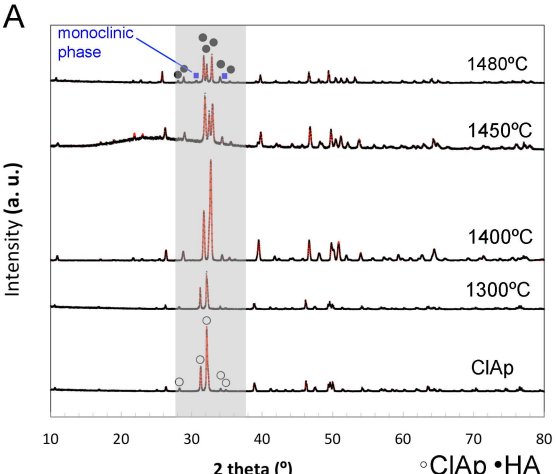
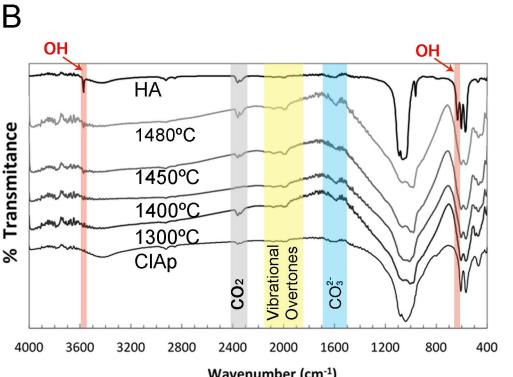
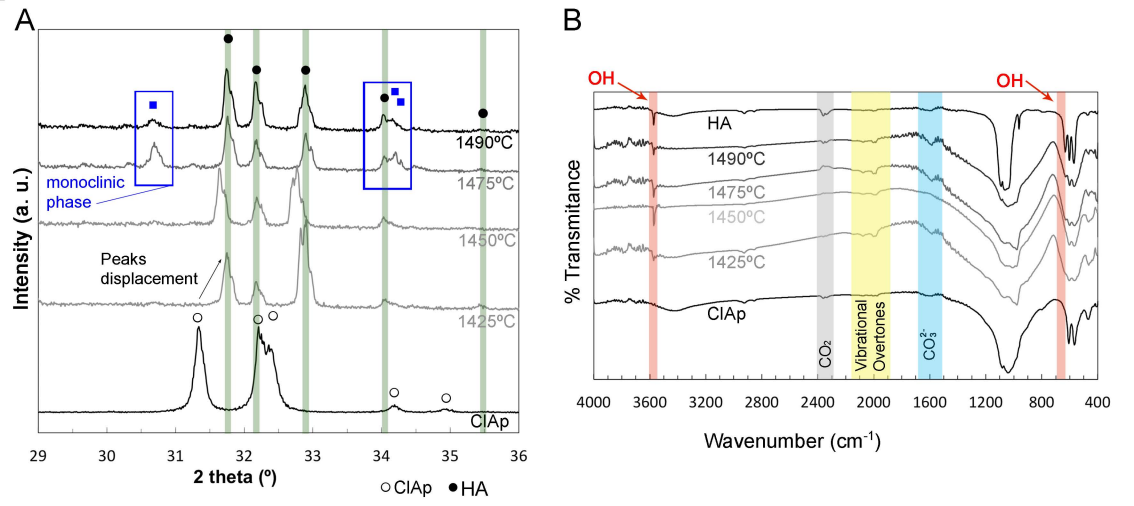
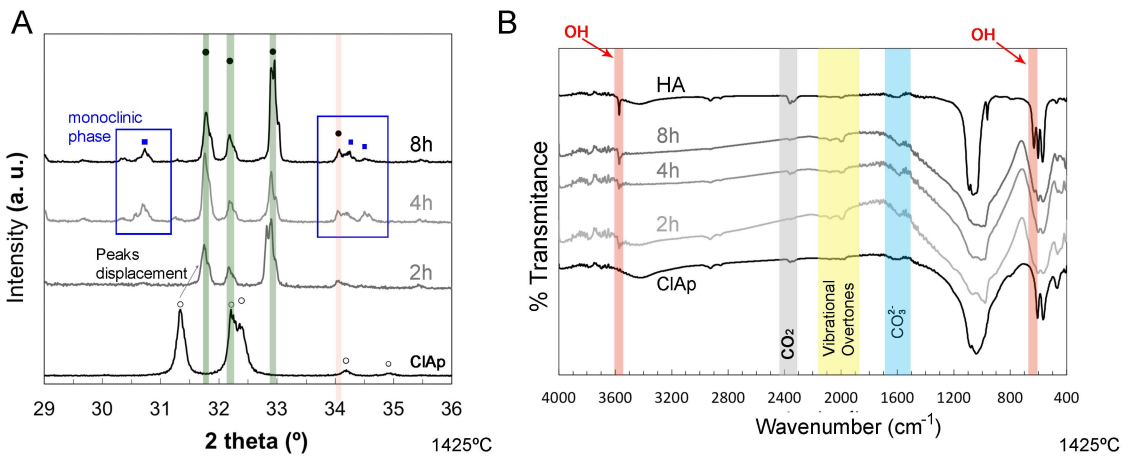
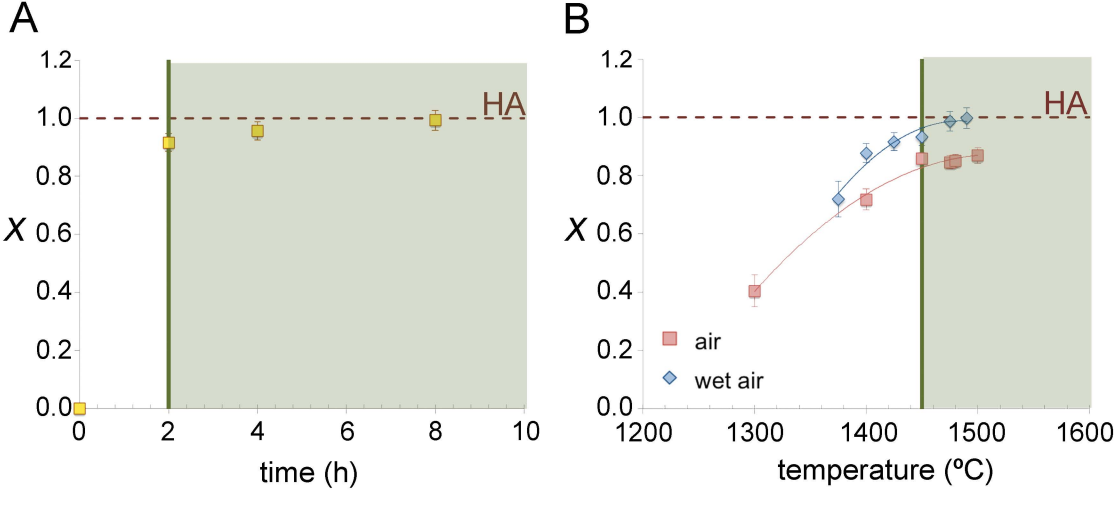
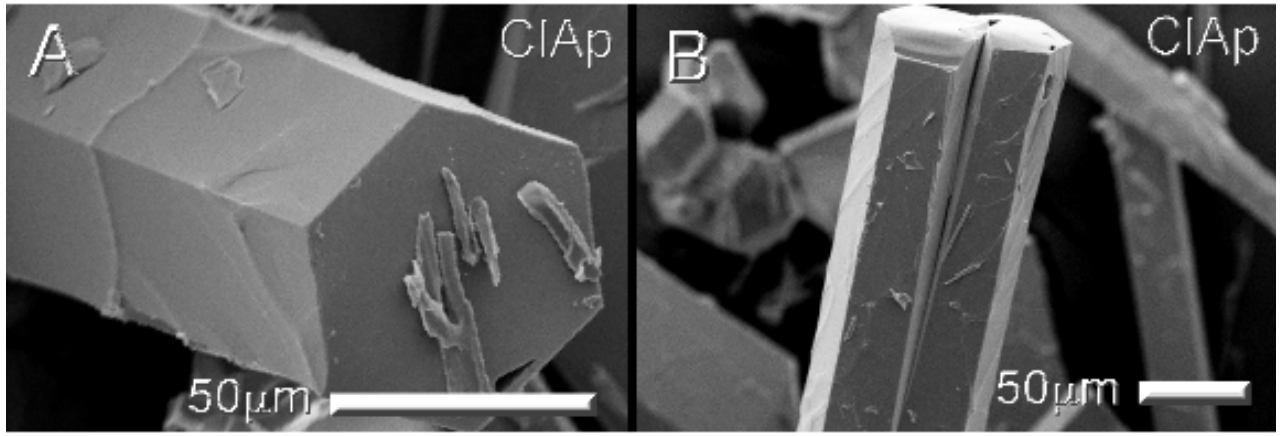

A
monoclinic phase
1480ºC
1450ºC
1400ºC
1300ºC
ClAp
Intensity (a. u.)
10
20
30
40
50
60
70
80
2 theta (º)
◦ClAp •HA

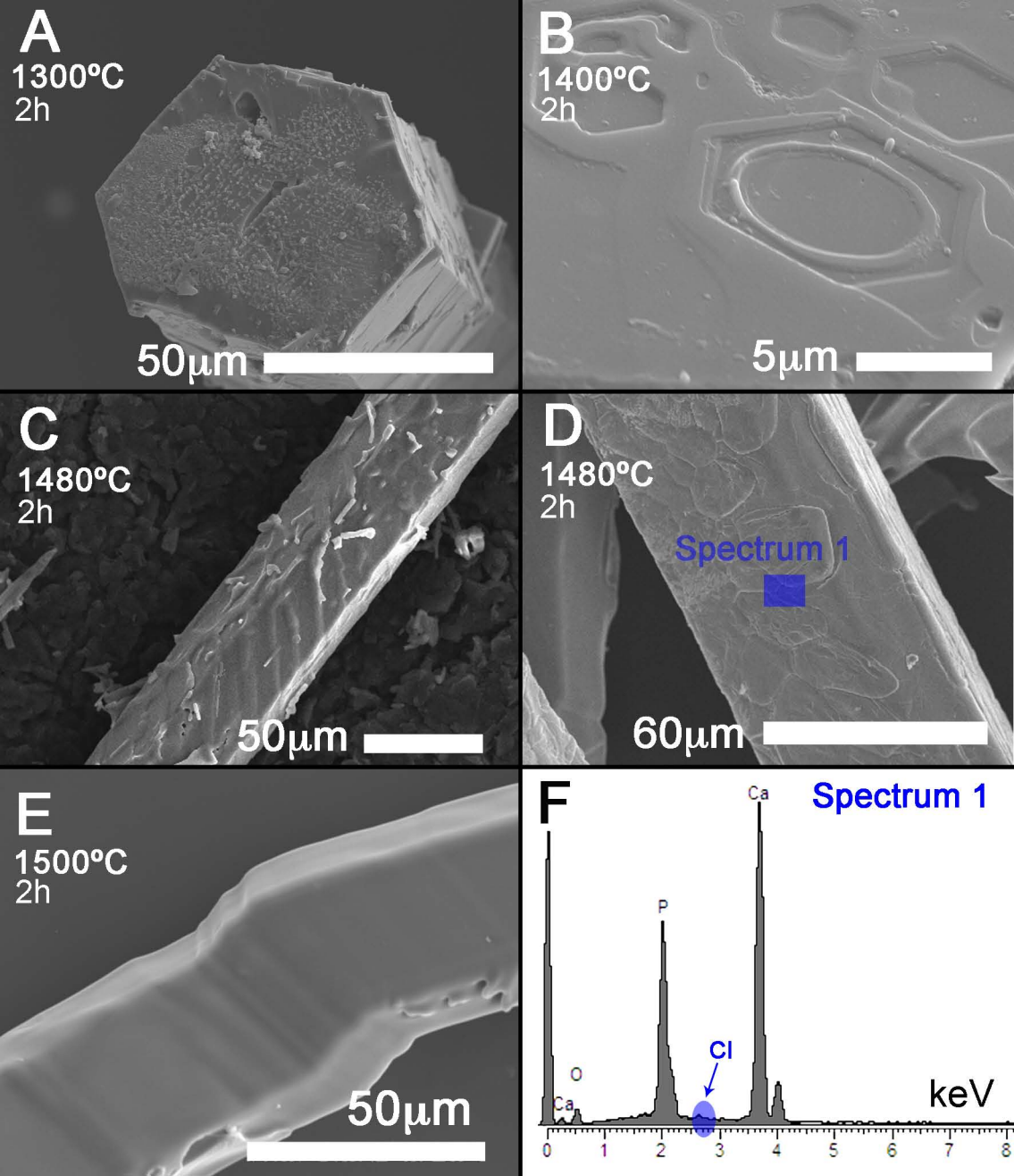

B
OH
OH
HA
1480ºC
1450ºC
1400ºC
1300ºC
ClAp
% Transmitance
CO2
Vibrational Overtones
CO3 2-
4000
3600
3200
2800
2400
2000
1600
1200
800
400
Wavenumber (cm-1)

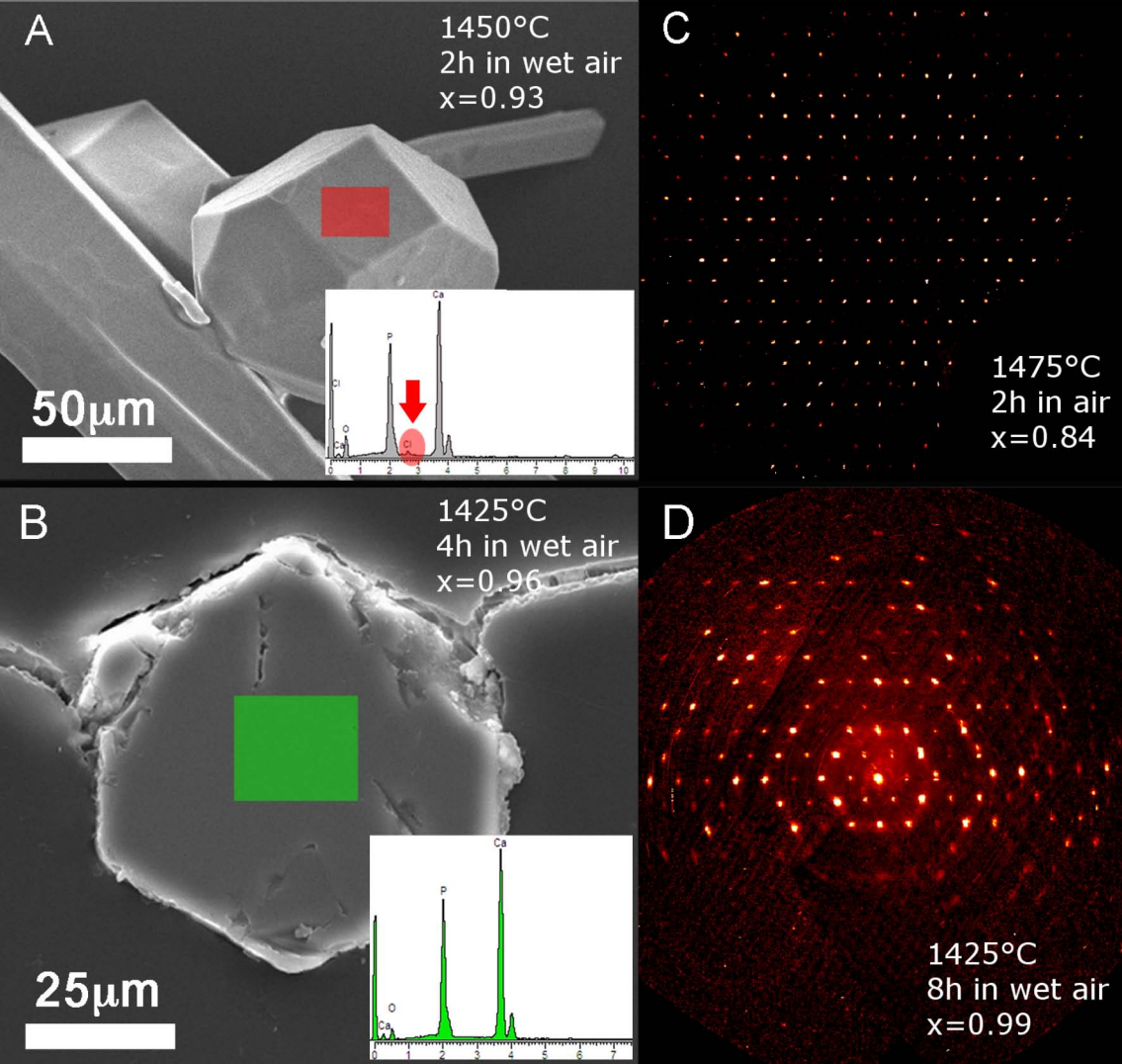

A
Intensity (a. u.)
monoclinic
phase
Peaks
displacement
1490ºC
1475ºC
1450ºC
1425ºC
ClAp
29
30
31
32
33
34
35
36
2 theta (º)
○ ClAp ● HA
B
OH
OH
HA
1490ºC
1475ºC
1450ºC
1425ºC
ClAp
% Transmitance
CO2
Vibrational
Overtones
CO3 2-
4000
3600
3200
2800
2400
2000
1600
1200
800
400
Wavenumber (cm-1)

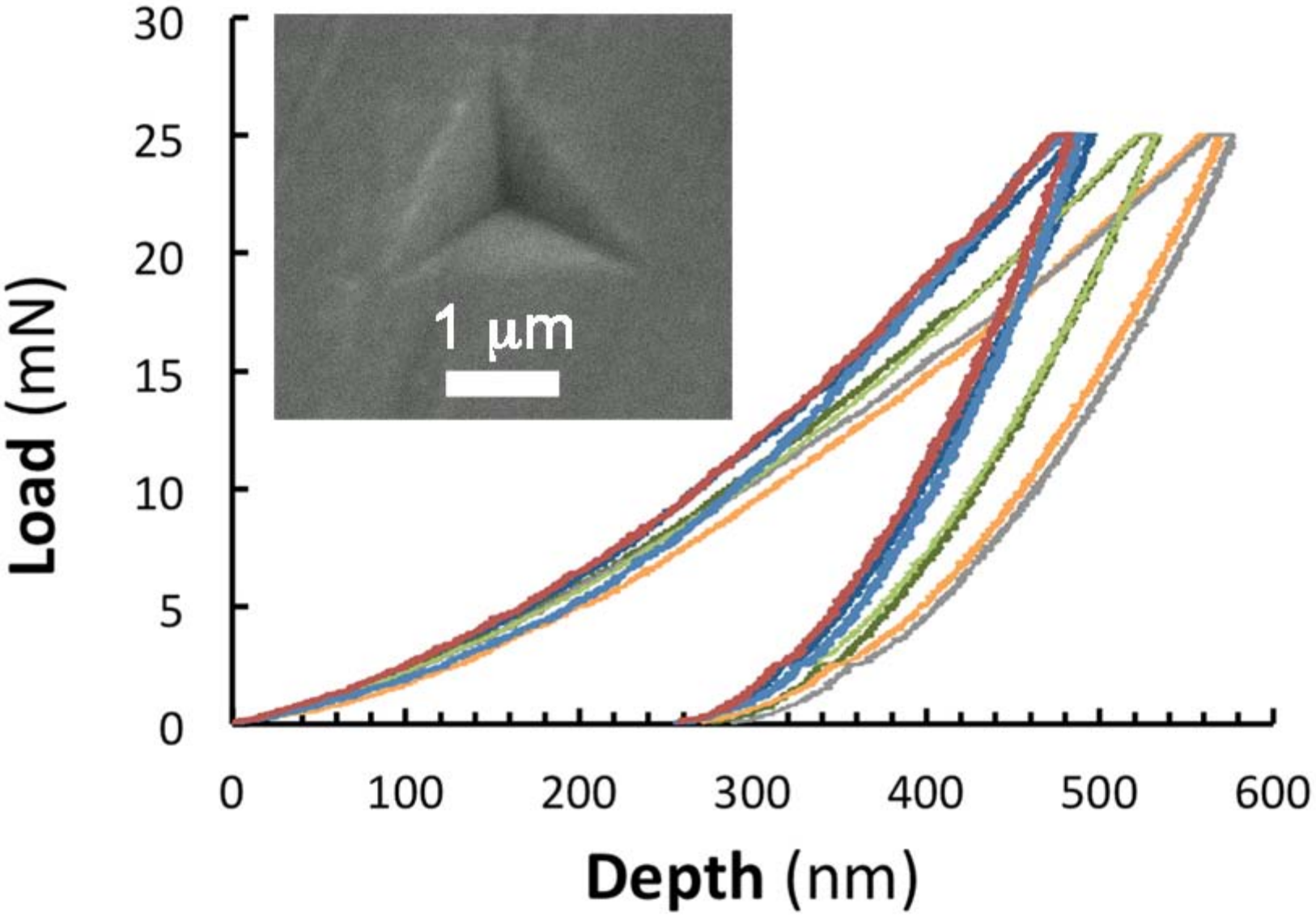

A
monoclinic phase
8h
4h
Peaks displacement
2h
ClAp
Intensity (a. u.)
29
30
31
32
33
34
35
36
2 theta (º)
1425ºC
B
OH
OH
HA
8h
4h
2h
ClAp
% Transmitance
CO2
Vibrational Overtones
CO3 2-
4000
3600
3200
2800
2400
2000
1600
1200
800
400
Wavenumber (cm-1)
1425ºC

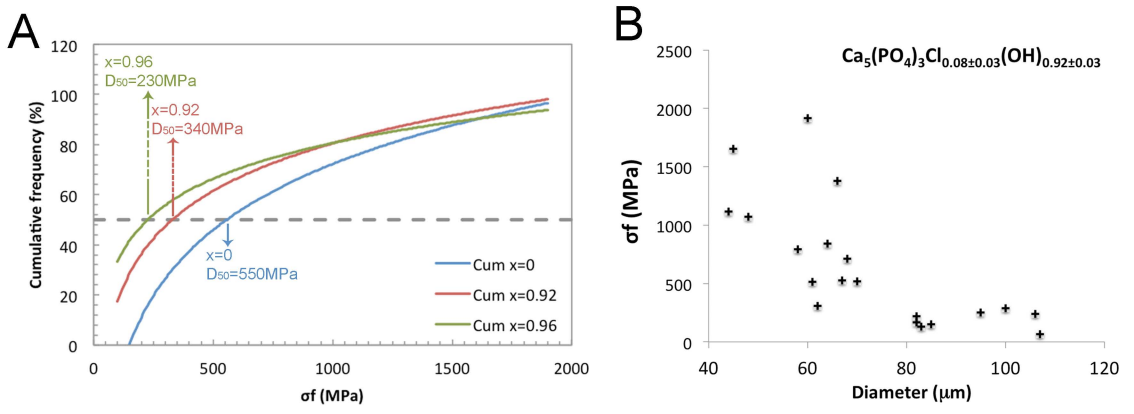

A
B
HA
HA
X
X
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
time (h)
1200
1300
1400
1500
1600
temperature (ºC)
air
wet air


A
ClAp
50μm
B
ClAp
50μm


A
1300ºC
2h
50µm
B
1400ºC
2h
5µm
C
1480ºC
2h
50µm
D
1480ºC
2h
Spectrum 1
60µm
E
1500ºC
2h
50µm
F
Spectrum 1
Ca
P
Cl
O
Ca
keV
0
1
2
3
4
5
6
7
8


A
1450°C
2h in wet air
x=0.93
50µm
Ca
P
Cl
O
Ca
Cl
B
1425°C
4h in wet air
x=0.96
25µm
Ca
P
O
Ca
C
1475°C
2h in air
x=0.84
D
1425°C
8h in wet air
x=0.99


30
25
20
15
10
5
0
Load (mN)
1 μm
0
100
200
300
400
500
600
Depth (nm)


A
x=0.96
D50=230MPa
x=0.92
D50=340MPa
x=0
D50=550MPa
Cum x=0
Cum x=0.92
Cum x=0.96
Cumulative frequency (%)
σf (MPa)
0
20
40
60
80
100
120
0
500
1000
1500
2000
B
Ca5(PO4)3Cl0.08±0.03(OH)0.92±0.03
σf (MPa)
Diameter (μm)
0
500
1000
1500
2000
2500
40
60
80
100
120