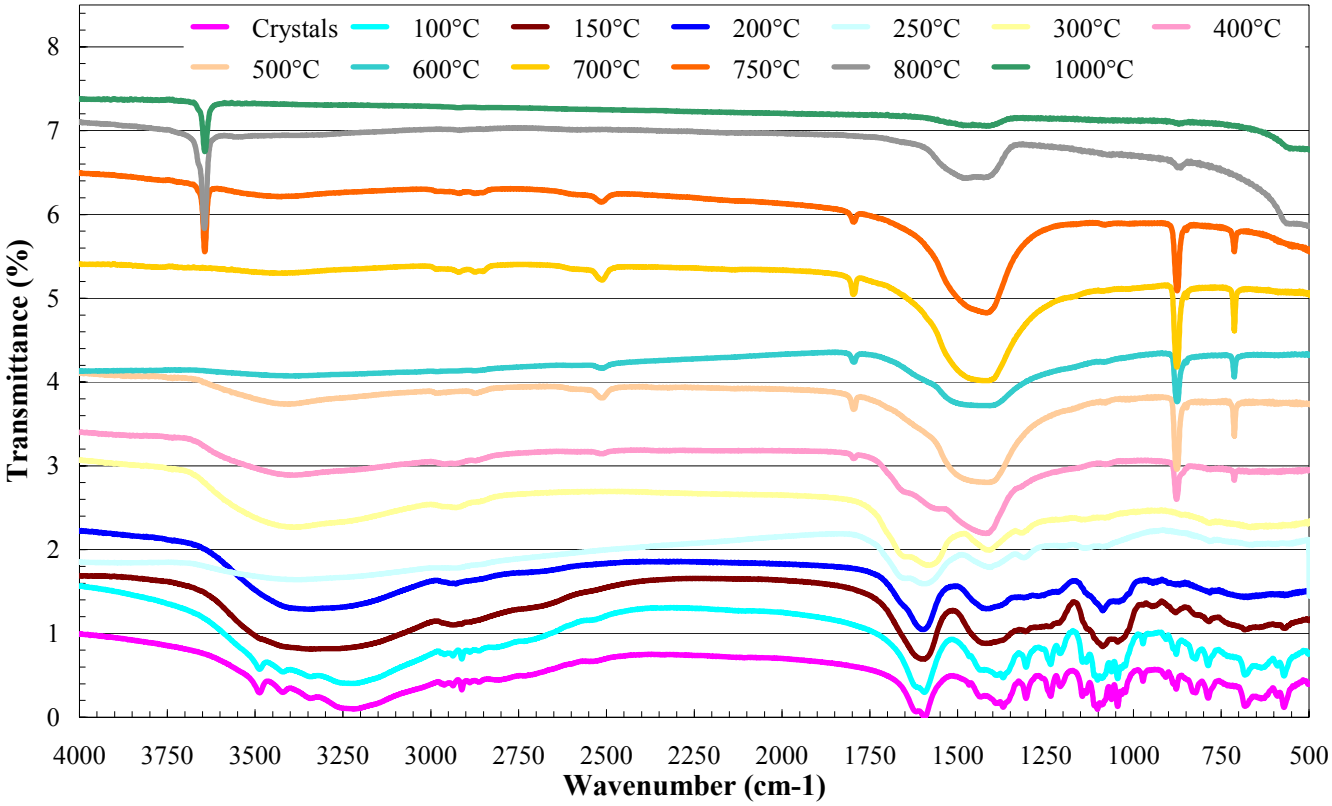


XRD spectrum of ammonium gluconate pyrolysed at 850°C for 5 min in nitrogen

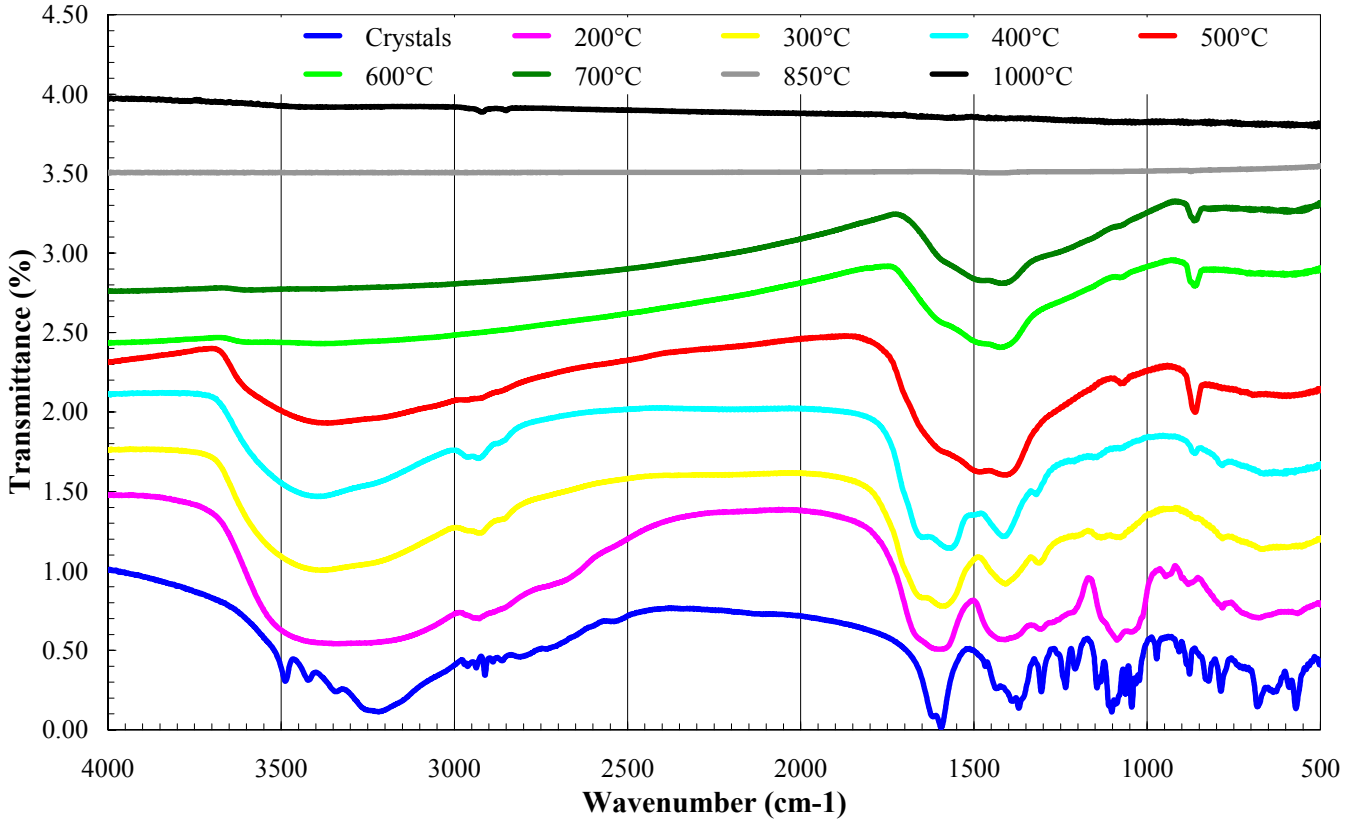


XRD spectrum of ammonium gluconate pyrolysed at 1000°C for 5 min in nitrogen

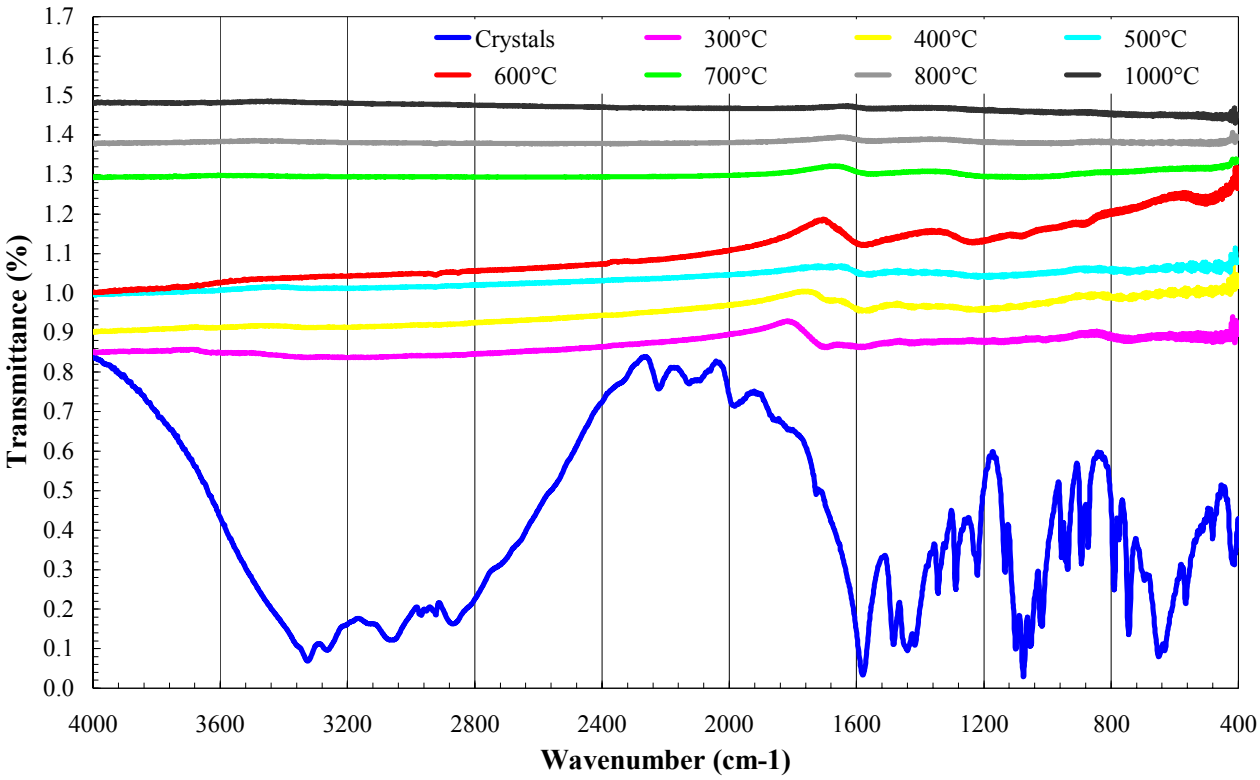
7.16.9. IR spectra of calcium gluconate monohydrate pyrolised in air



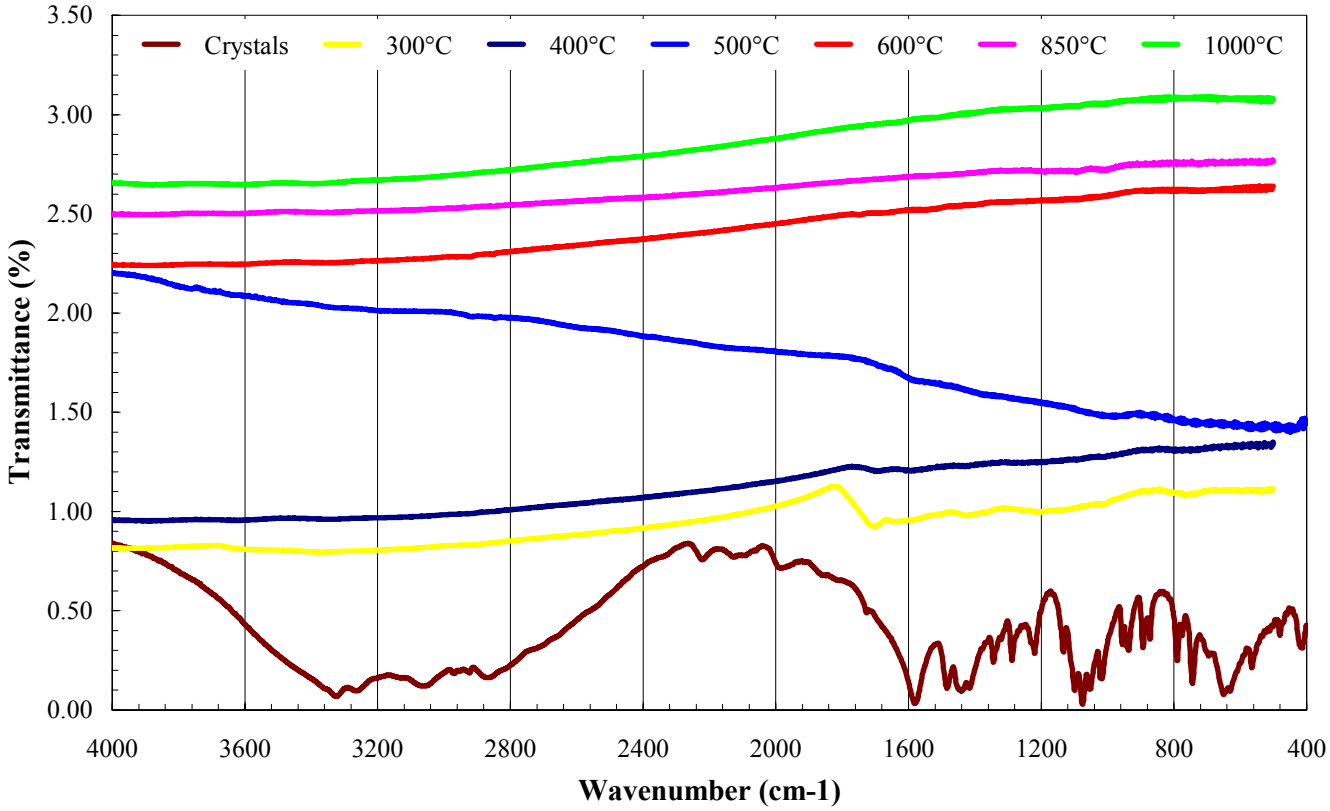
7.16.10. IR spectra of calcium gluconate pyrolised in nitrogen



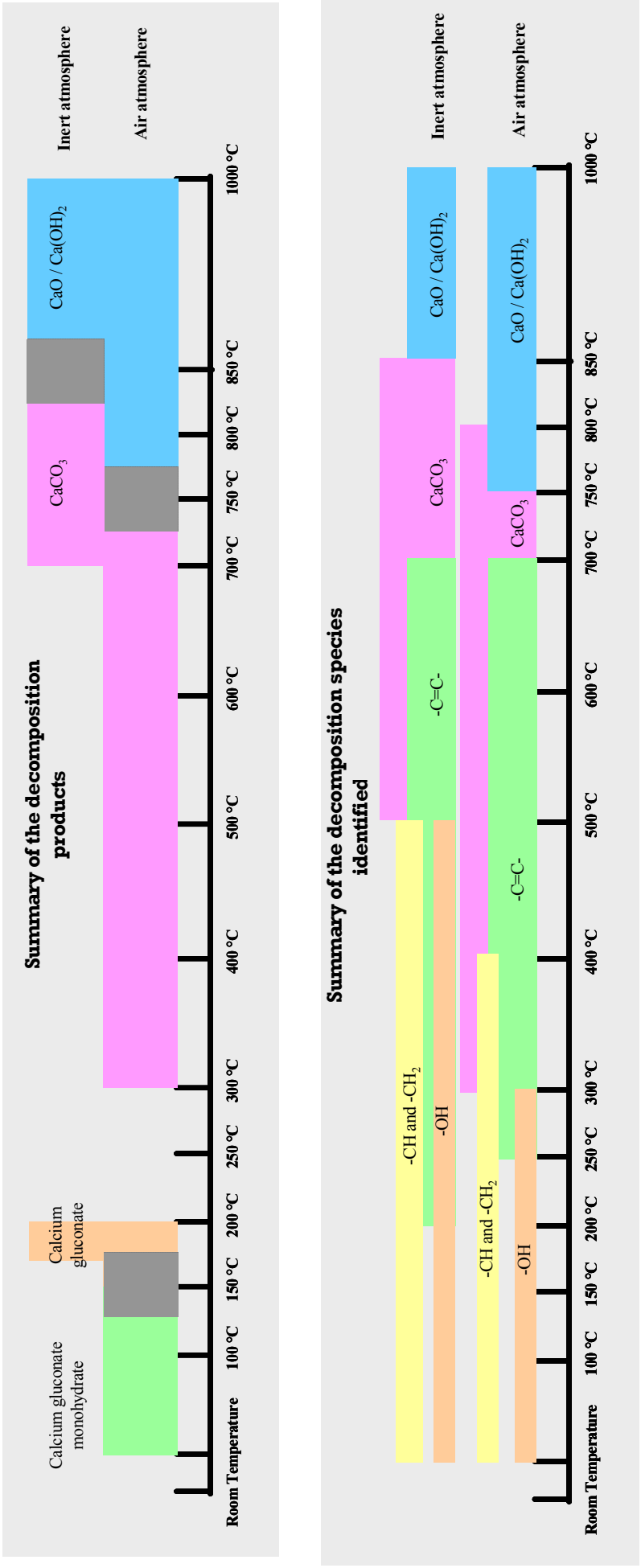
7.16.11. IR spectra of ammonium gluconate hydrate pyrolised in air



7.16.12. IR spectra of ammonium gluconate pyrolised in nitrogen



7.16.13 Decomposition products of calcium gluconate monohydrate



Graphic summary of the solid decomposition products of calcium gluconate monohydrate as identified with XRD and IR spectroscopy

7.17. Appendix Q

7.17.1. Thermal conductivity results from the SABS

```
Friday, September 29, 2000, Time 08:28

WinTherm32 Version 2.11
Instrument Program Version 38
Instrument Serial Number: 288


Sample Name: TKUP!
Sample Thickness: 5.025cm
        [ Polystyrene sample ]
Sample Thickness obtained    :  from instrument

TEST RUN

Calibration used   :  1450b
Calibration read from instrument

Number of transdusers per plate:        1
Number of transdusers used per plate:   1

Number of Setpoints: 2

Block Averages for setpoint 1 in SI units

Tupper  Tlower  Qupper  Qlower  Lambda
 [°C]    [°C]    [µV]    [µV]    [W/mK]
 10.01   35.01   -1676    1930  0.04023
 10.01   35.02   -1670    1935  0.04021
 10.01   35.02   -1669    1931  0.04015
 10.01   35.02   -1669    1928  0.04012
 10.01   35.02   -1669    1927  0.04010
 10.01   35.02   -1669    1924  0.04007
 10.01   35.02   -1668    1923  0.04004
 10.01   35.02   -1667    1922  0.04003
 10.01   35.02   -1666    1922  0.04002
 10.01   35.02   -1665    1921  0.03999

Friday, September 29, 2000, Time 09:24

Setpoint No.    1
  Setpoint Upper:       10.00 °C
  Setpoint Lower:       35.00 °C
    Temperature Upper:  10.01 °C
    Results Upper:              0.04006 W/mK
    Temperature Lower:  35.02 °C
    Results Lower:              0.04001 W/mK
    Percent Difference: 0.12%


        Experiment's Criteria:
        Temperature Equilibrium:        0.20
        Between Block HFM Equil.:       70
        HFM Percent Change:     2.00
        Min Number of Blocks:   10
        Calculation Blocks:             5

Block Averages for setpoint 2 in SI units

Tupper  Tlower  Qupper  Qlower  Lambda
 [°C]    [°C]    [µV]    [µV]    [W/mK]
 30.02   50.02   -1428    1700  0.04252
 30.03   50.03   -1439    1687  0.04250
 30.02   50.02   -1444    1682  0.04253
 30.02   50.01   -1443    1686  0.04257
 30.02   50.03   -1443    1687  0.04256
 30.02   50.02   -1446    1680  0.04252
 30.02   50.01   -1446    1681  0.04256
 30.02   50.02   -1447    1678  0.04252
 30.02   50.02   -1446    1681  0.04255
 30.02   50.01   -1446    1677  0.04251

Friday, September 29, 2000, Time 10:24

Setpoint No.    2
  Setpoint Upper:       30.00 °C
  Setpoint Lower:       50.00 °C
    Temperature Upper:  30.02 °C
    Results Upper:              0.04230 W/mK
    Temperature Lower:  50.02 °C
    Results Lower:              0.04276 W/mK
    Percent Difference: 1.08%


        Experiment's Criteria:
        Temperature Equilibrium:        0.20
        Between Block HFM Equil.:       70
        HFM Percent Change:     2.00
        Min Number of Blocks:   10
        Calculation Blocks:             5

Results Table -- SI Units

Mean Temp       Upper Cond      Lower Cond      Average Cond
22.52           0.04006         0.04001         0.04003
40.02           0.04230         0.04276         0.04253
```

Friday, September 29, 2000, Time 11:09

WinTherm32 Version 2.11
Instrument Program Version 38
Instrument Serial Number: 288

Sample Name: TKUP2
Sample Thickness: 5.027cm
{ Polystyrene sample with sample in the middle
Sample Thickness obtained : from instrument

TEST RUN

Calibration used : 1450b
Calibration read from instrument

Number of transdusers per plate: 1
Number of transdusers used per plate: 1

Number of Setpoints: 2

Block Averages for setpoint 1 in SI units

Tupper [°C]	Tlower [°C]	Qupper [µV]	Qlower [µV]	Lambda [W/mK]
10.00	35.01	-1741	1960	0.04132
10.01	35.02	-1725	1959	0.04112
10.01	35.02	-1715	1948	0.04088
10.01	35.02	-1708	1943	0.04074
10.01	35.02	-1700	1933	0.04055
10.01	35.02	-1699	1921	0.04041
10.01	35.02	-1695	1918	0.04034
10.00	35.02	-1682	1919	0.04019
10.02	35.02	-1674	1919	0.04010
10.02	35.03	-1675	1916	0.04007

Friday, September 29, 2000, Time 12:09

Setpoint No. 1
Setpoint Upper: 10.00 °C
Setpoint Lower: 35.00 °C
Temperature Upper: 10.01 °C
Results Upper: 0.04050 W/mK
Temperature Lower: 35.02 °C
Results Lower: 0.03994 W/mK
Percent Difference: 1.39%

Experiment's Criteria:
Temperature Equilibrium: 0.20
Between Block HFM Equil.: 70
HFM Percent Change: 2.00
Min Number of Blocks: 10
Calculation Blocks: 5

Block Averages for setpoint 2 in SI units

Tupper [°C]	Tlower [°C]	Qupper [µV]	Qlower [µV]	Lambda [W/mK]
30.02	50.01	-1462	1706	0.04311
30.02	50.03	-1460	1711	0.04313
30.02	50.03	-1461	1687	0.04283
30.02	50.02	-1458	1677	0.04267
30.02	50.03	-1455	1675	0.04259
30.02	50.03	-1451	1668	0.04246
30.02	50.02	-1450	1664	0.04240
30.02	50.04	-1448	1668	0.04239
30.02	50.03	-1446	1651	0.04216
30.02	50.02	-1444	1649	0.04214

Friday, September 29, 2000, Time 13:09

Setpoint No. 2
Setpoint Upper: 30.00 °C
Setpoint Lower: 50.00 °C
Temperature Upper: 30.02 °C
Results Upper: 0.04235 W/mK
Temperature Lower: 50.03 °C
Results Lower: 0.04227 W/mK
Percent Difference: 0.19%

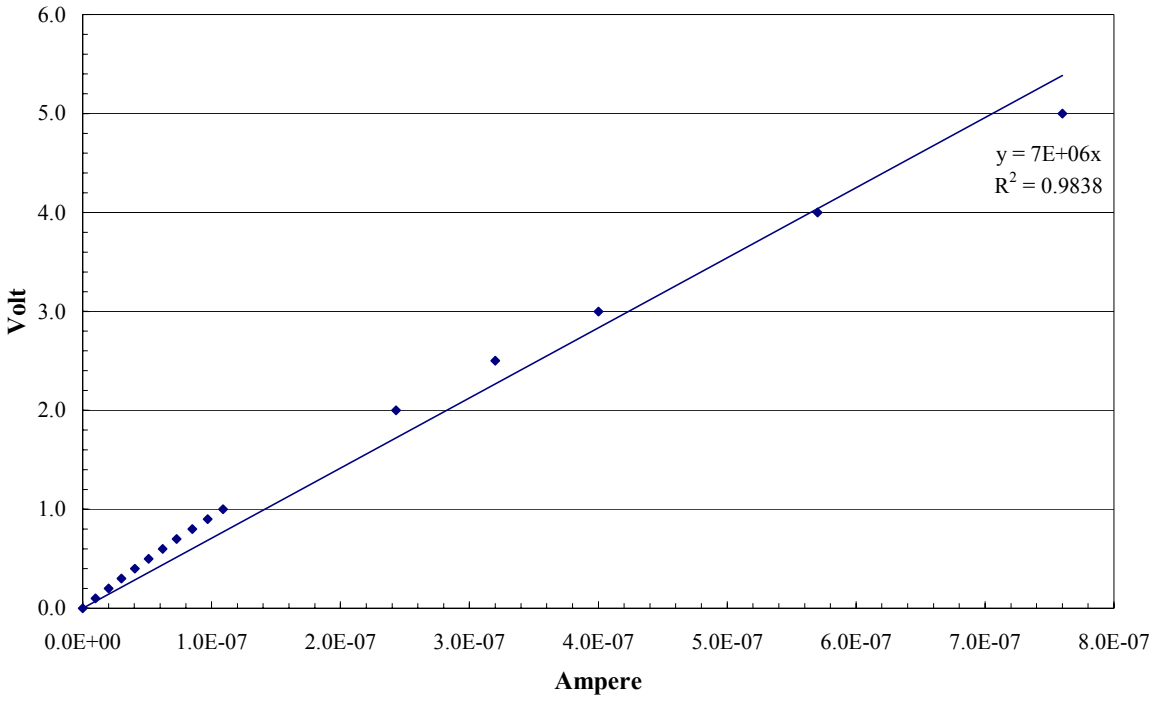
Experiment's Criteria:
Temperature Equilibrium: 0.20
Between Block HFM Equil.: 70
HFM Percent Change: 2.00
Min Number of Blocks: 10
Calculation Blocks: 5

Results Table -- SI Units

Mean Temp	Upper Cond	Lower Cond	Average Cond
22.52	0.04050	0.03994	0.04022
40.02	0.04235	0.04227	0.04231

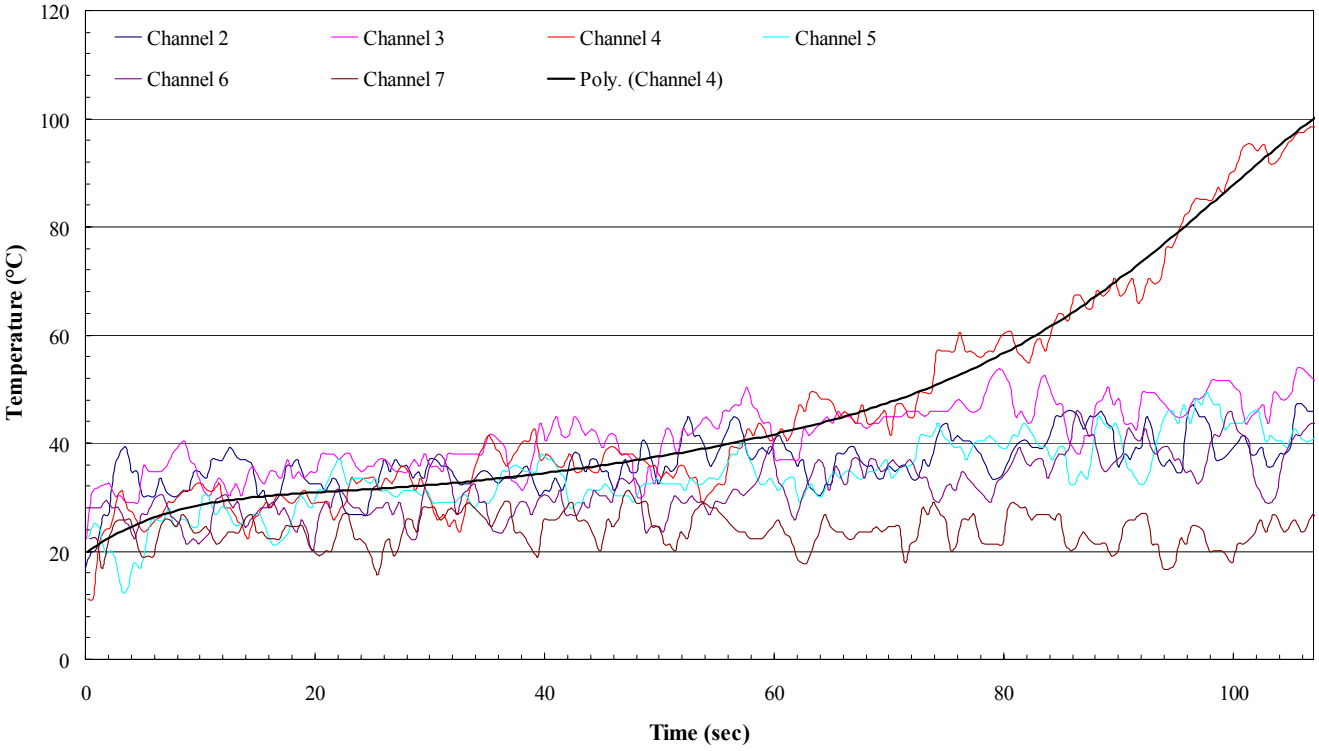
7.18. Appendix R

7.18.1. Electric conductivity for the pyrolysed ammonium gluconate

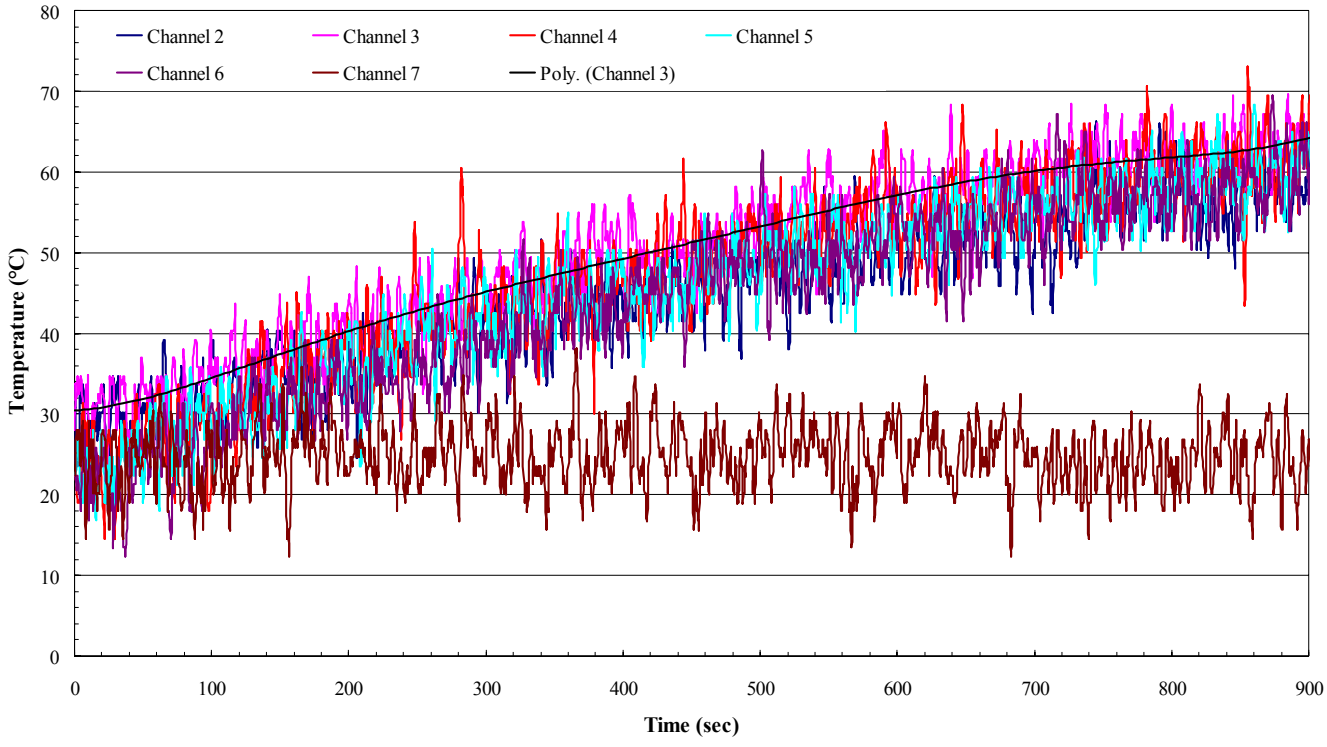


7.19. Appendix S

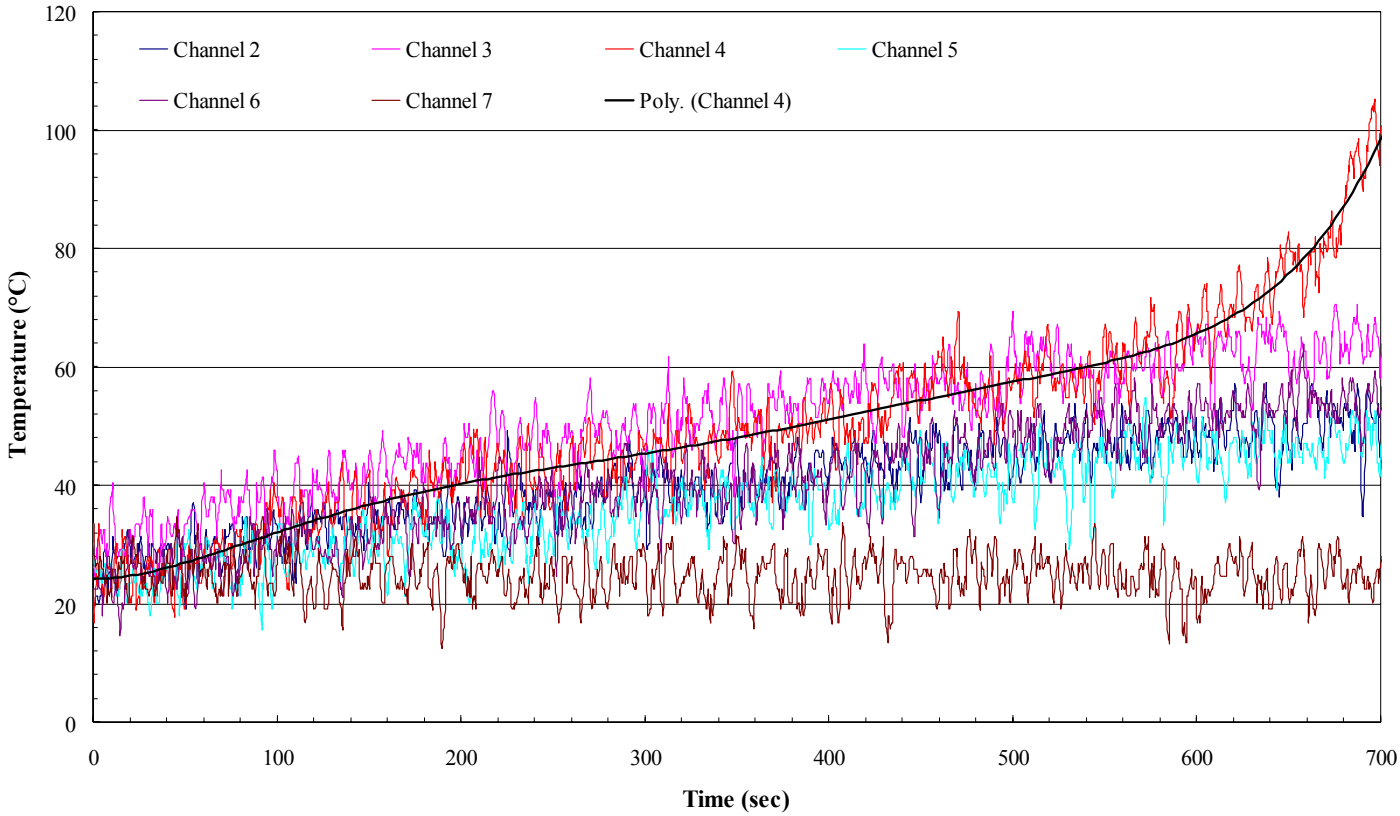
7.19.1. Burn through tests for the painted balsa wood planks – Graphs



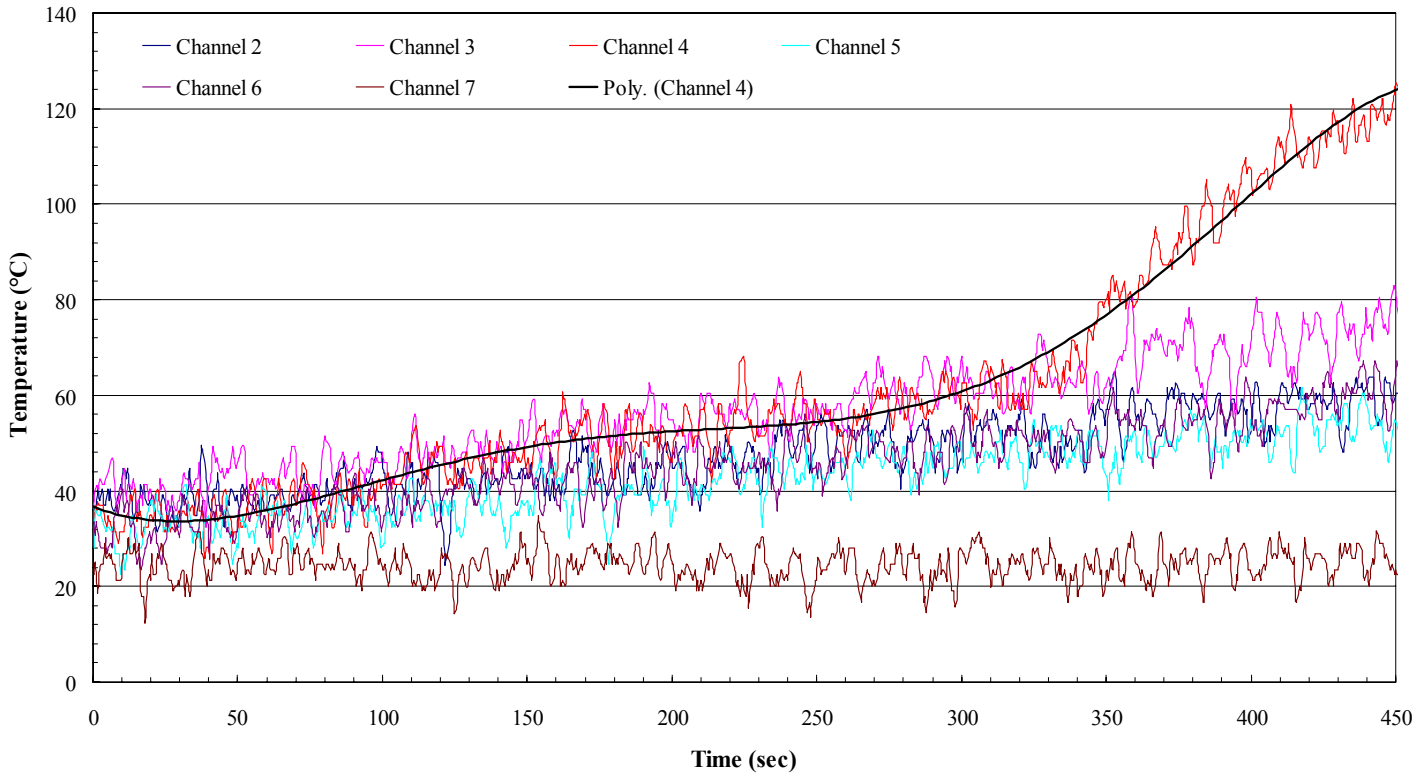
Balsa wood plank not painted (control)



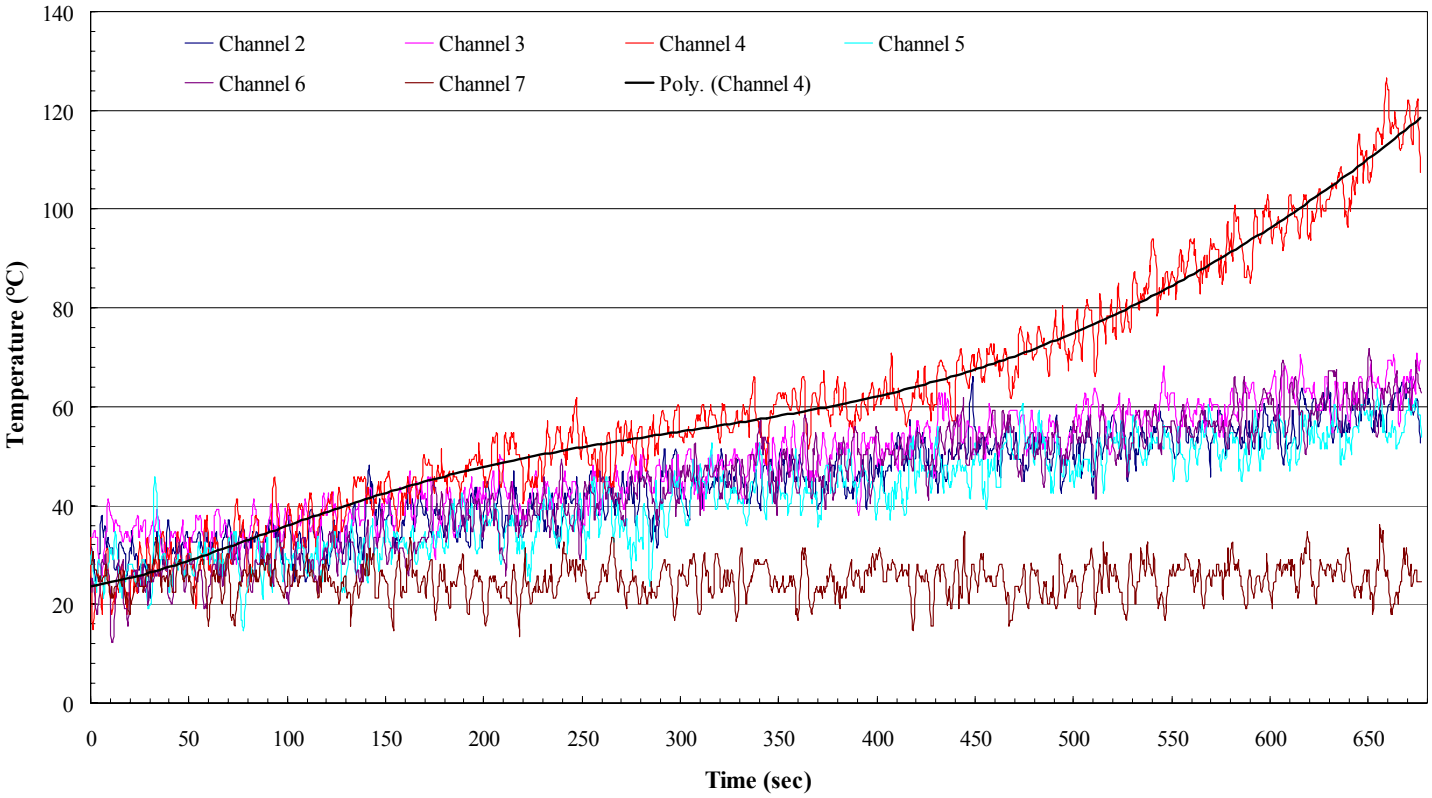
Balsa wood plank painted with AP750



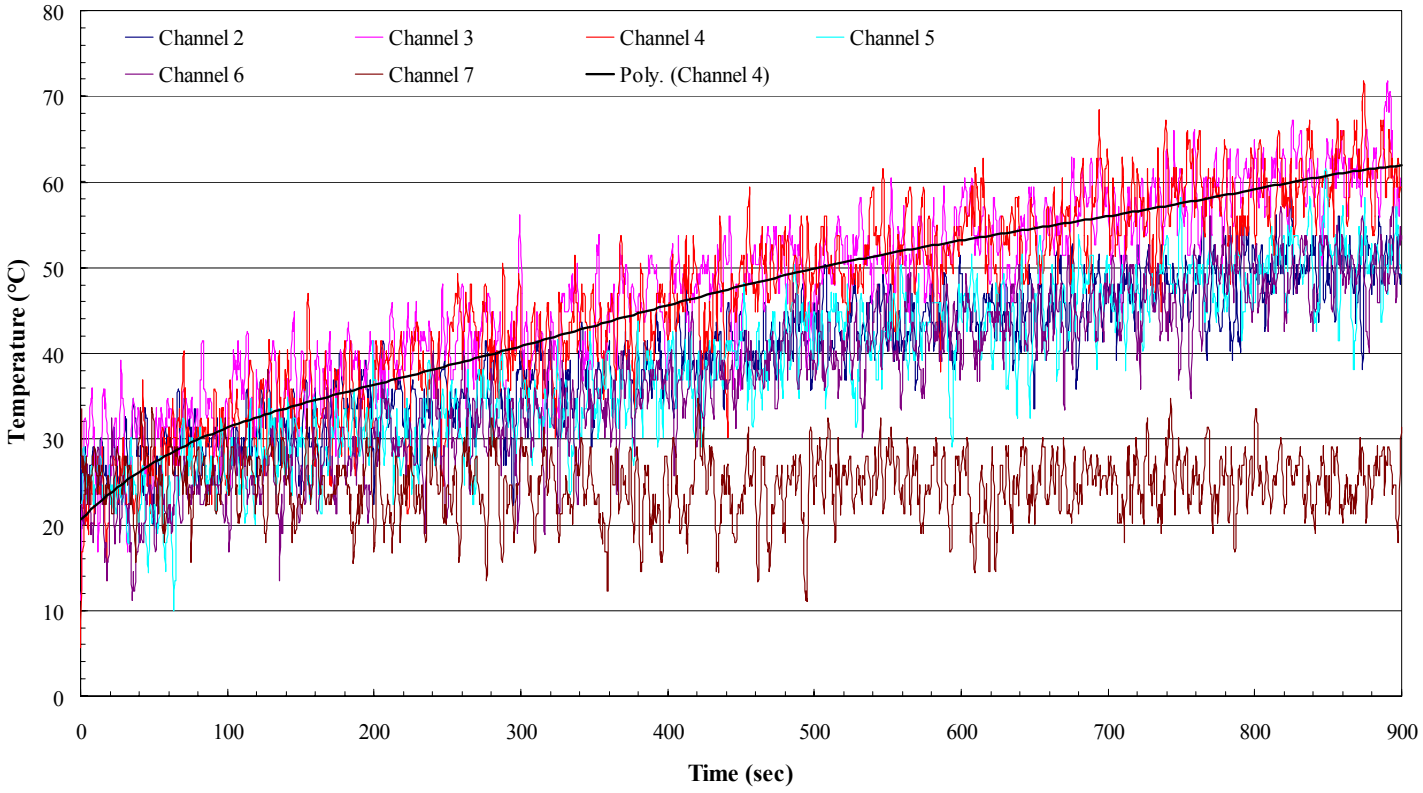
Balsa wood plank painted with PEN



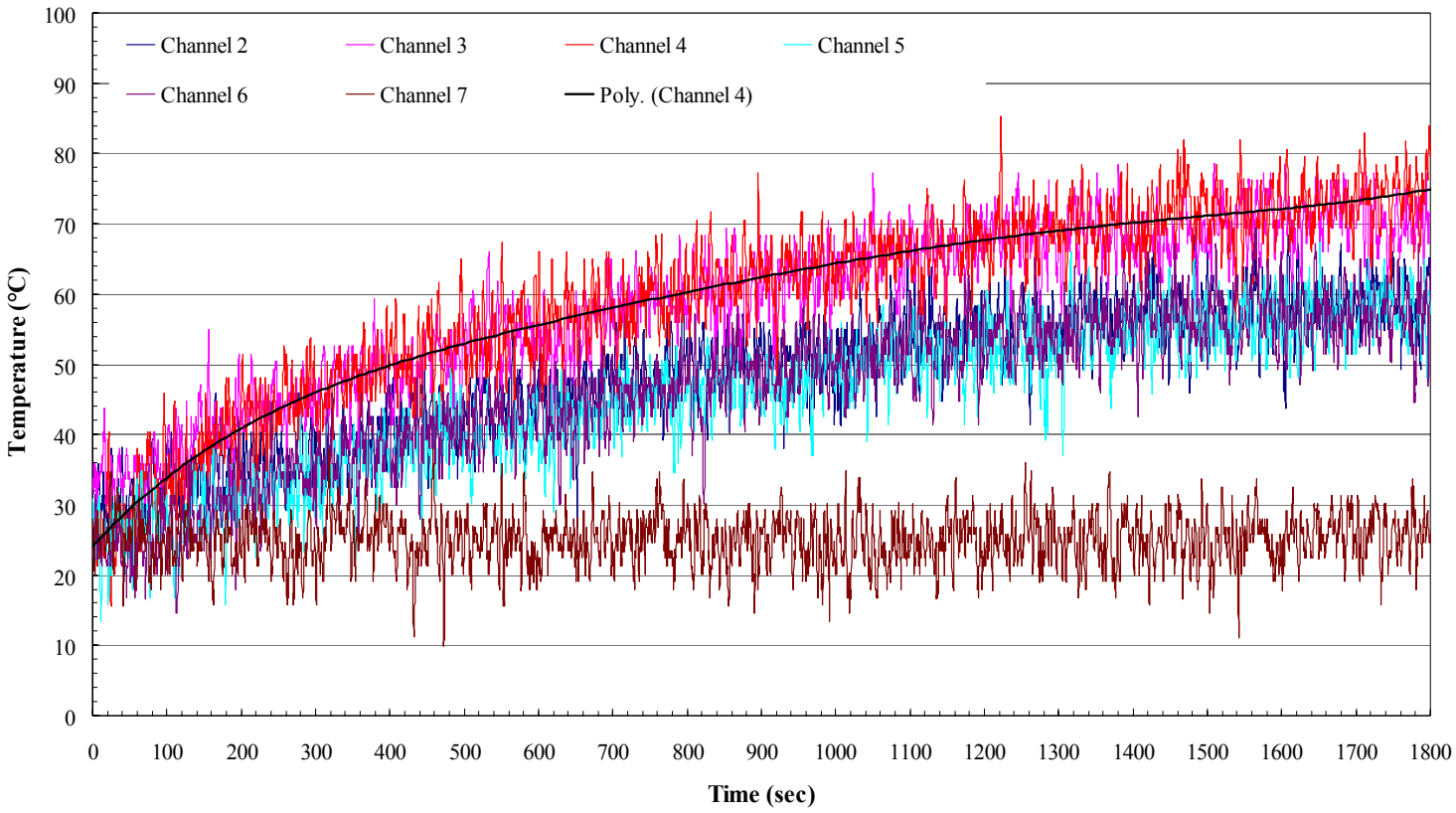
Balsa wood plank painted with Calcium gluconate



Balsa wood plank painted with Calcium gluconate and leached SiO_2



Balsa wood plank painted with Calcium gluconate and Expandable graphite



Balsa wood plank painted with Calcium gluconate, Leached SiO_2 and Expandable graphite

7.19.2. Burn through tests for the painted balsa wood planks – Pictures




With no coating: Left top – 30 sec exposure Right top – 50 sec exposure

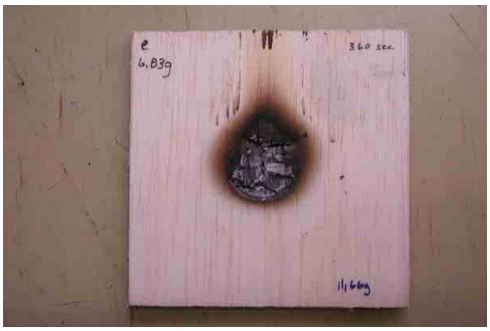
Left and right bottom – 80 sec exposure



With AP750 coating: Left top – 60 sec exposure Right top – 180 sec exposure

Left and right bottom – 960 sec exposure






With Gluconate/silica/graphite coating: Left top – 60 sec exposure

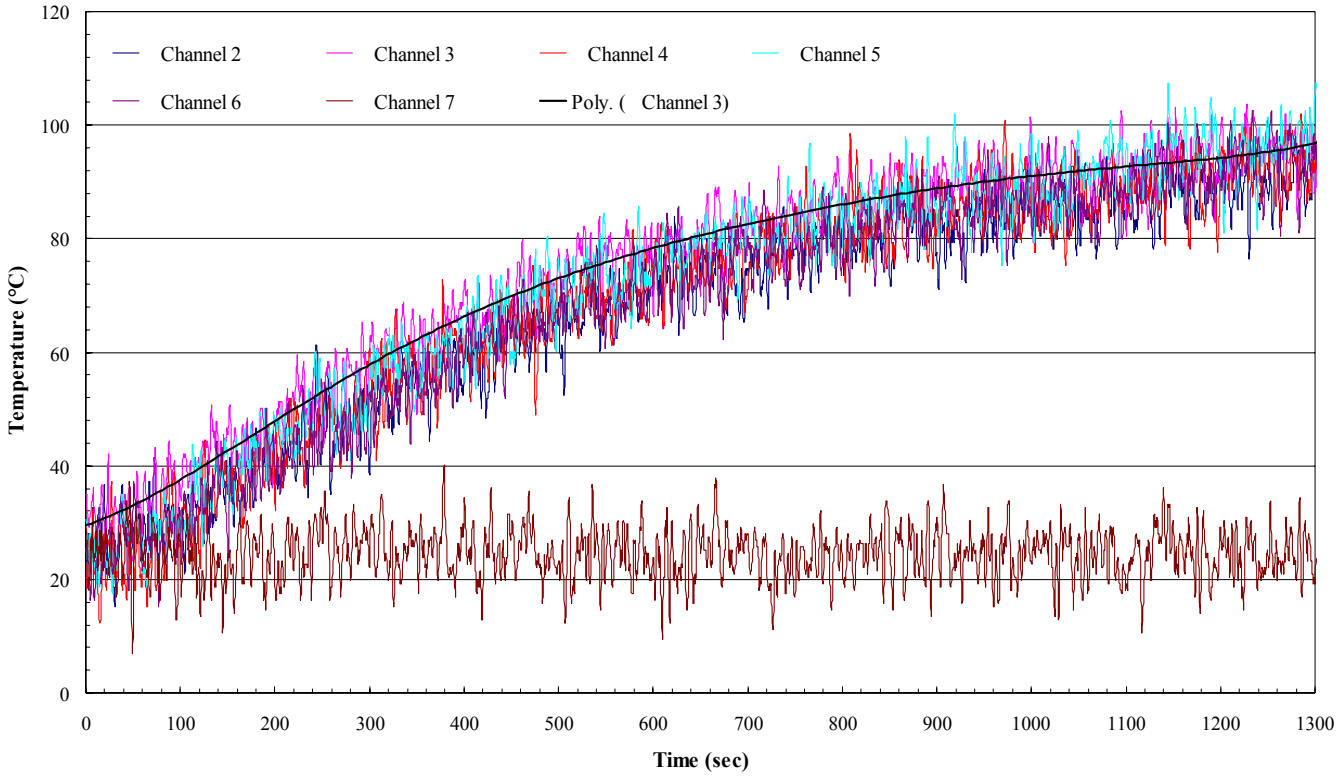
Right top – 270 sec exposure Left and right bottom – 360 sec exposure



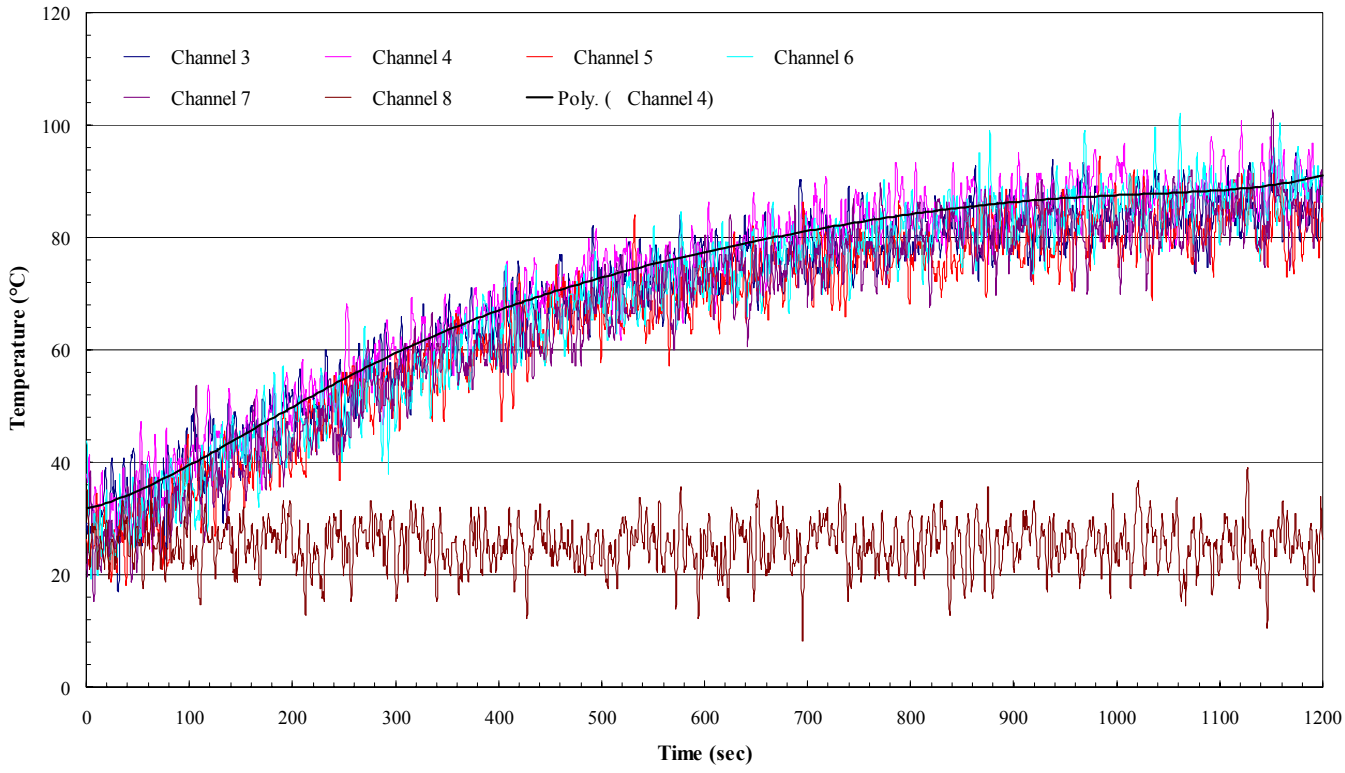

With PEN coating: Left top – 30 sec exposure Right top – 150 sec exposure

Left and right bottom – 180 sec exposure

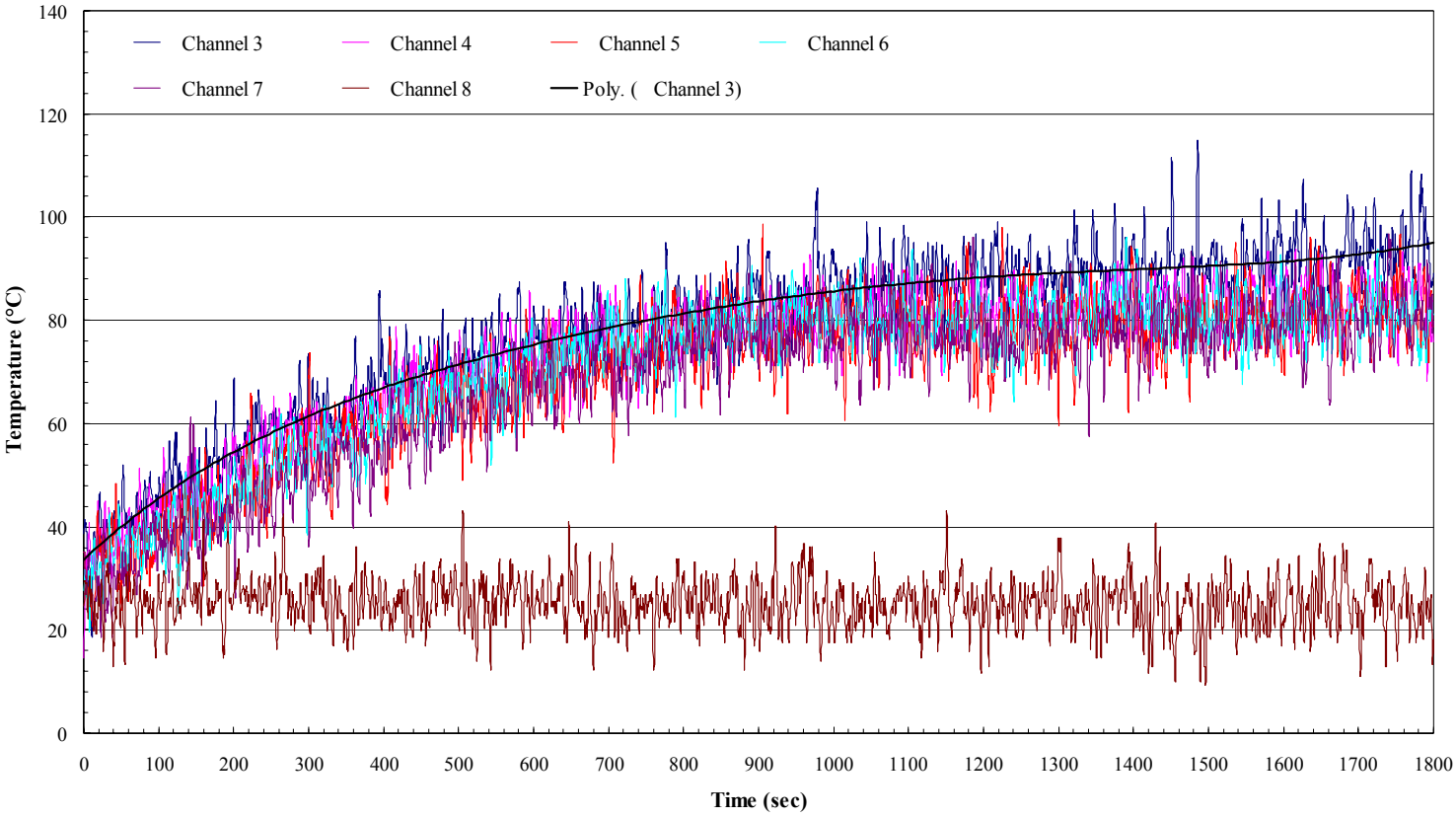
7.19.3. Burn through tests for the painted aluminium plates – Graphs



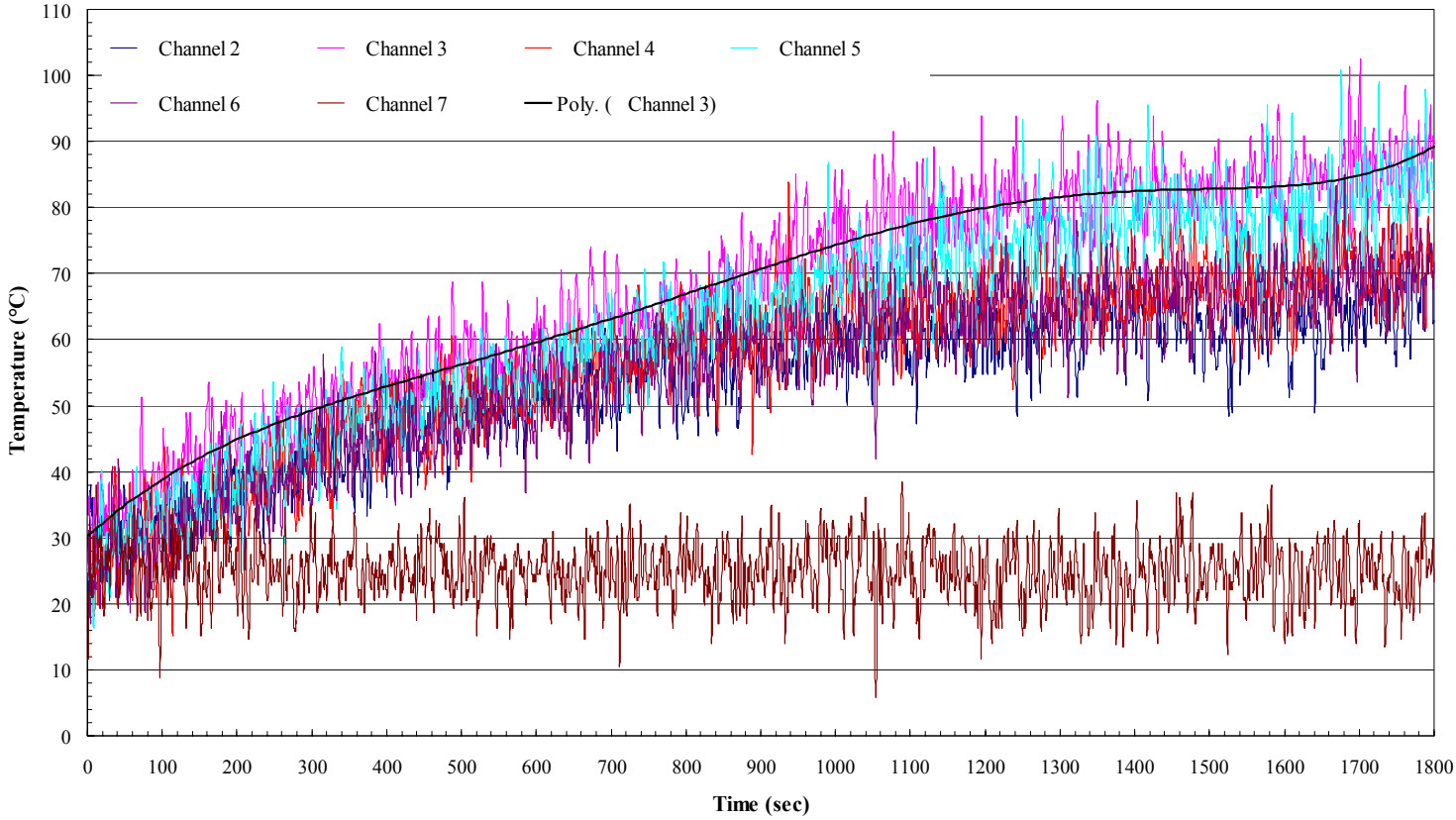
Aluminium plate not painted (control)



Aluminium plate painted with AP750



Aluminium plate painted with PEN



Aluminium plate painted with Calcium gluconate, Leached SiO2 and Expandable Graphite

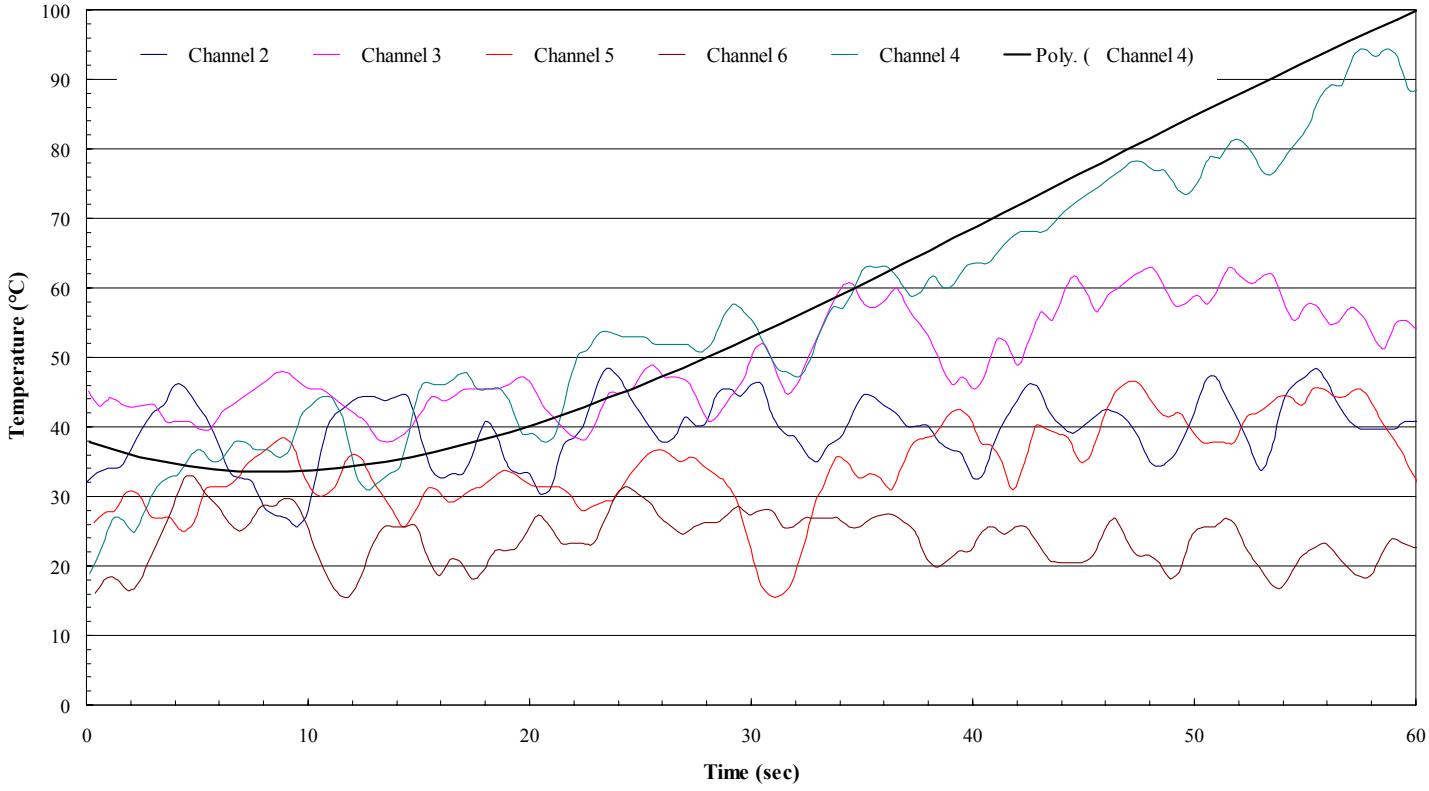
7.19.4. Burn through tests for the painted aluminium plates – Pictures


AP750 coating: Left – 420 sec, Right – 1800 sec

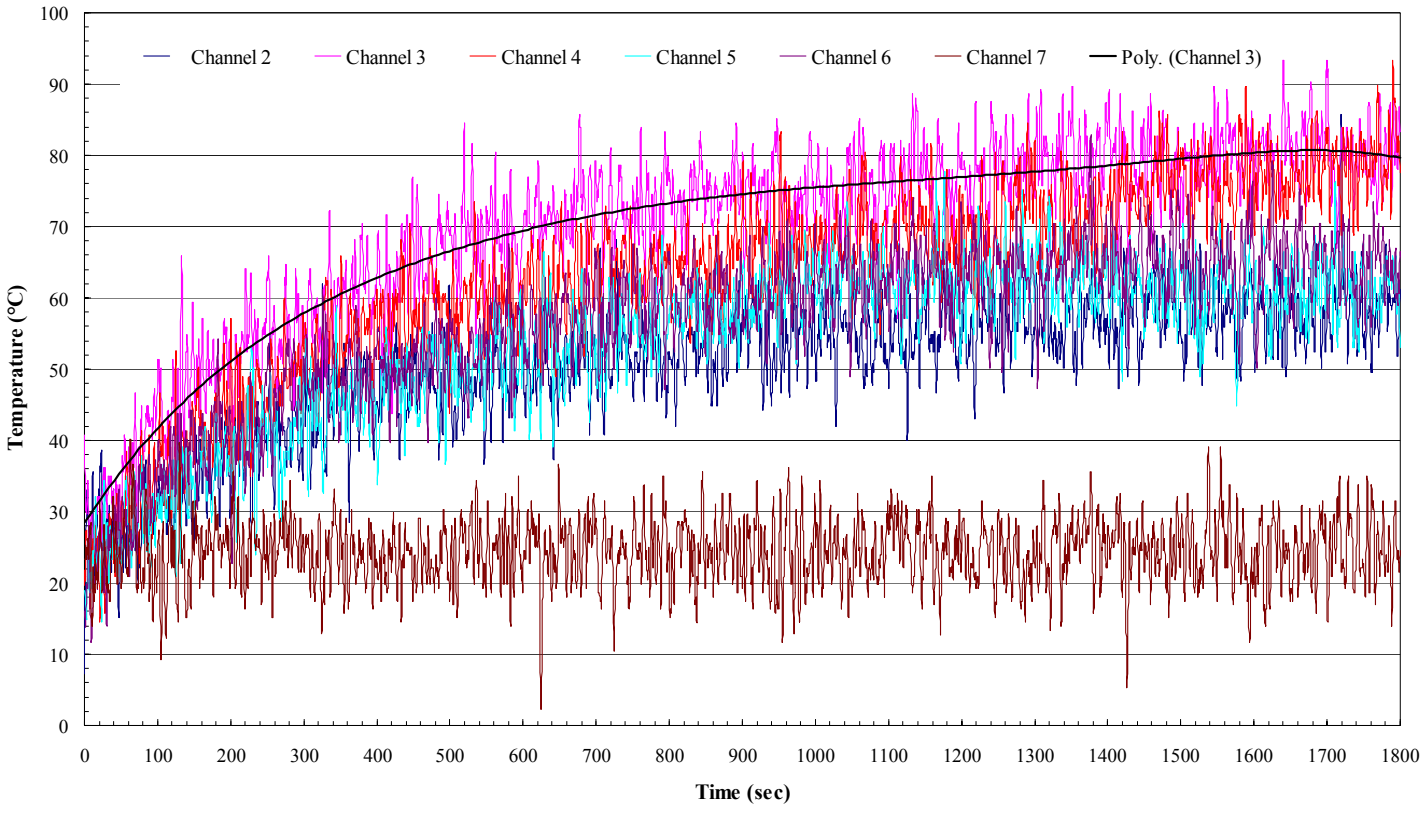

PEN coating: Left – 600 sec, Right – 1800 sec


Gluconate/graphite/silica coating: Left – 600 sec, Right – 1800 sec

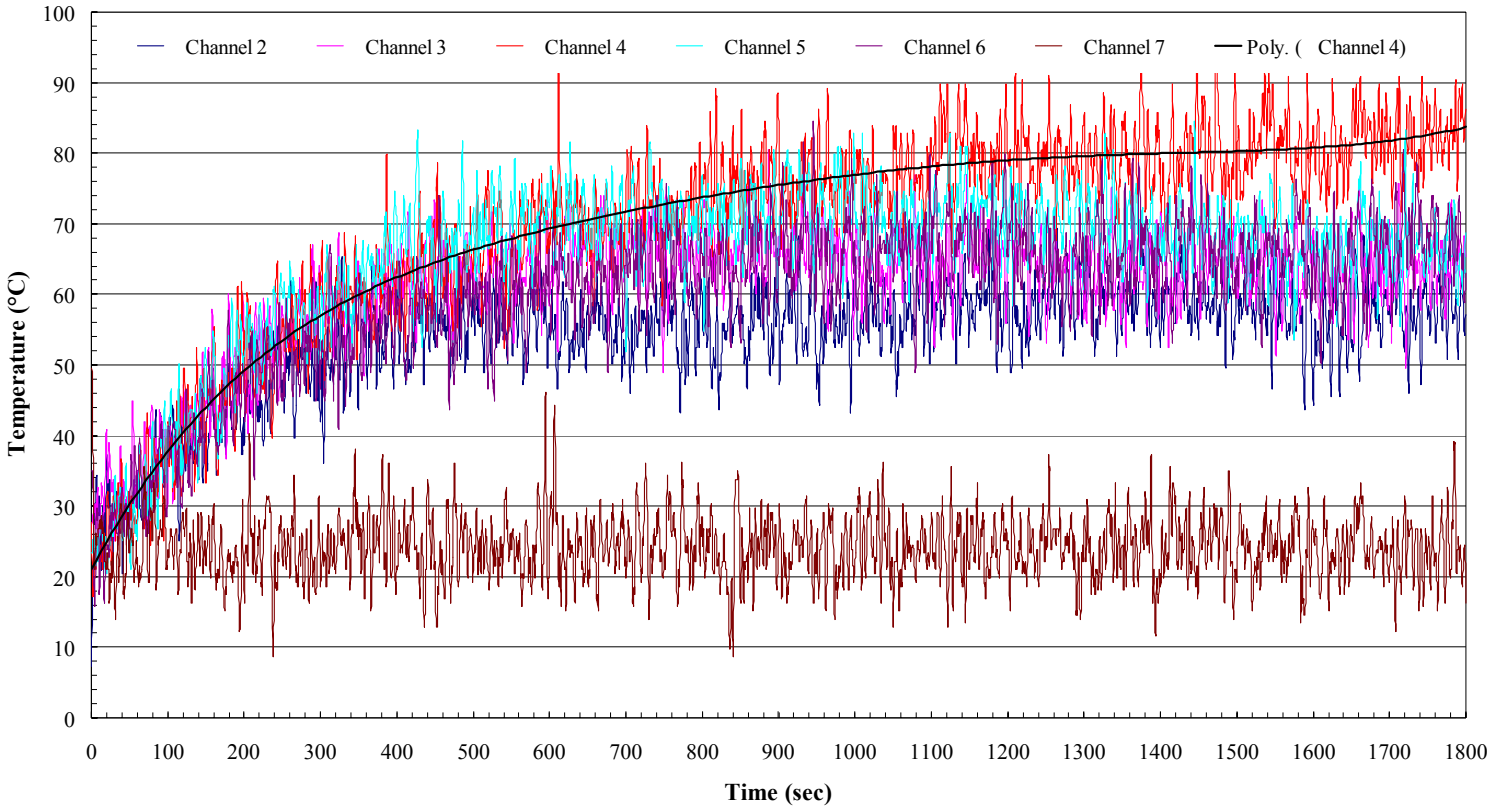
7.19.5. Burn through tests for the painted cardboard sheets – Graphs



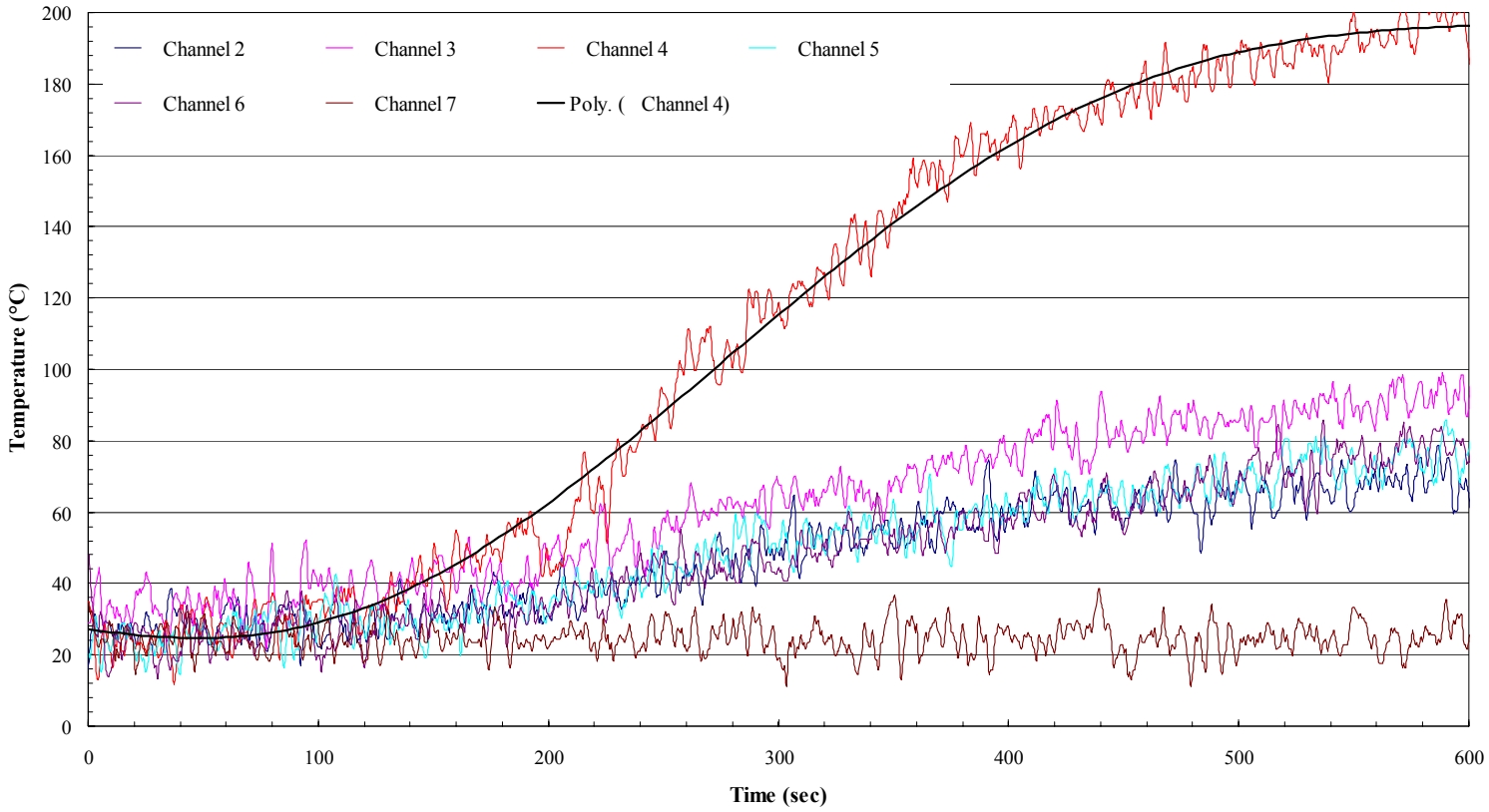
Cardboard sheet not painted (control)



Cardboard sheet painted with AP750



Card board sheet painted with PEN

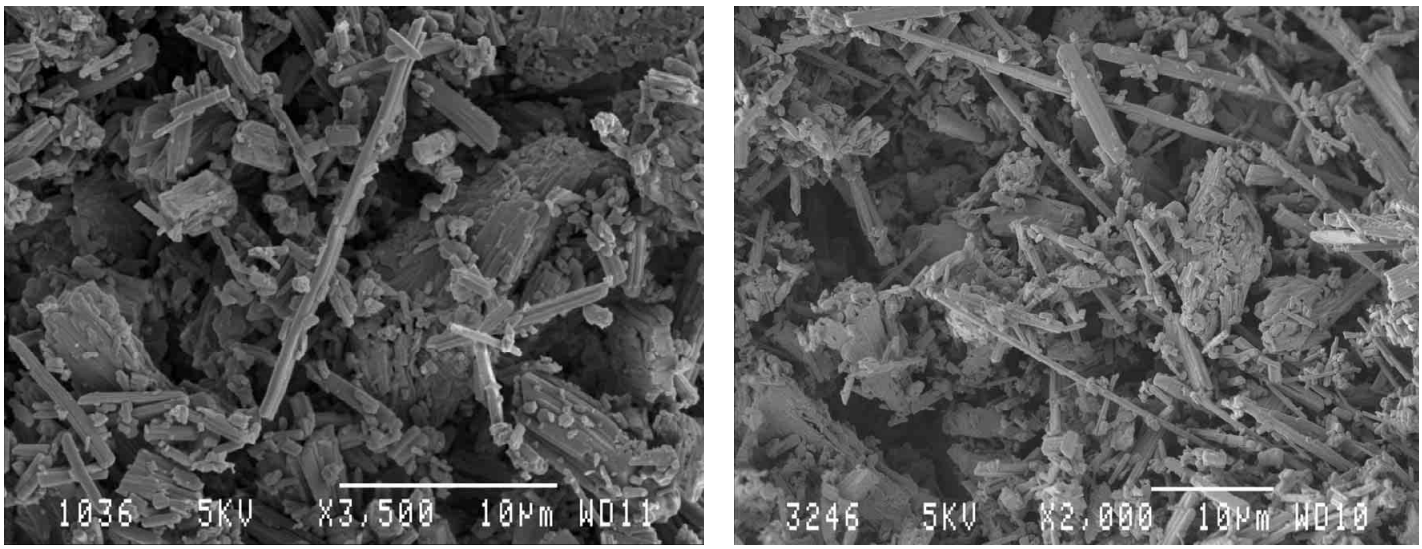


Cardboard sheet painted with Calcium gluconate, Leached SiO_2 and Expandable graphite

7.20. Appendix T

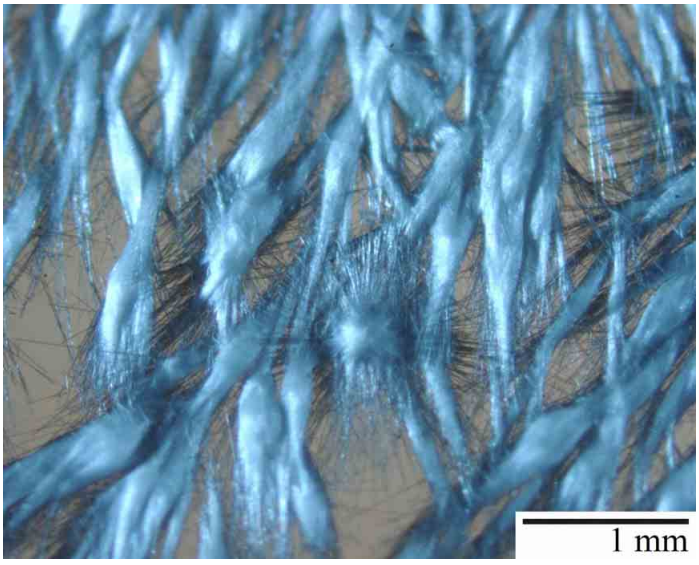
7.20.1. Light microscope and SEM images of calcium gluconate monohydrate crystals (powder)

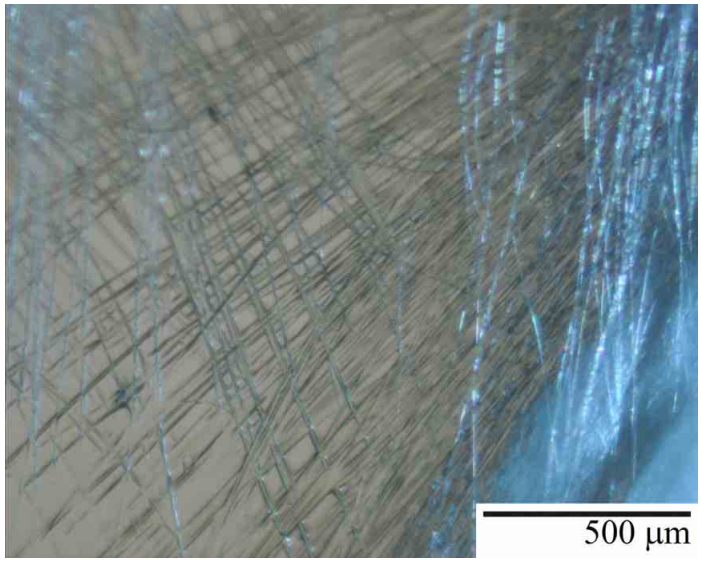
Light microscope images of calcium gluconate monohydrate crystals (powder)



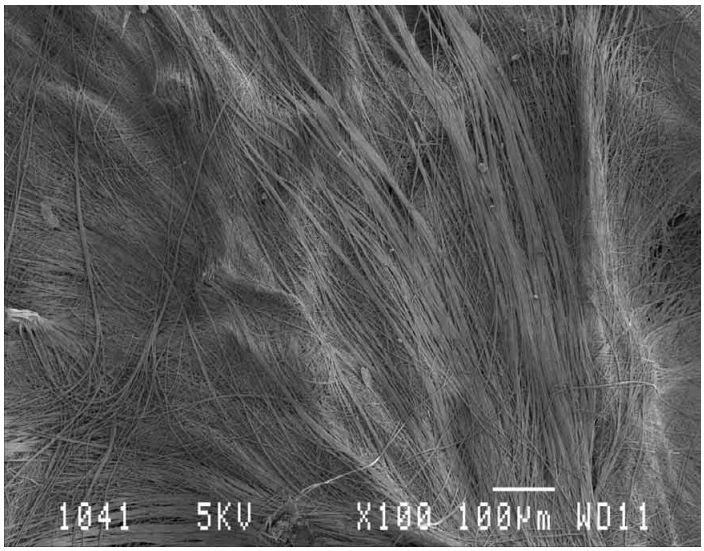
SEM images of calcium gluconate monohydrate crystals (powder)

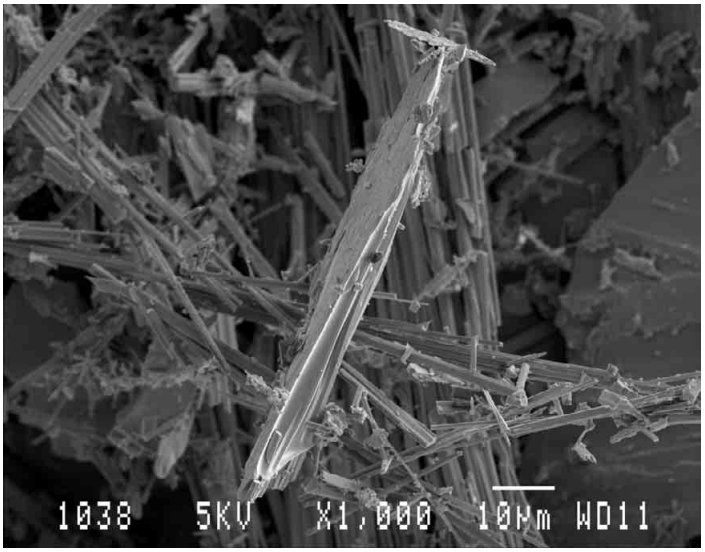
7.20.2. Light microscope and SEM images of calcium gluconate monohydrate crystals recrystallised through diffusion technique



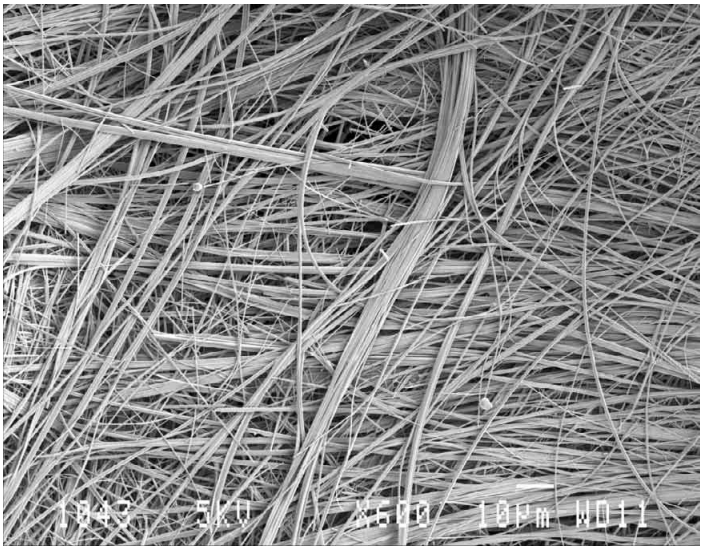


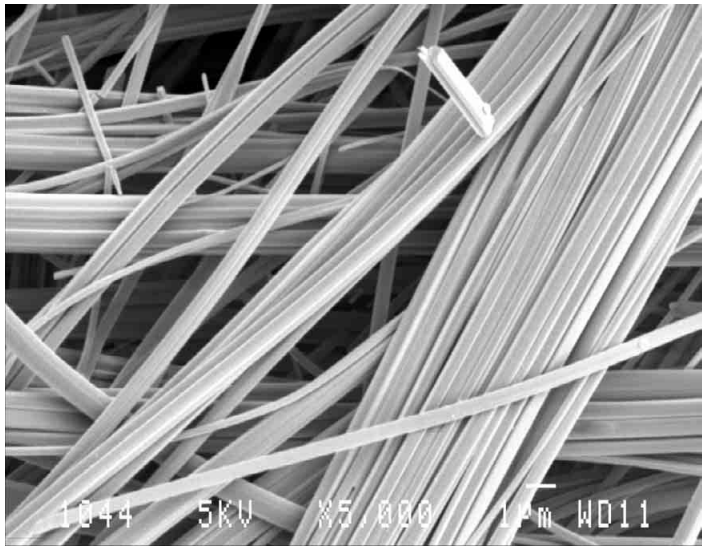
Light microscope images of calcium gluconate monohydrate recrystallised from water through diffusion with ethanol





SEM images of calcium gluconate monohydrate recrystallised from water through diffusion with ethanol

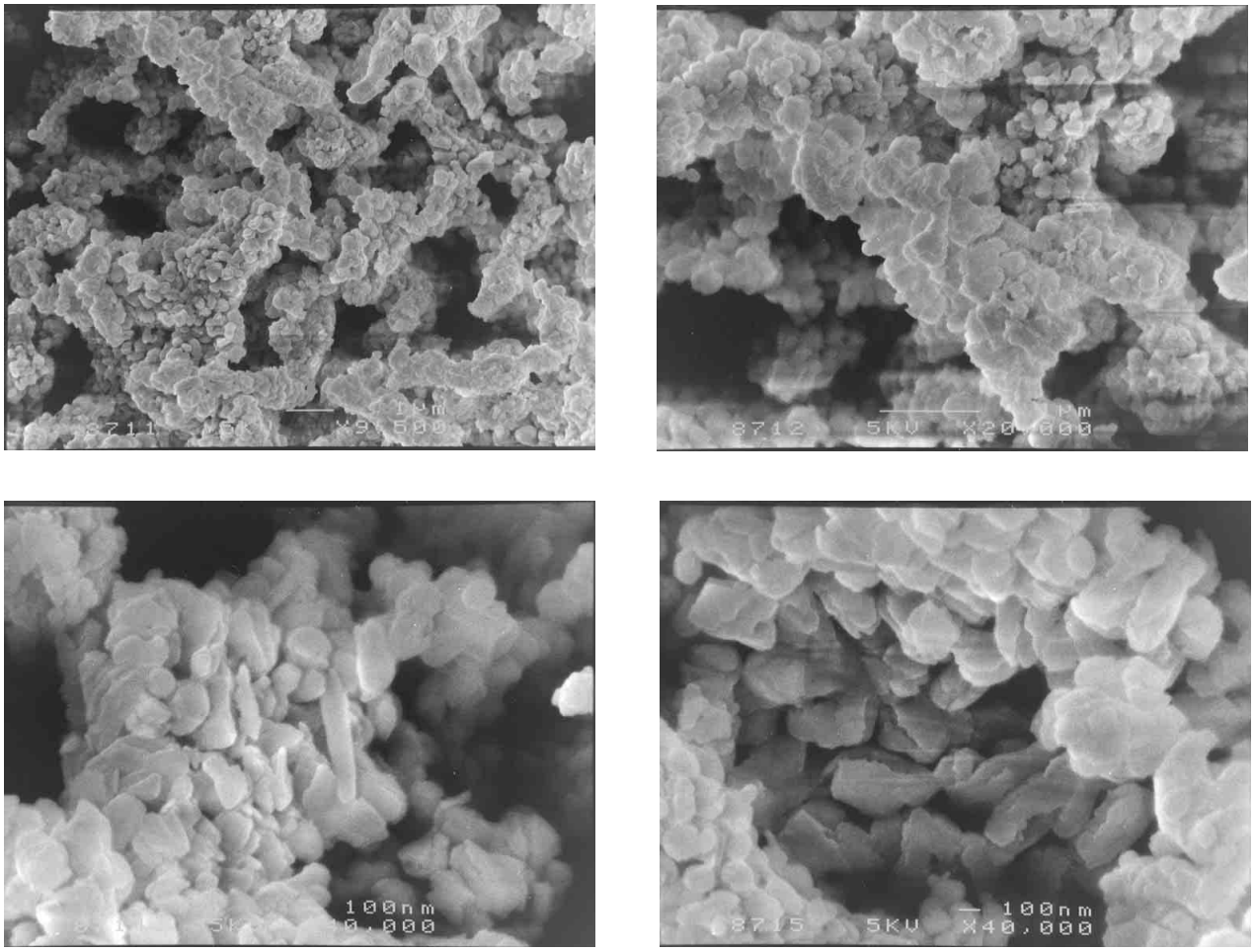




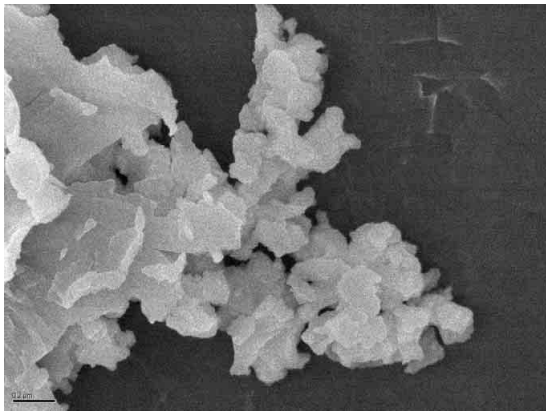
SEM images of calcium gluconate monohydrate recrystallised from water through diffusion with ethanol

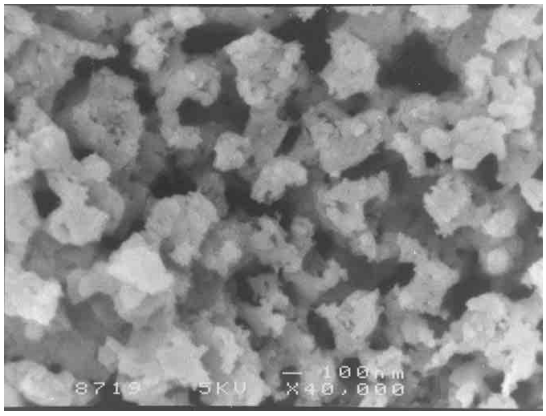
7.21. Appendix U

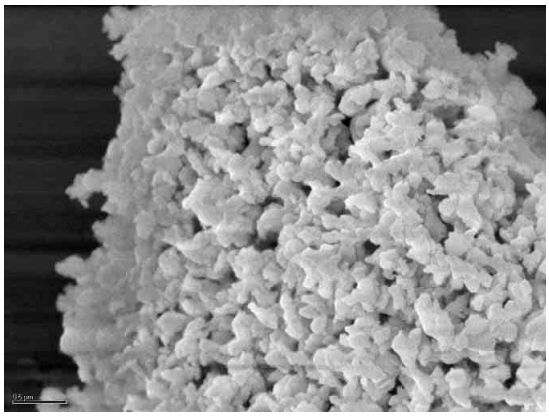
7.21.1. Metal oxides and carbonates prepared from the metal dextrose solutions and calcium gluconate monohydrate

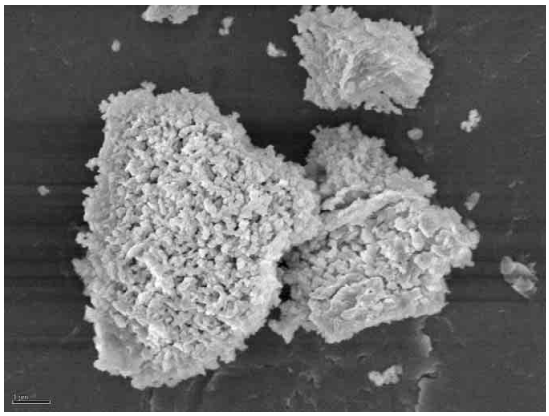


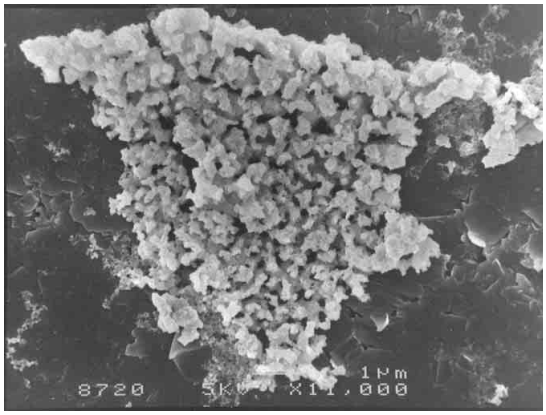
Calcium carbonate prepared from calcium gluconate monohydrate

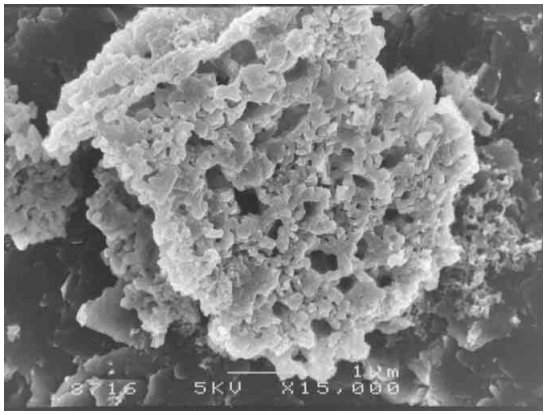


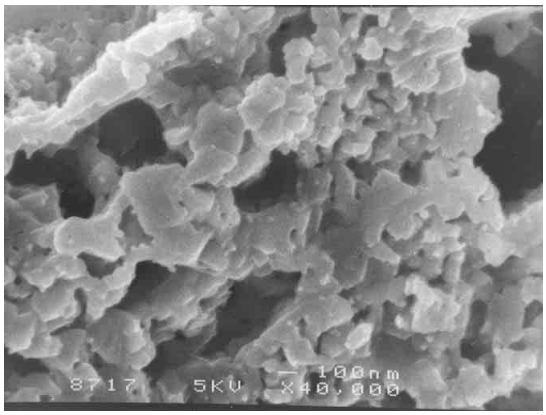


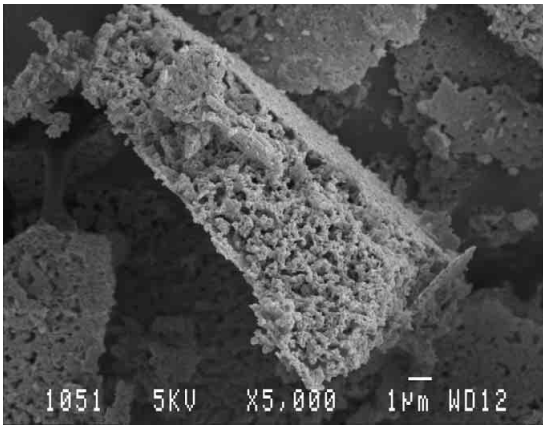




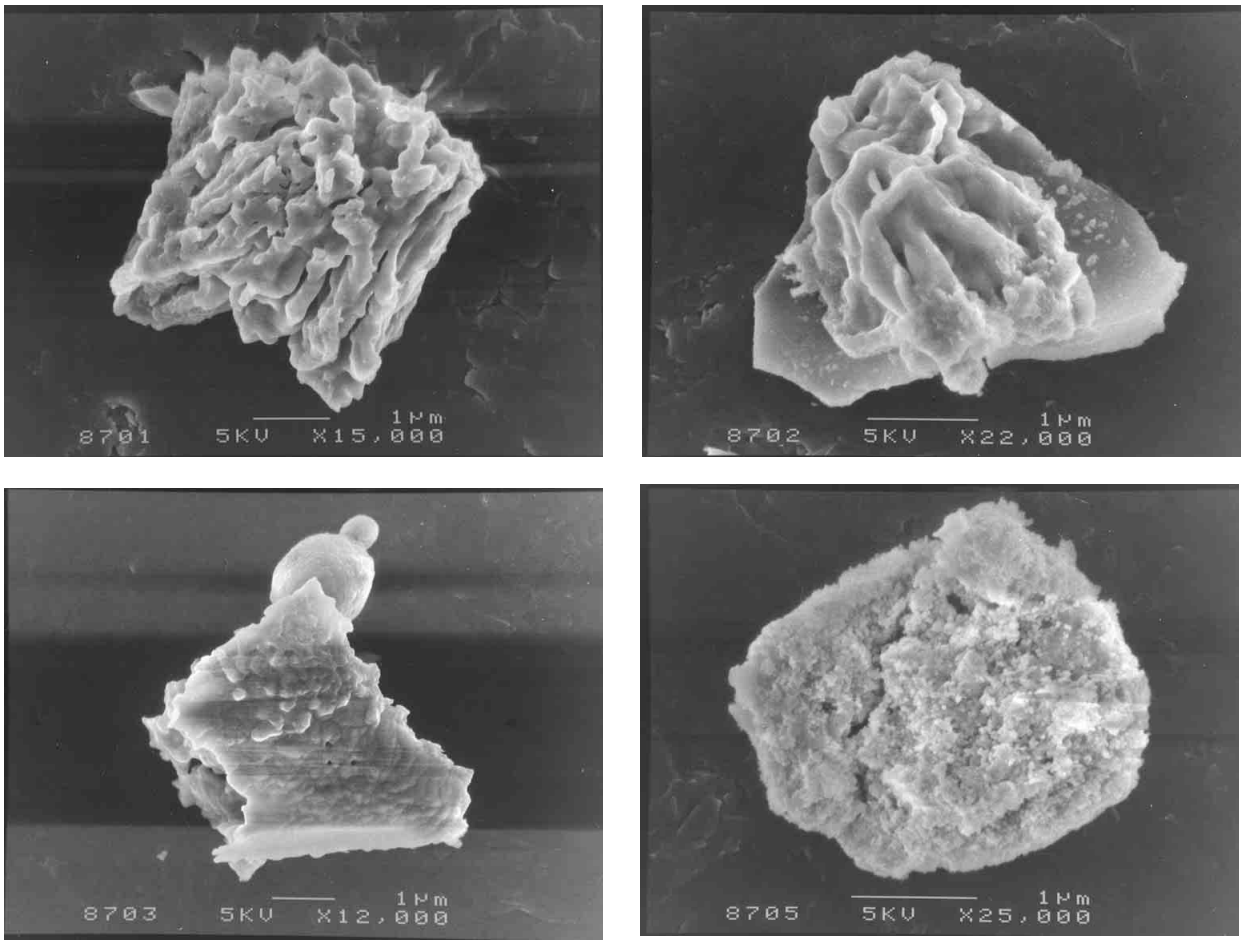




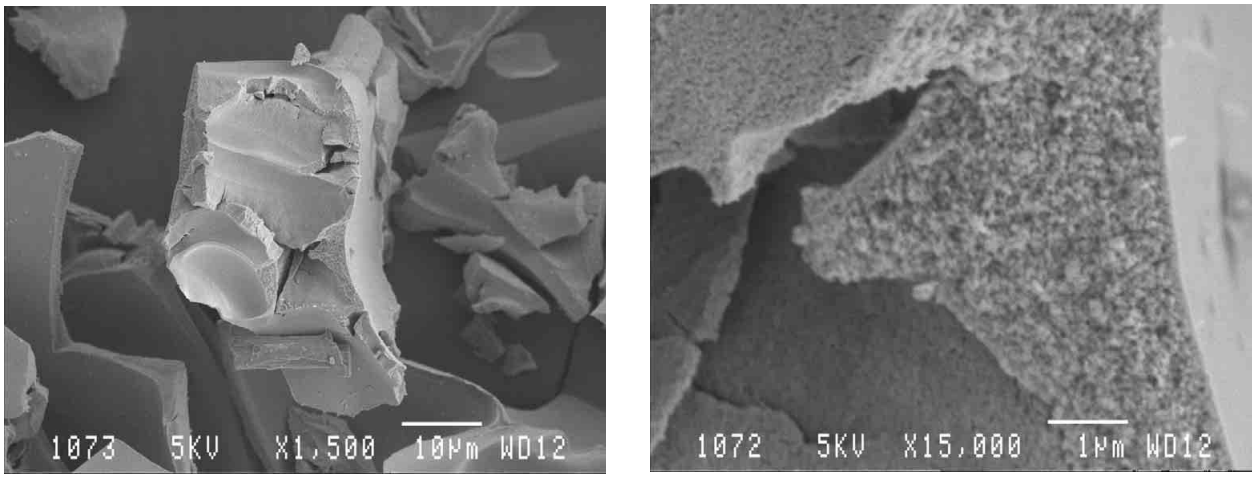




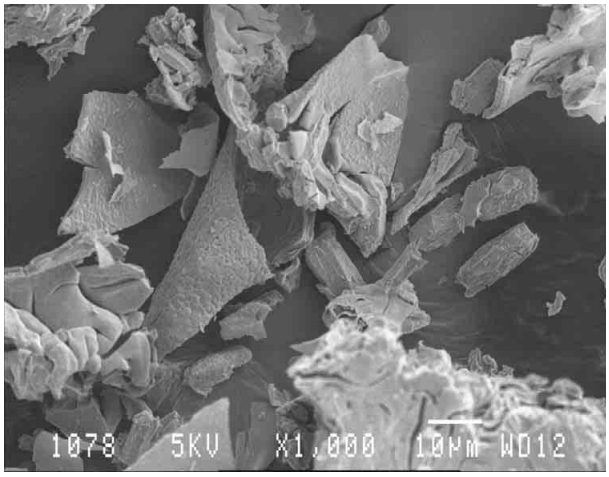
Calcium carbonate prepared from calcium dextrose solution

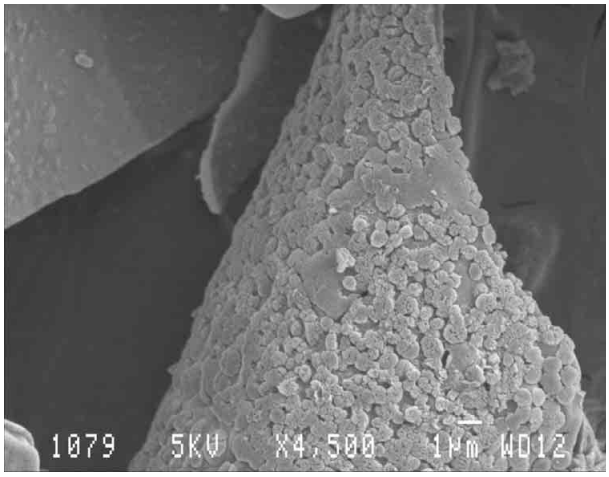


Aluminium oxide prepared from aluminium ammonium dextrose solution

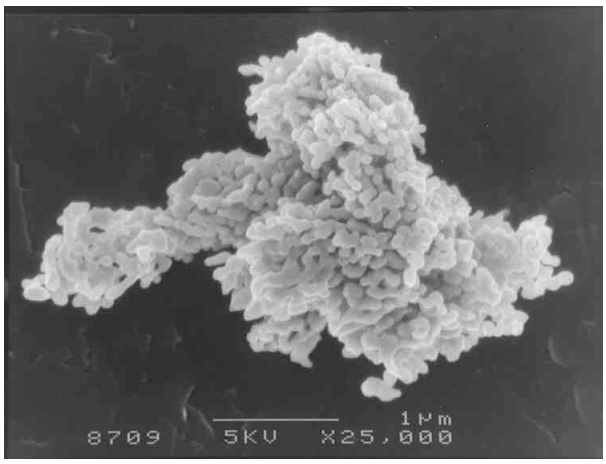


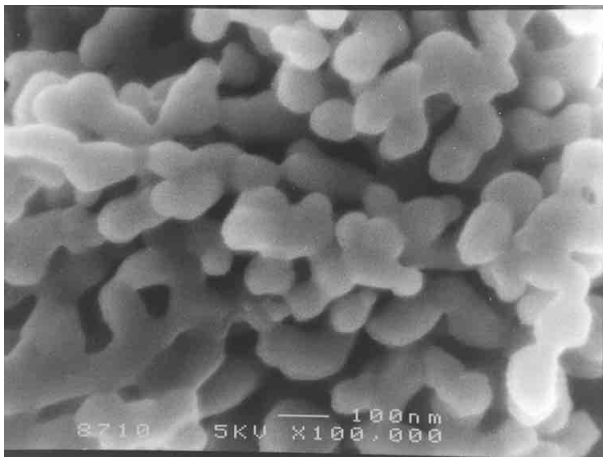
Zinc oxide prepared from zinc dextrose solution

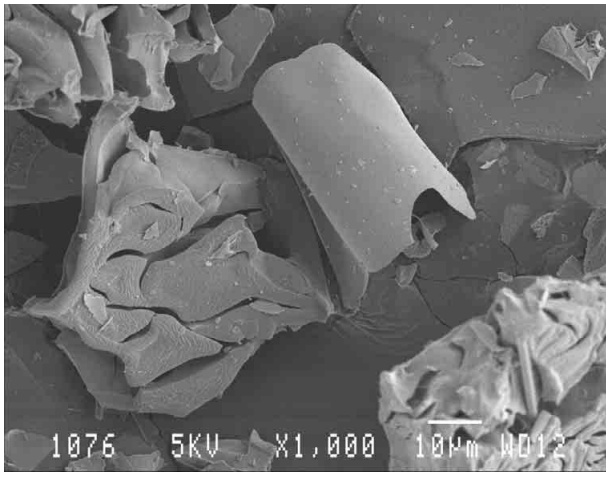


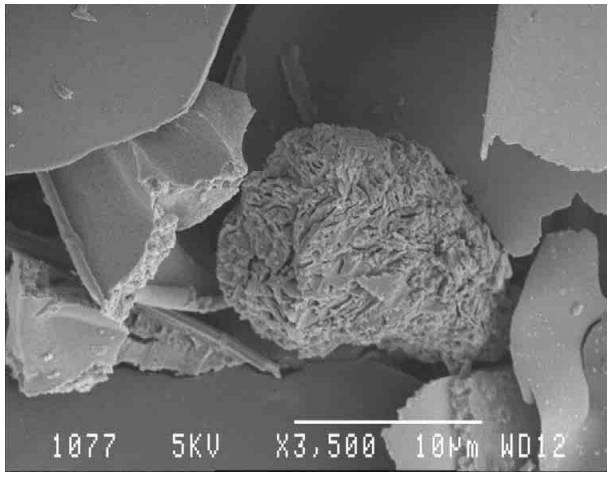


Iron oxide prepared from iron ammonium dextrose solution

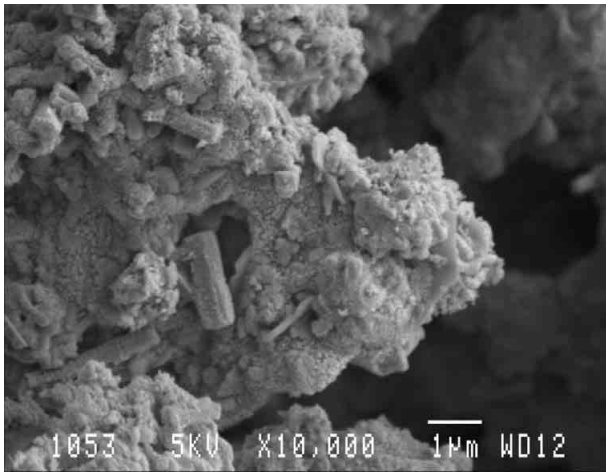


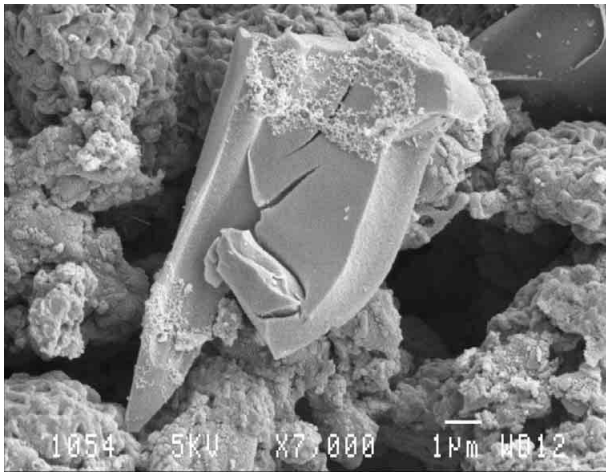


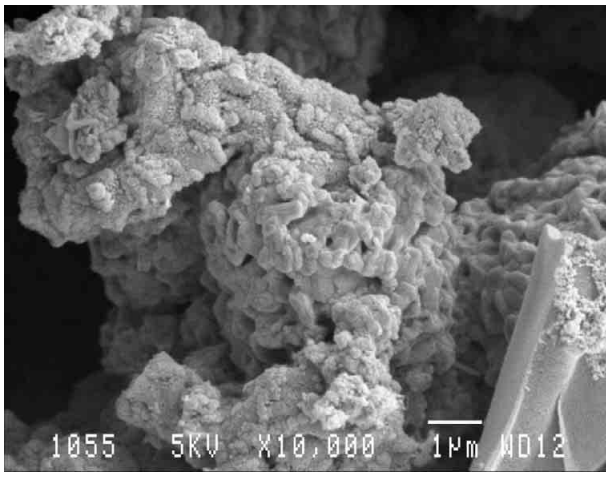


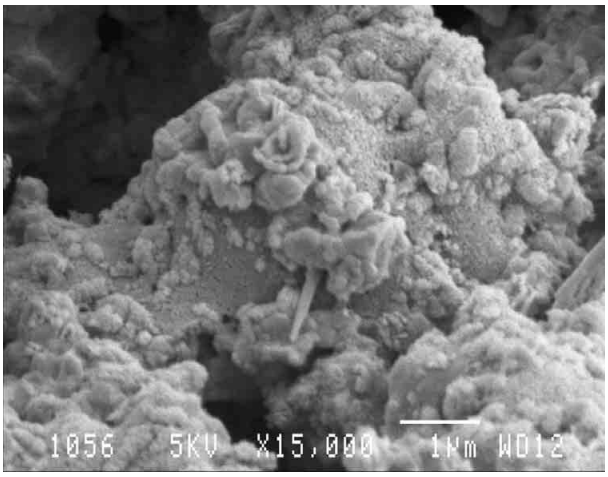


Iron oxide prepared from iron dextrose solution

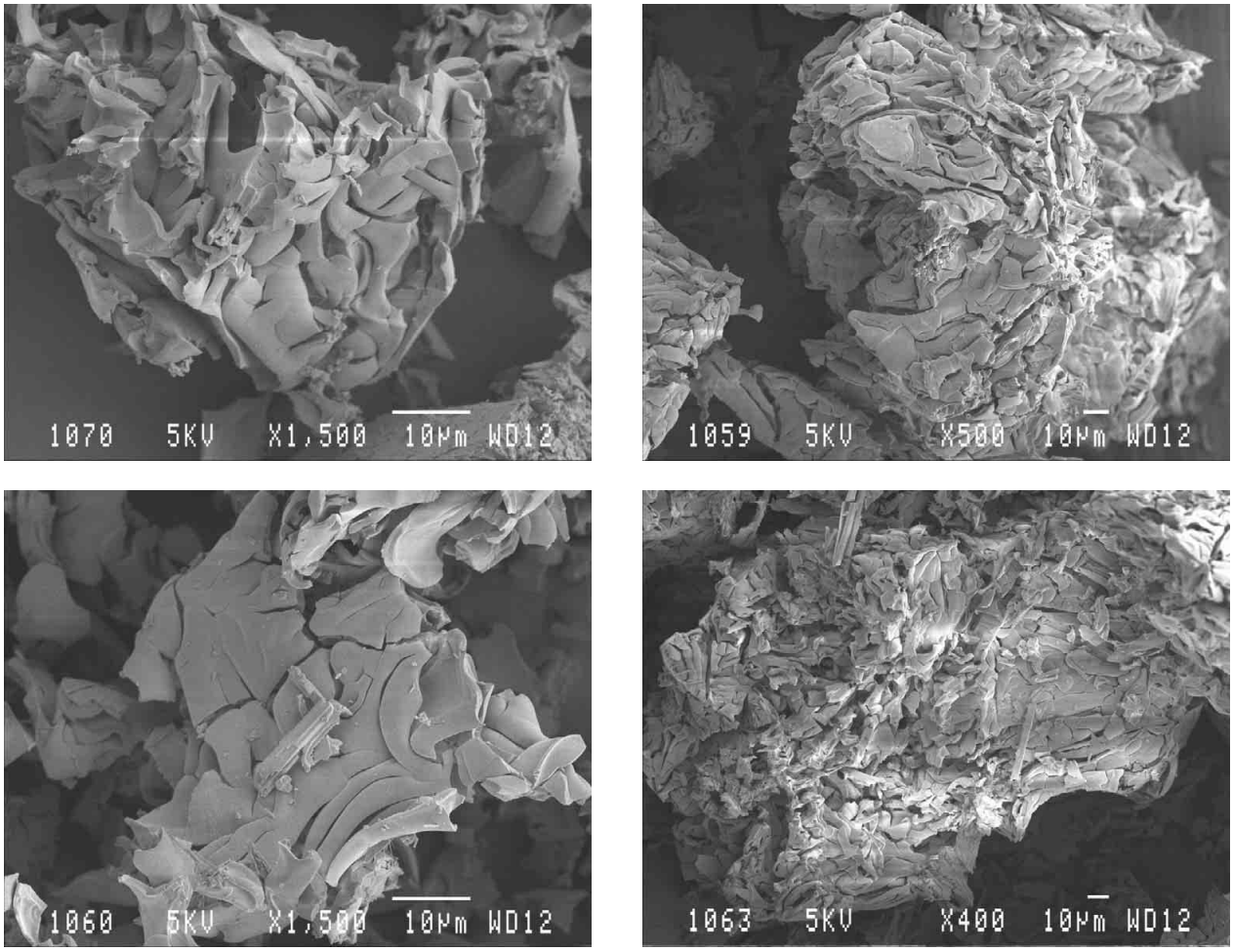








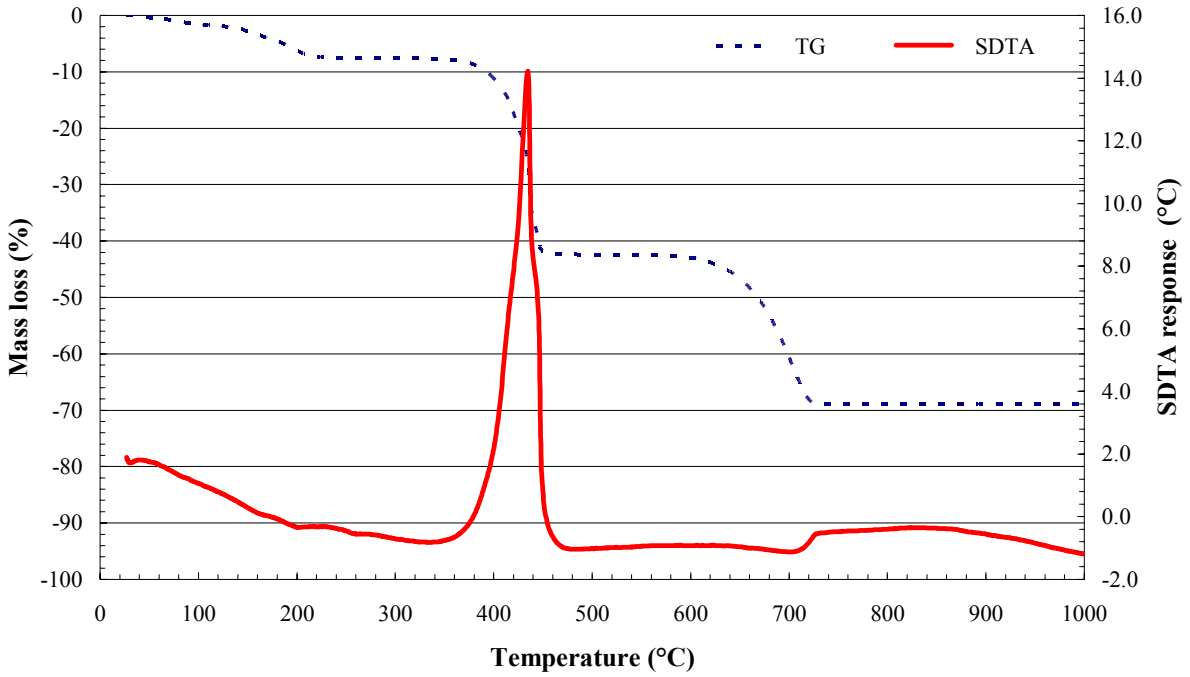
Copper oxide prepared from copper dextrose solution



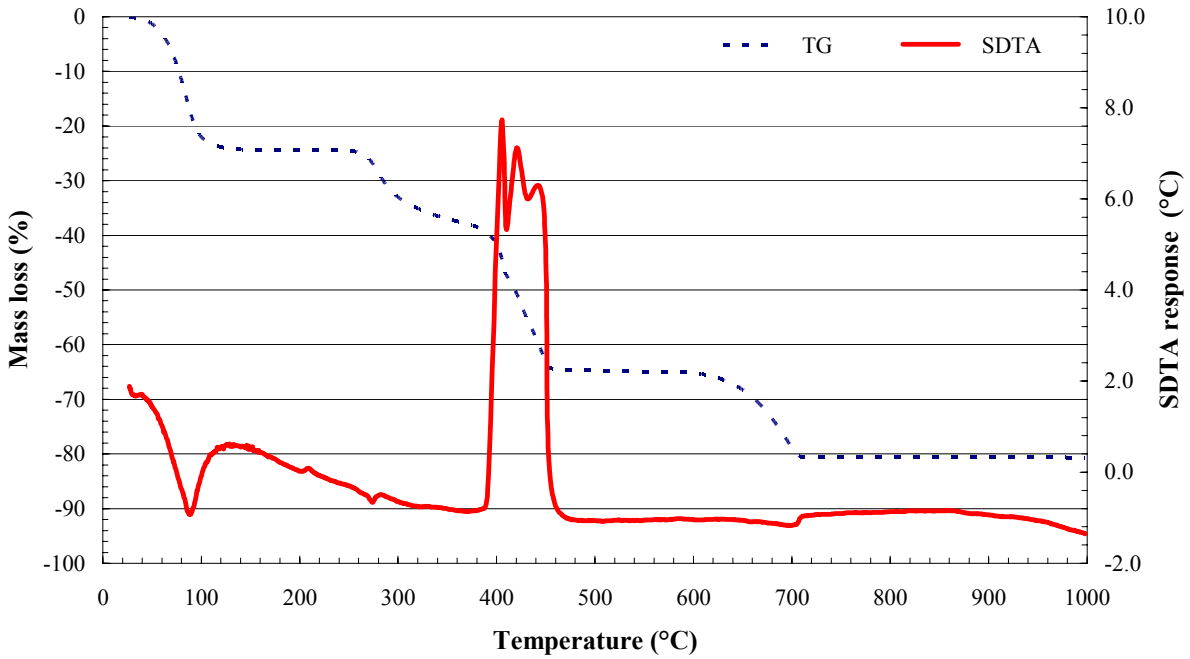
Zirconium oxide prepared from zirconium dextrose solution

7.22. Appendix V

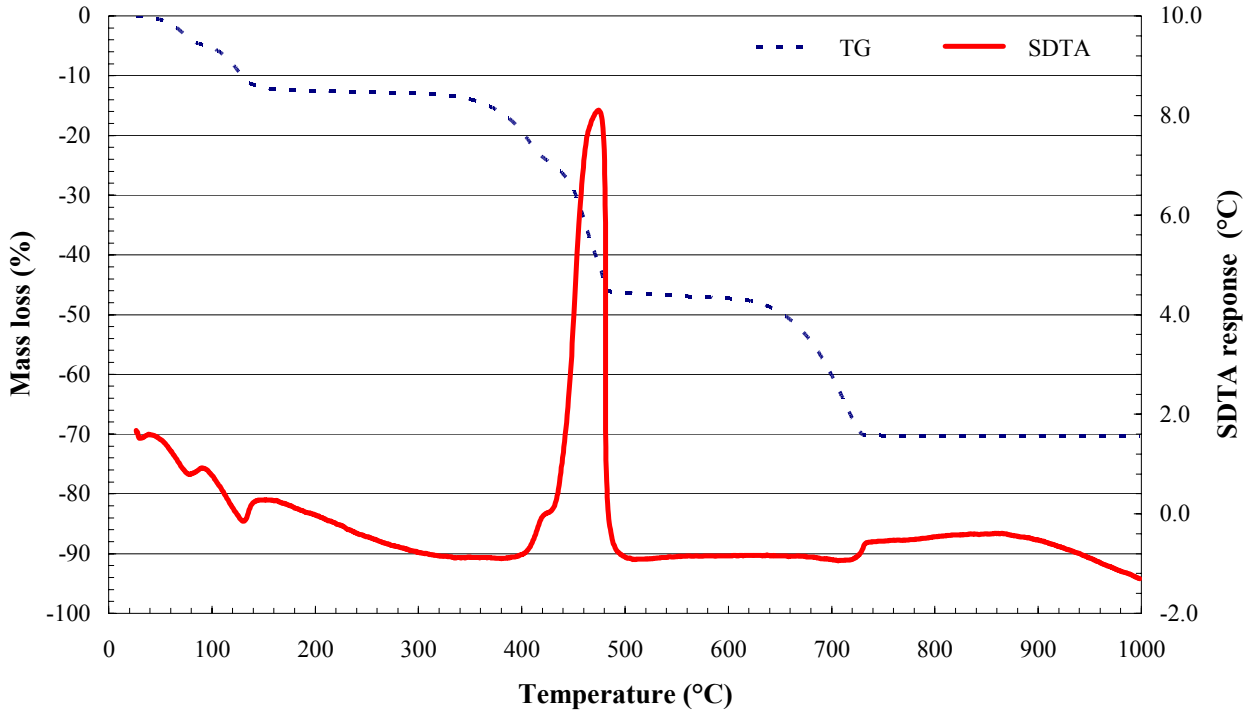
7.22.1. Thermal analysis of selected calcium salts



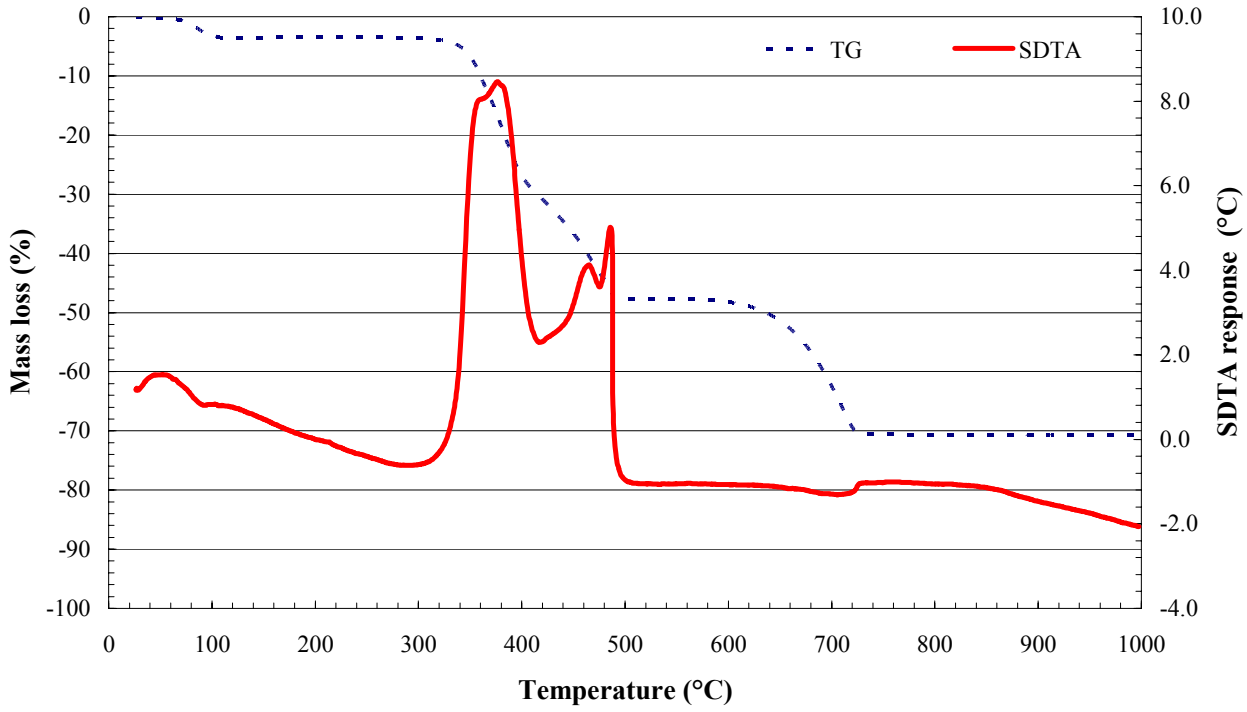
Thermal analysis of acetic acid calcium salt hydrate in air at 10°C/min



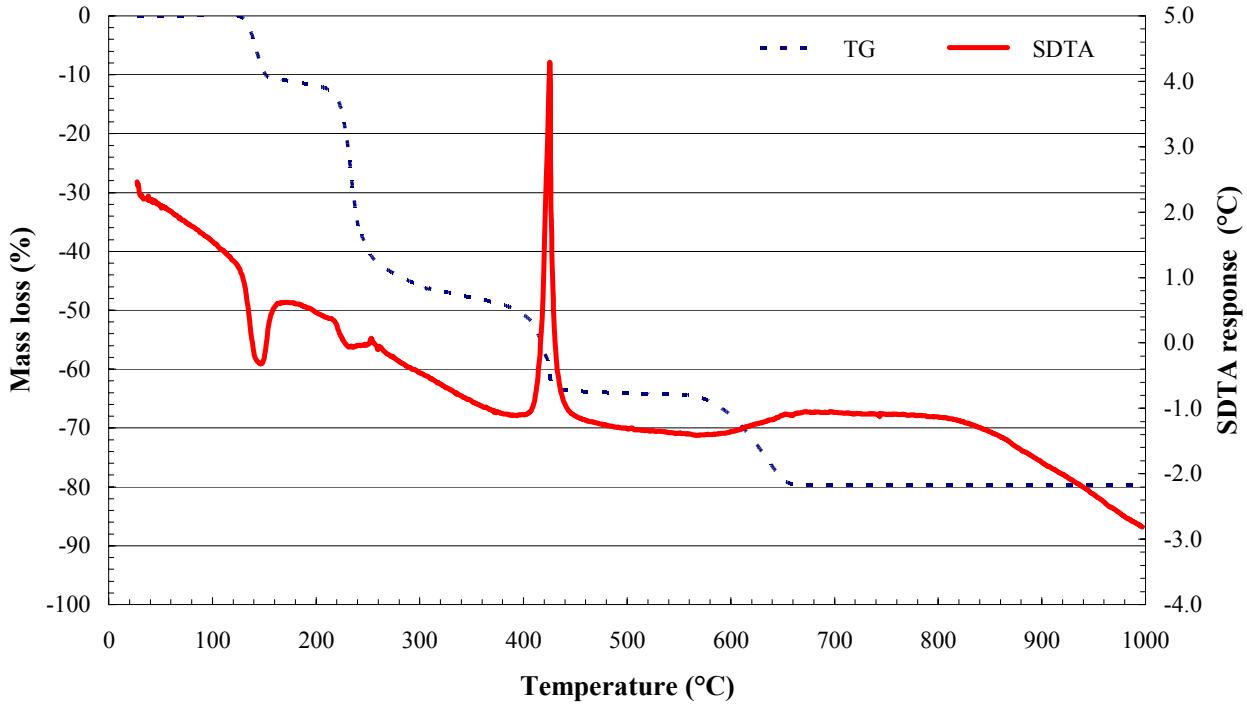
Thermal analysis of lactic acid calcium salt pentahydrate in air at 10°C/min



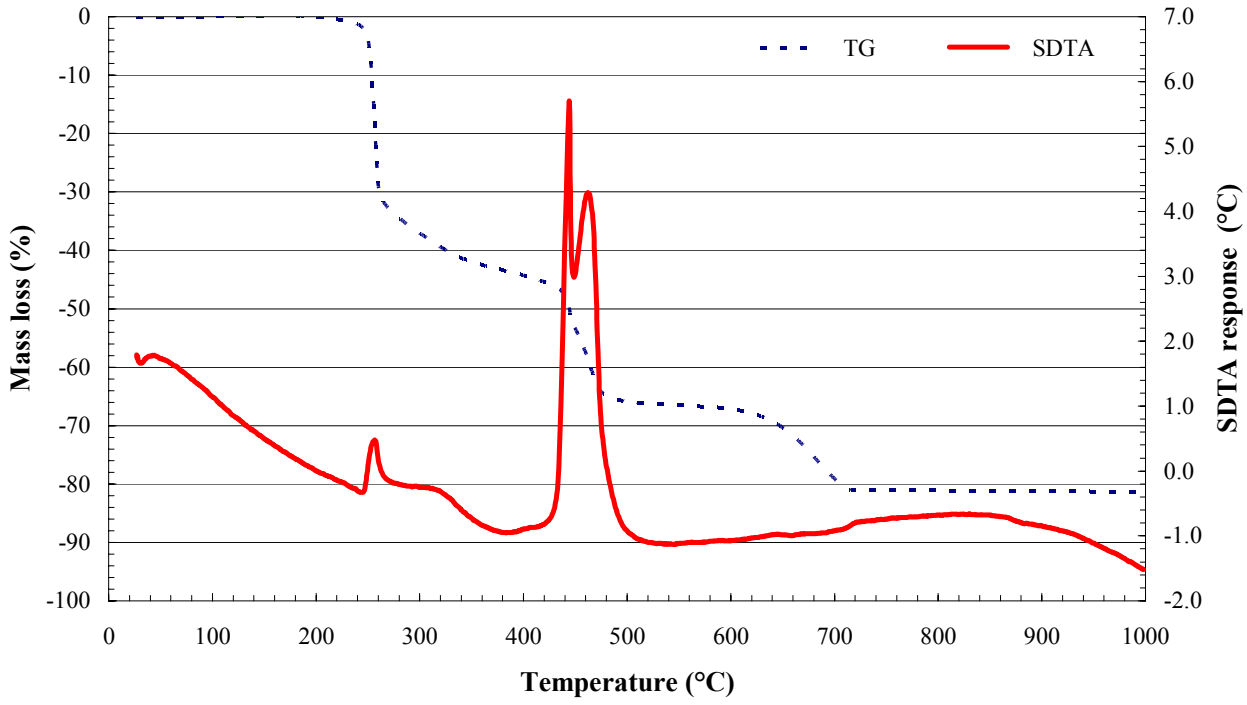
Thermal analysis of citric acid calcium salt tetrahydrate in air at 10°C/min



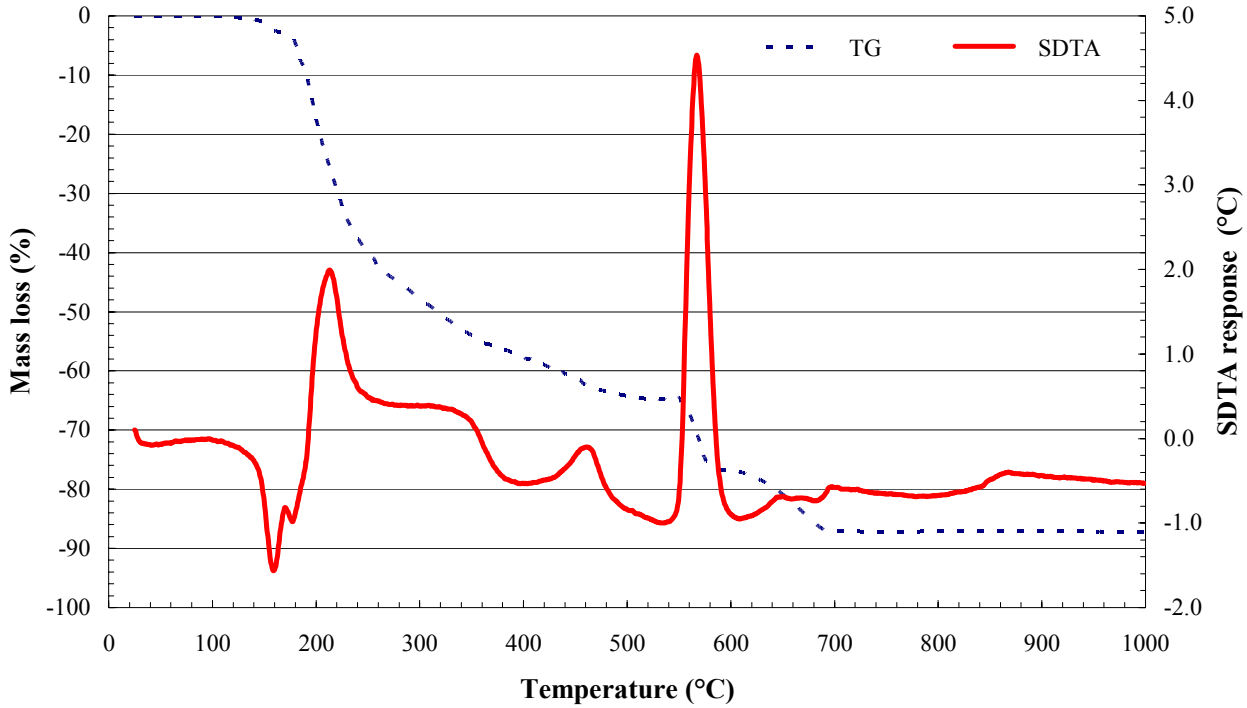
Thermal analysis of propionic acid calcium salt in air at 10°C/min



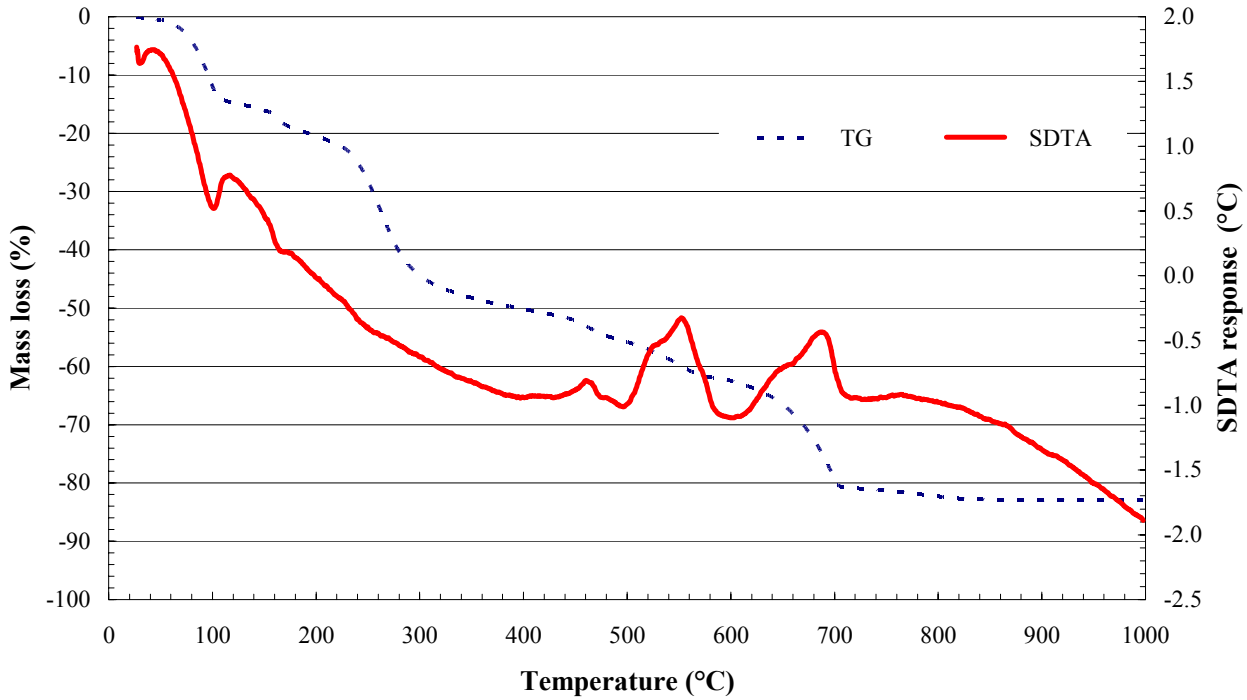
Thermal analysis of glyceric acid hemicalcium salt monohydrate in air at 10°C/min



Thermal analysis of threonic acid hemicalcium salt in air at 10°C/min



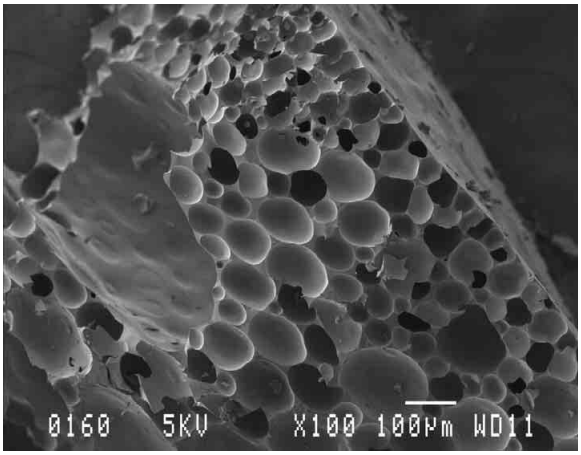
Thermal analysis of gluconic acid calcium salt monohydrate in air at 10°C/min

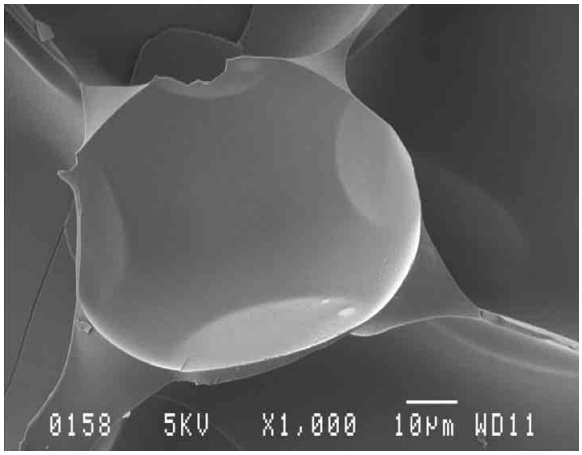


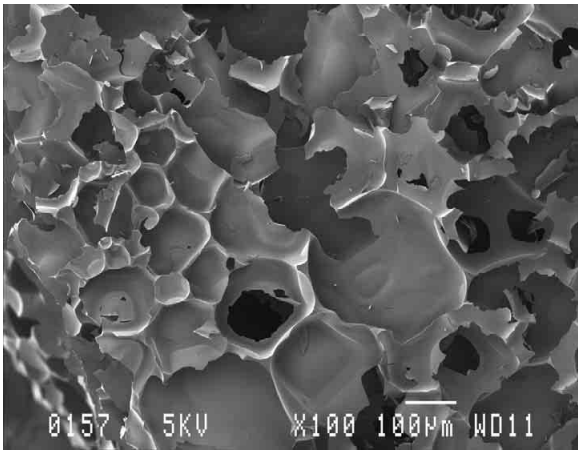
Thermal analysis of saccarinic acid calcium salt tetrahydrate in air at 10°C/min

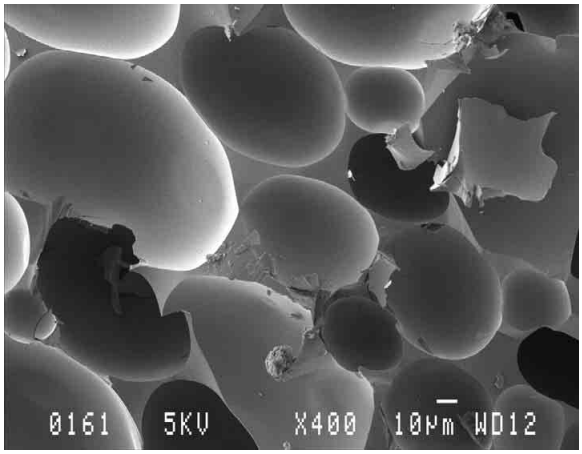
7.22.2. SEM images of glyceric acid hemicalcium salt monohydrate at selected temperatures in air

Glyceric acid hemicalcium salt monohydrate pyrolysed at 200°C in air

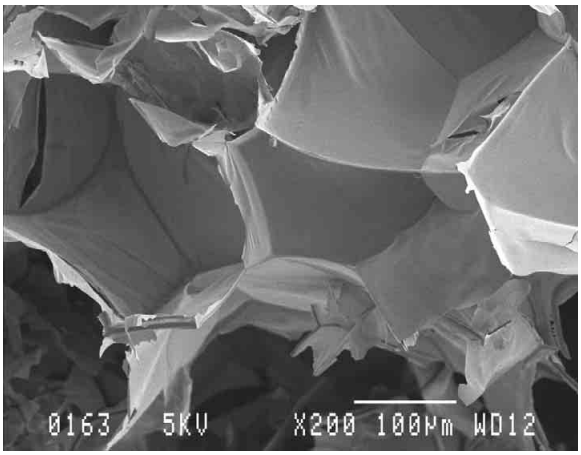


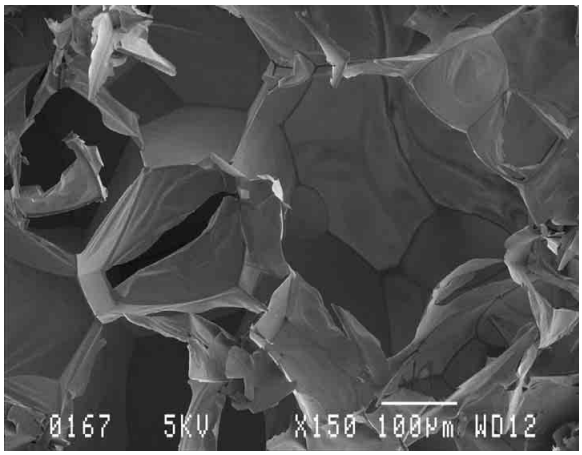


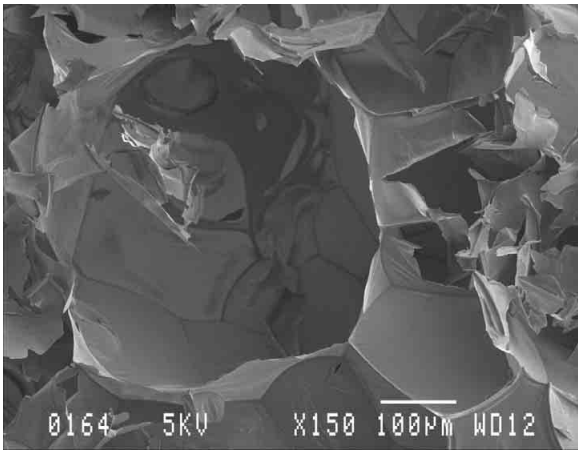


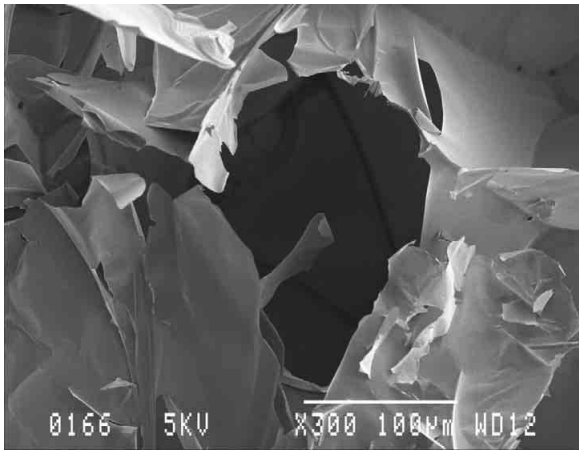


Glyceric acid hemicalcium salt monohydrate pyrolysed at 300°C in air









Glyceric acid hemicalcium salt monohydrate pyrolysed at 400°C in air