

Supplementary Information

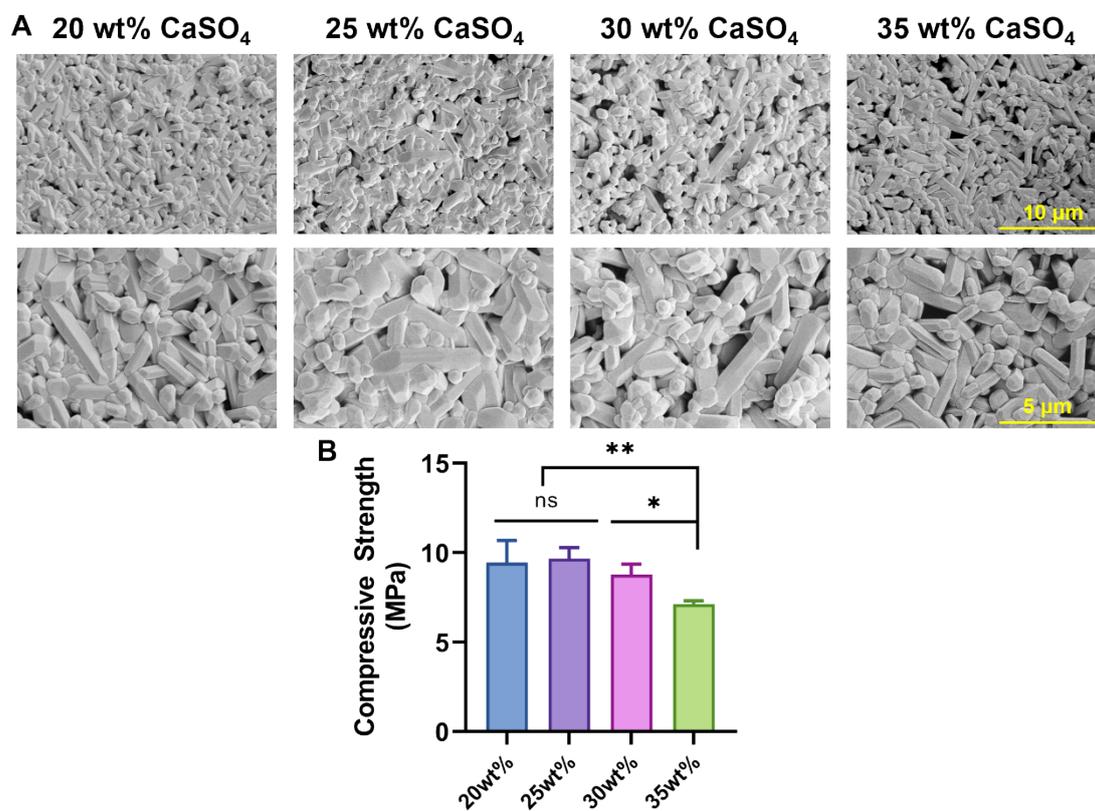


Figure S1. In-situ whisker HAp ceramic with different CaSO₄ concentration. (A) whisker morphology; (B) compressive strength.

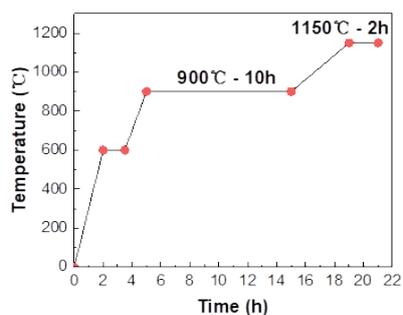


Figure S2. The sintering curve of the ceramics.

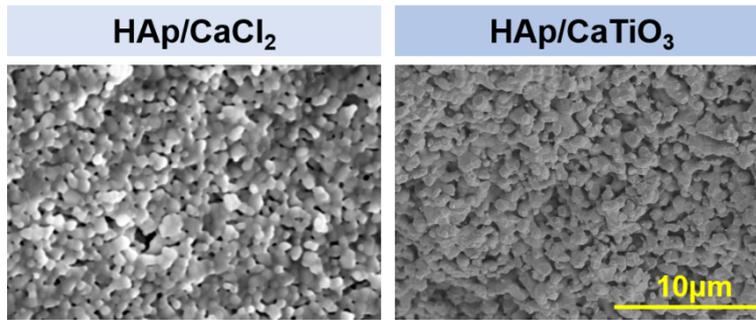


Figure S3. Micromorphology of HAp/CaCl₂ and HAp/CaTiO₃ bioceramics.

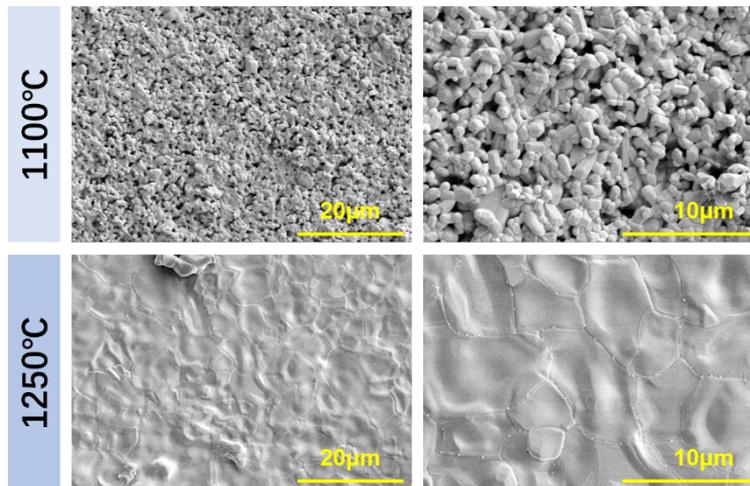


Figure S4. Micromorphology of HAp/CaSO₄ bioceramics at different sintering temperatures.

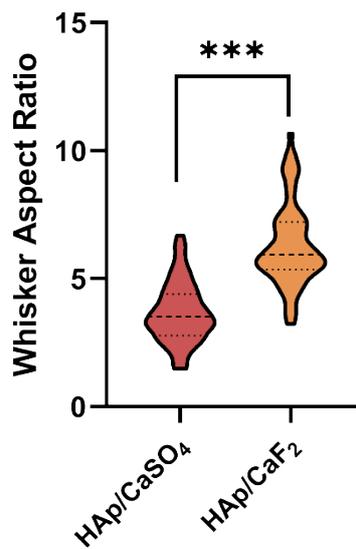


Figure S5. Whisker aspect ratio of the in-situ whisker bioceramics.

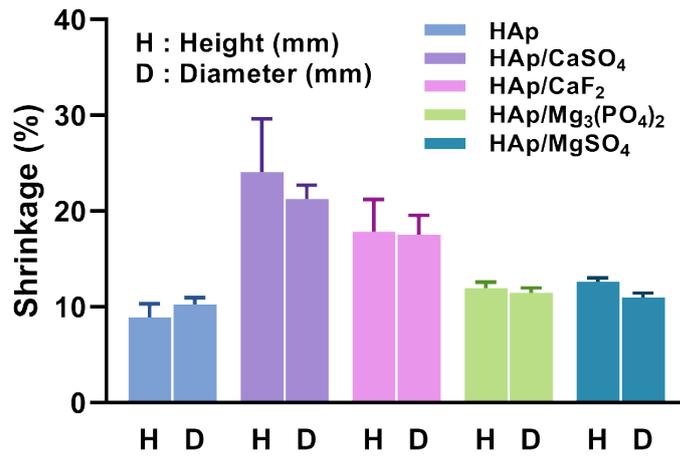


Figure S6. The shrinkage rate of bioceramics with different additives.

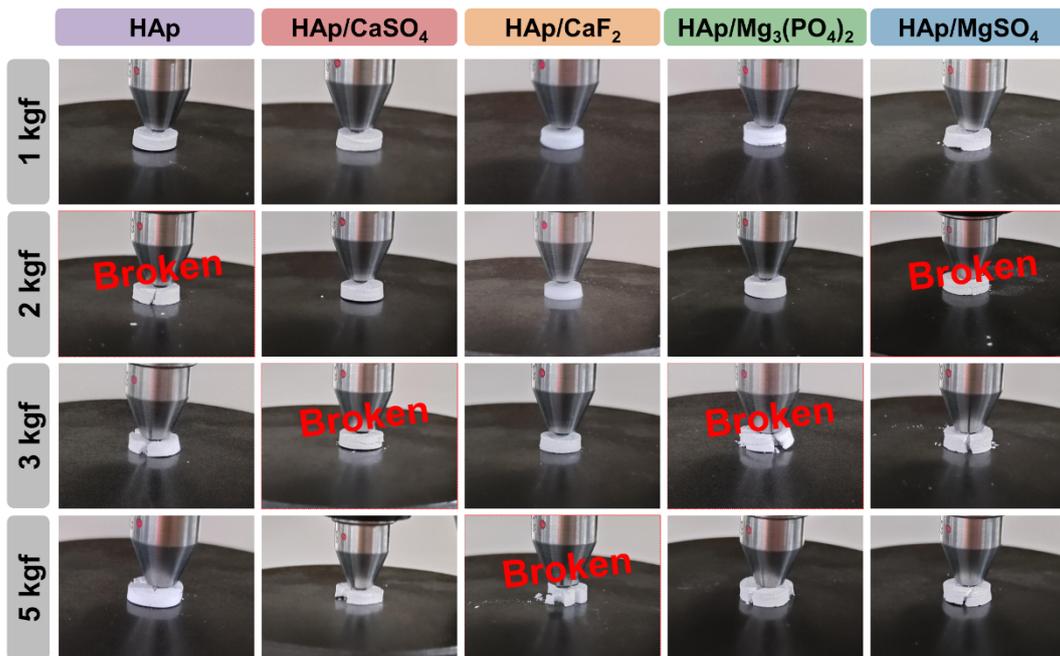


Figure S7. The indentation tests of bioceramics with different additives.

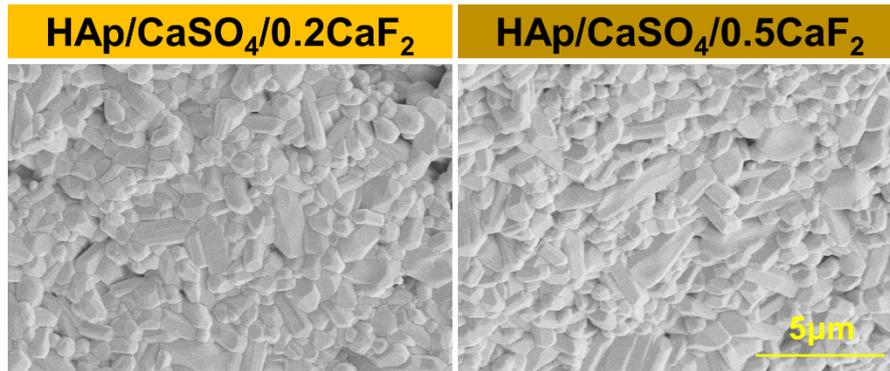


Figure S8. The SEM images of HAp/CaSO₄/0.2CaF₂ and HAp/CaSO₄/0.5CaF₂ bioceramics.

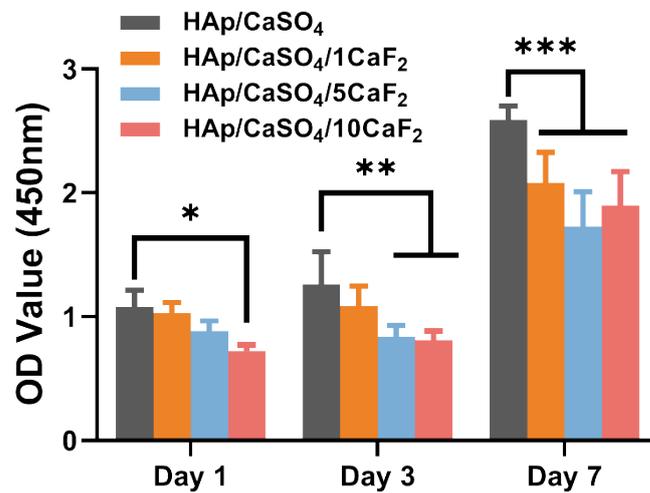


Figure S9. CCK-8 OD values for MC-3T3 cells co-cultured with scaffolds with high CaF₂ content.

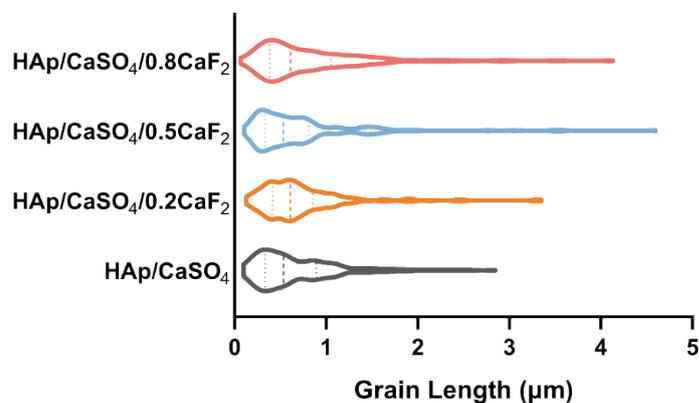


Figure S10. The grain length of HAp/CaSO₄/CaF₂ bioceramics.

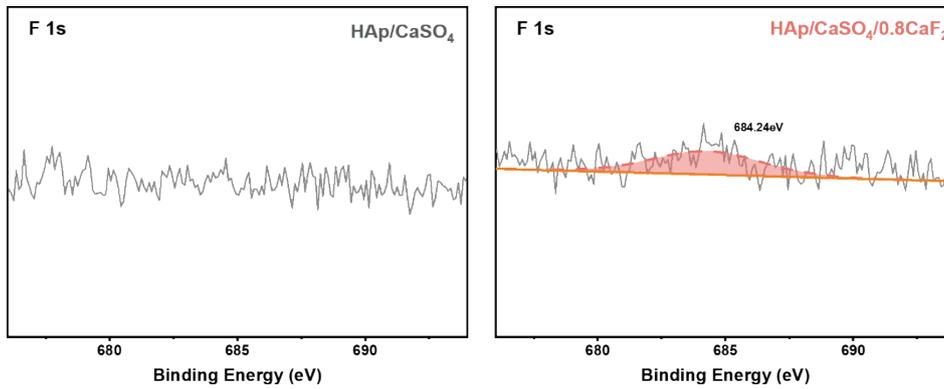


Figure S11. The XPS peak fitting of F 1s.

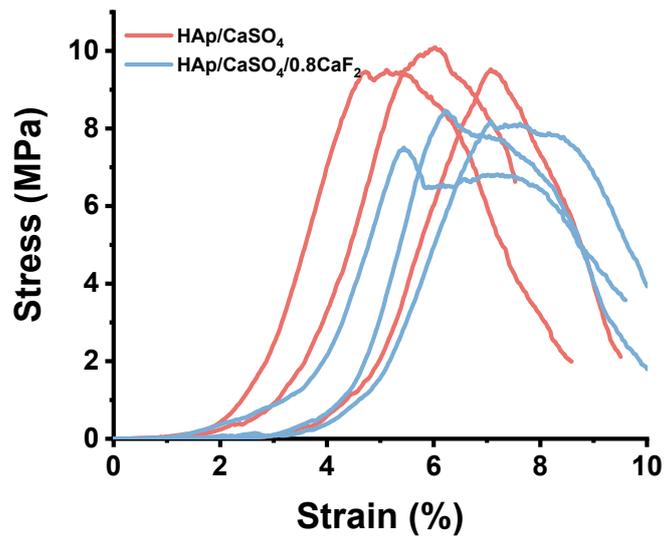


Figure S12. The stress-strain curves of HAp/CaSO₄ and HAp/CaSO₄/0.8CaF₂ bioceramics.

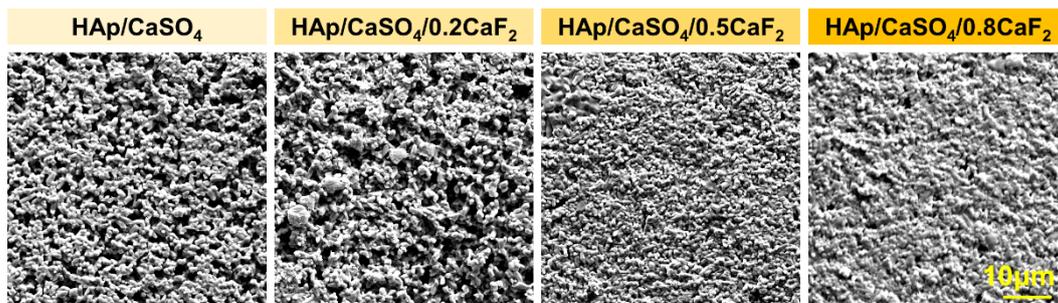


Figure S13. The morphological images of bioceramics surfaces after immersing in PBS for 42 days.

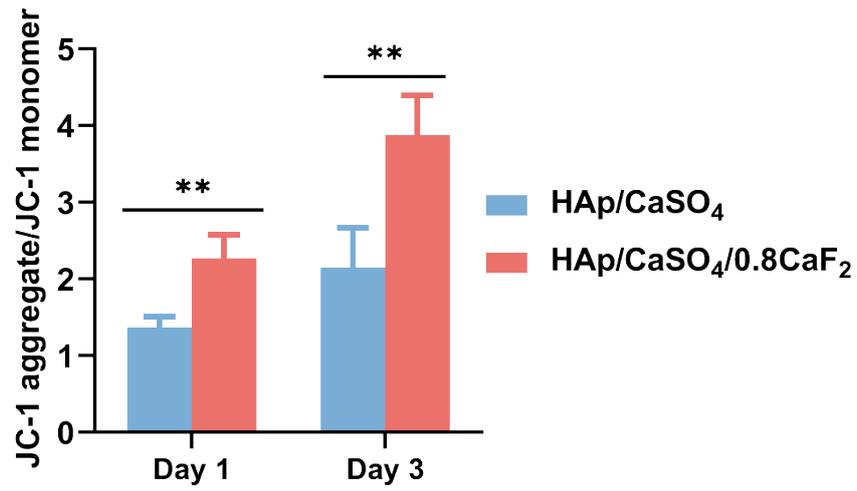


Figure S14. The ratio of JC-1 aggregates to monomers.

Table S1. F⁻ release from HAp/CaSO₄/CaF₂ bioceramics.

Time	1 Day	3 Days	5 Days
F ⁻ concentration	0.15 mg/L	0.20 mg/L	0.30 mg/L

Table S2. qRT-PCR target genes and their primer sequences.

Gene	Primer (5'-3')
GAPDH	FORWARD : GCACTGTTGAAGTCGCAGGAGA
	REVERSE : CCGCCCAGAACATCATCCCT
β-actin	FORWARD : CCAACCGCGAGAAGATGACC
	REVERSE : CCAGAGGCGTACAGGGACA
COL I	FORWARD : GGCAAAGAAGGCGGCAAAGG
	REVERSE : GGAGCACCAGCAGGACCATC
Spp 1	FORWARD : CAGAATCTCCTAACACCGCAGAATG
	REVERSE : TGGTCATCGTCCTCATCCTCATC
Runx 2	FORWARD : AGCAGCAGCAGCAACAGCAG
	REVERSE : GCAGCACCGAGCACAGGAAG
ALP	FORWARD : CAGGCTGGAGATGGACAAGTTC
	REVERSE : TCACGCCGCACAGGTAGG
Bmp-2	FORWARD : GCCAGATCAGTCCCTTTG
	REVERSE : ACCACCACCCCTTAATTTG
Citrate Synthase	FORWARD : AGTTCACCTGCCATGGCTTTA
	REVERSE : CAAGACAGGATGAATTCTTGGCTC
ATP5F1A	FORWARD : GCAAGGAACCTTCATGCCTCT
	REVERSE : ATCTCAGCAGTGCCAGTCTTC