

‘ *

pH

Ca/P

Ca/P

°C

(pH / /)

"

"

"

"

-

/

:

*

:

-

:

-

:

[]
pH
CO₃²⁻
Cl⁻ F⁻ HPO₄²⁻ Fe²⁺ Na⁺ Mg²⁺
[]
(Ca,X)₁₀(PO₄,CO₃,Y)₆(OH,Z)₂
Z Y X
[]

[]

[]

[]

pH

:

Ca/P

[]

mM [PO₄]³⁻ /

°C

(HA)

[]

B

A

pH

B

A

/

[]

B

)

[]

(Rugger Vaccum Pump, Reax 2000

cmHg

() °C

[]

(Biotol, Plasma Biotol Limited, England) HA

°C

* Torr

EDWARDS

°C / h

ARL 3410 ICP-AES

PW 3710 (XRD)

pH

(ELTRA 80S) /

[]

°C

pH

Netzsch (TG DTA)

°C/min

STA 1640

°C

T= °C

[]

[]

pH /
mM

(HANNA Instruments, pH 211 Microprocessor) pH

Ca/P

mM

mL (+) μm
pH /

Ca/P

[]

rpm

°C

/ Ca/P
CO₃

/ pH / mol/L

Ca/P

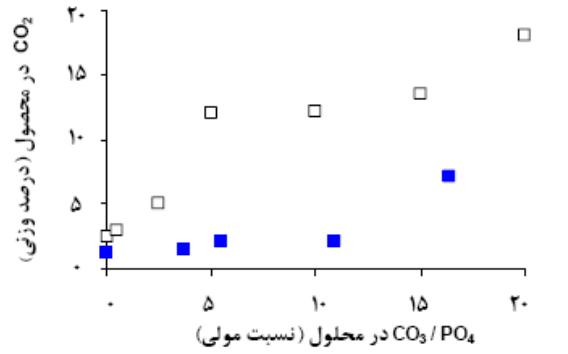
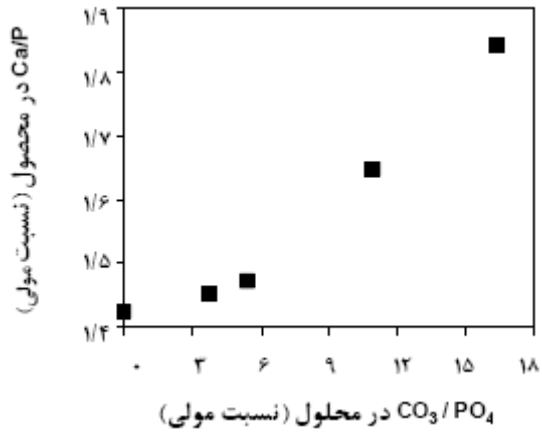
(CO₂)

pH

)

(CO₃/PO₄)

/ pH



Ca/P = / (CO₃/PO₄)

[]

°C [] Tadic []

Tadic .

[]
pH / (°C)

()

Ca/P

Tadic

[]

)
Ca/P (CO₃/PO₄)

CO₂

Ca/P

CO₂

Ca/P

[]

(HA) /

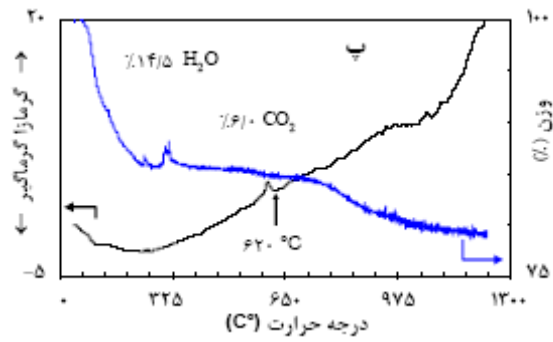
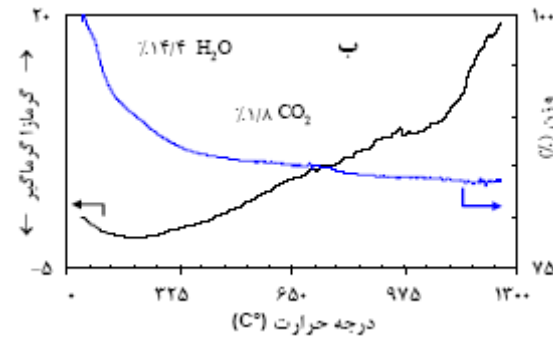
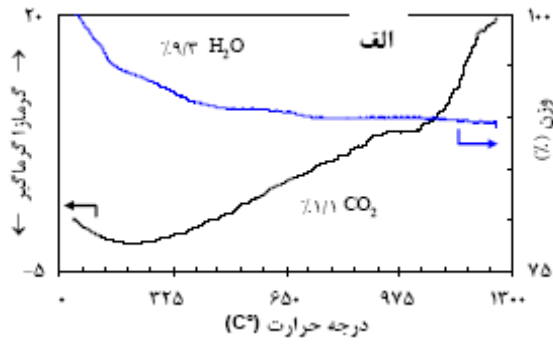
CO₂

N₂

) Ca₉(PO₄)₆

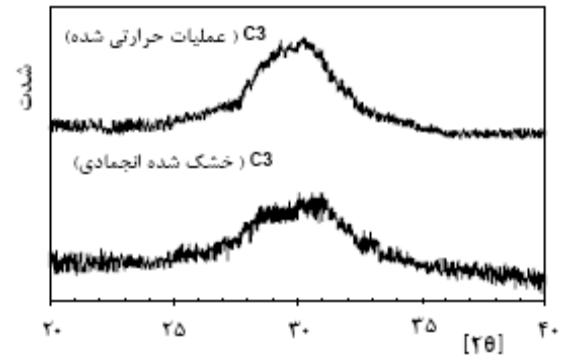
[]

¹ clusters



TG DTA

:(CO₃/PO₄)
/ /



C3

°C

°C

CO₂

[]

) C1

) C2 (

C3 (CO₃/PO₄ = /

)

(CO₃/PO₄ = /

C3 C2 C1

°C

.(/)

C3 C2 C1

°C

°C

C2 C1

°C

C3

C3 C2 C1

TG

°C

(DTA TG)

C3 C2 C1

/)

°C

C1

.(

/

(HC) °C	ICP				(FC)	/ / /	C3 C2 C1	TG
	Ca	P	H ₂ O	CO ₃				
FC1	/	/	/	/				
FC2	/	/	/	/				
FC3	/	/	/	/				
HC1	/	/	-	/				
HC2	/		-	/				
HC3	/	/	-	/				

°C
OH
pH
Ca²⁺

OH
" (FC) "
(HC) " °C

C3 TG
°C
(CO₂)
[]
2 HPO₄²⁻ + 2 CO₃²⁻ → PO₄³⁻ + H₂O + 2 CO₂ ()

[] [] °C

² Bone substitutes

³ Bioactive materials

[]

()

[]

pH /

°C

pH

/

pH

[]

pH

[]

pH

[]

/ /

/

[]

%

(FC)

(HC)

[]

()

[]

FC3 HC3)

" "

(FC2 HC2

[]

()

)

C2 C1

(

HC1 FC1

[]

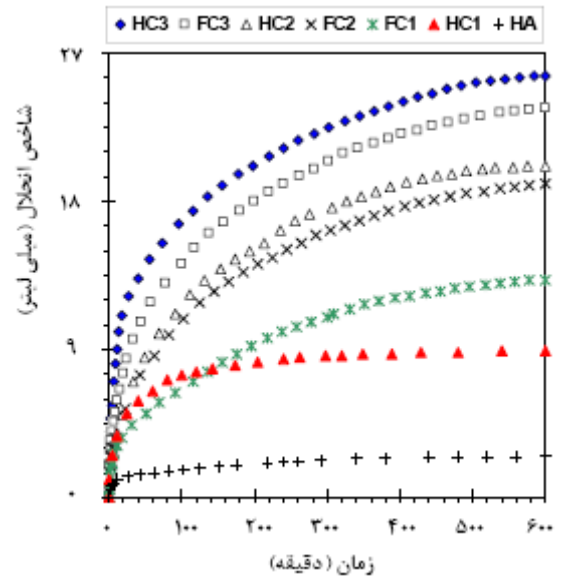
[]

⁴ Osteoclasts

⁵ Ruffled border

⁶ Phagocytose

⁷ Carbonic anhydrase



°C pH / /
 (HNO₃, mM)
 HC
 FC
 HA .(

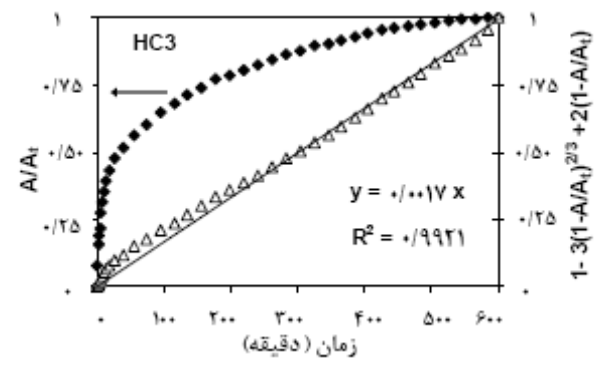
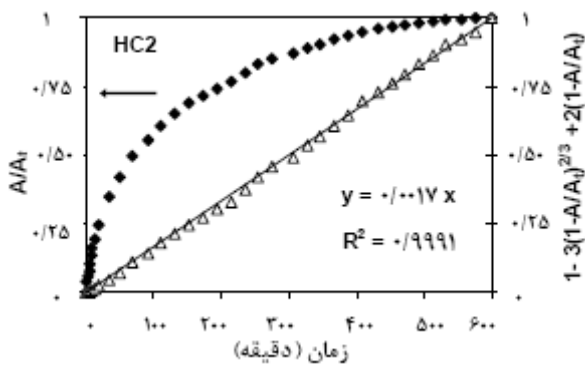
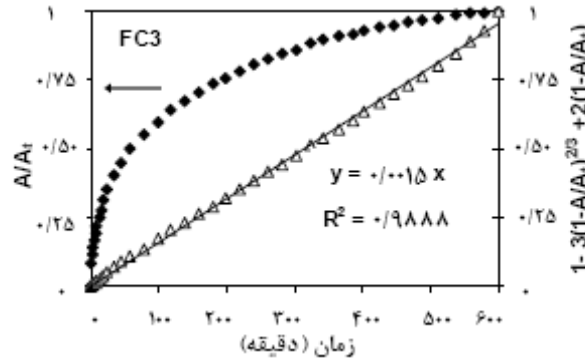
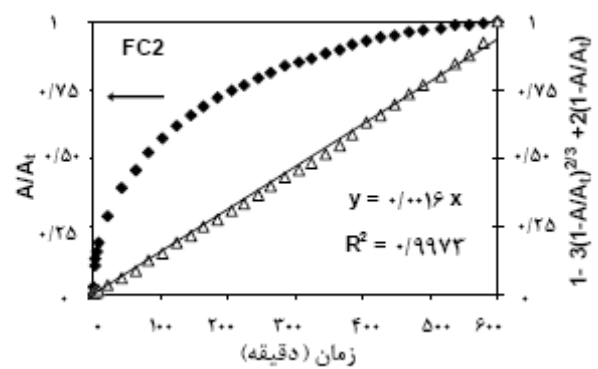
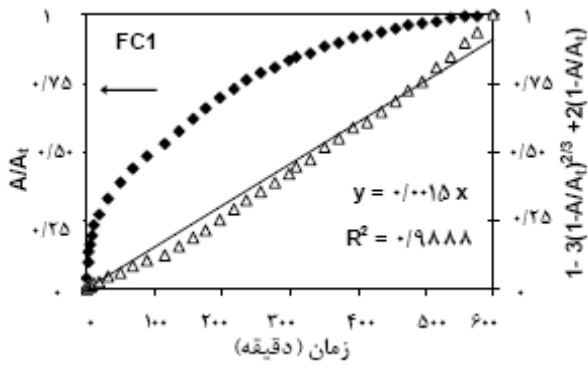
)
 .
 (

()
 () ()
 :[]

:()
 $kt = X$ ()
 :()

$kt = 1 - 3(1 - X)^{\frac{2}{3}} + 2(1 - X)$ ()
 :()
 $kt = 1 - (1 - X)^{\frac{1}{3}}$ ()
 k t X

[]
 :
 $X = \frac{A}{A_t}$ ()
 A_t A
 []



HC2)

(FC3 FC2 FC1)

°C

rpm

pH / /

(HC3

k

HC1

[]

: []

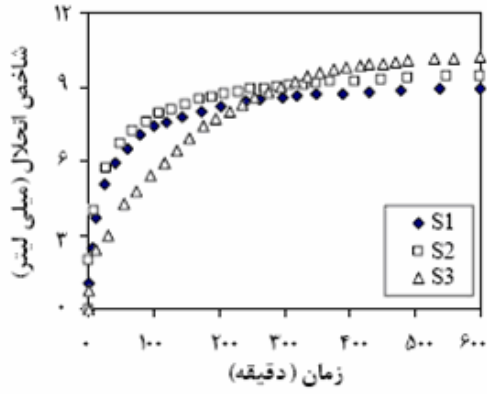
$$-\ln(1 - X) = k t^n$$

()

(FC3 FC2 FC1)

[]

(HC3 HC2)



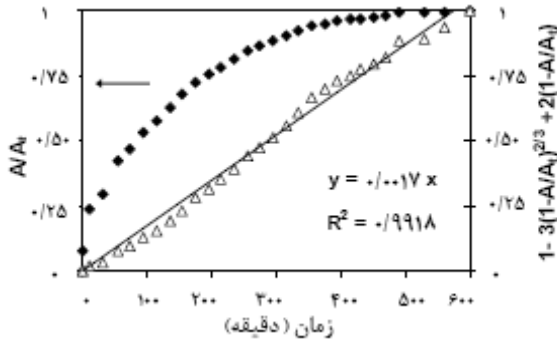
pH / / HCl

HCl

[]

S2 °C rpm S1
°C rpm S3 °C rpm

HCl



°C rpm pH / / HCl

HCl

$$-\ln\left(1 - \frac{A}{A_t}\right) = k t^{0.56} \quad ()$$

°C HCl

°C

°C

°C

°C

()

(XRD)

XRD

[]

)

(XRD

H₃O⁺

(DCPD, $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$)

" " "

[] Tadic

Ca/P

pH

/

XRD

DCPD

[]

Ca/P

/

°C

DCPD

DCPD

[]

HA

DCPD

/

HA

DCPD

[]

DCPD

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