The typical XRD patterns of all synthesized samples are shown in Fig. S1 and S2. The diffraction peaks shifted to low 2θ values with the Sr addition and to high 2θ values with the Mg addition, indicating an increase (decrease) in d-spacings and hence lattice parameters. The patterns showed that all Sr-substituted HA samples had good crystallinity. However, the peaks were dramatically broadened with the addition of Mg, indicating a decrease in crystallinity. The patterns showed a characteristic amorphous peak when the content of Mg was 50%.

The TEM and SAED patterns provided other adequate evidences as shown in Fig. S3 and S4. When the Mg content was up to 20%, the structure of nano-rod cluster has been formed. The amorphous nano-hollow sphere began to appear when the Mg content was up to 40%. The product was completely turned into lamellar structure with certain crystallinity when the Mg content was up to 100% (magnesium salt). Consistent with the XRD data, all Sr-substituted HA showed well crystallinity as can be seen from the SAED patterns. Meanwhile, the incorporation of Sr destroyed the hexagonal structure and made the grain irregular. However, the grains become more and more regular with the Sr content further increasing until the grain exhibited a regular hexagonal structure again at 100% Sr. It was worth noting that the 100%Sr-substituted HA had a longer c-axis than that of HA.

The crystallinity of HA decreases with the incorporation of Sr and the extreme minimum value is near 40 ~ 60% Sr substitution, while it increases gradually when further increasing Sr content as shown in Table S1. This observation may attribute to the change of lattice structure. The nanoparticles present regular hexagonal structure

with either high Ca content or Sr content, but exhibit irregular shapes when the Ca content is close to that of Sr (40 ~60% Sr). Such relatively irregular morphology induces the decreases of crystallinity.

All the above findings suggested that the hydroxyapatite crystals grow in different ways when the calcium is substituted by strontium or magnesium.

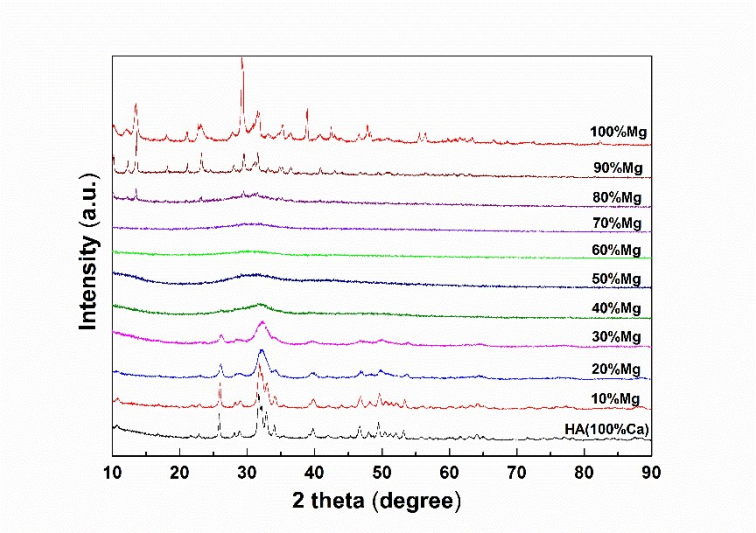

Figure S1 XRD patterns of the Mg-substituted HA samples.

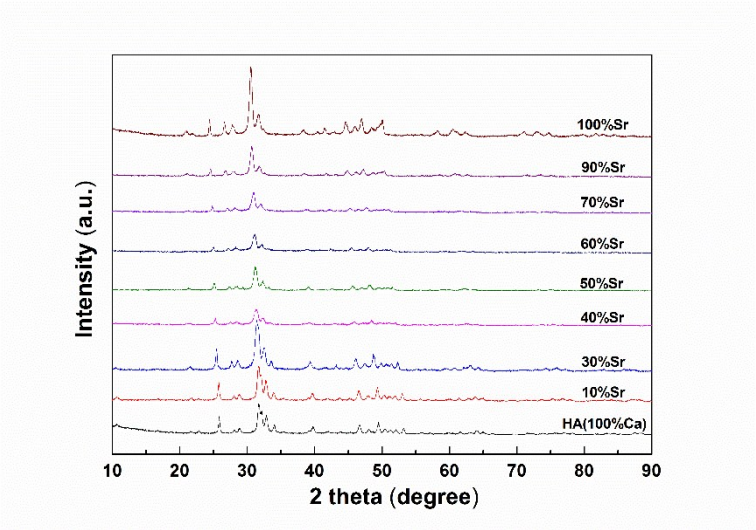

Figure S2 XRD patterns of the Sr-substituted HA samples.

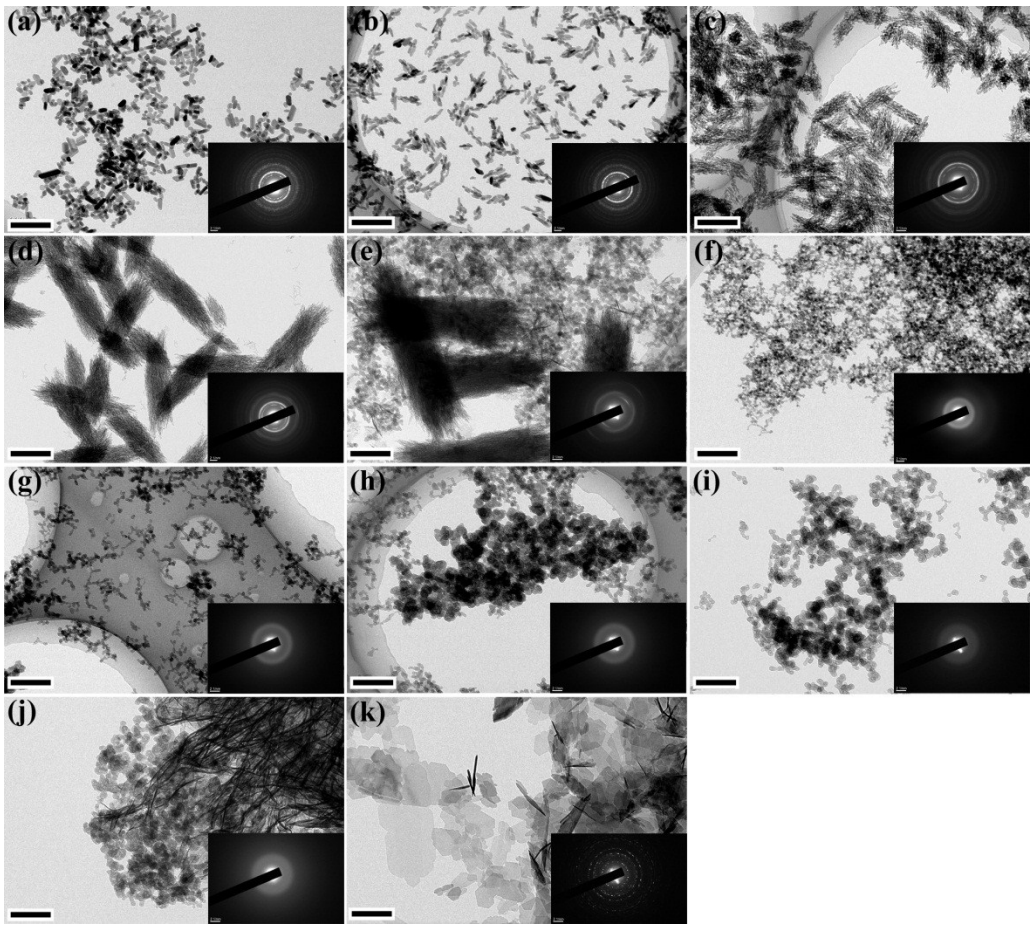

Figure S3 TEM and SAED images of the HA and Mg-substituted HA samples: (a) HA, (b) 10%Mg, (c) 20%Mg, (d) 30%Mg, (e) 40%Mg, (f) 50%Mg, (g) 60%Mg, (h) 70%Mg, (i) 80%Mg, (j) 90%Mg, (k) 100%Mg.Scale bars: 200nm.

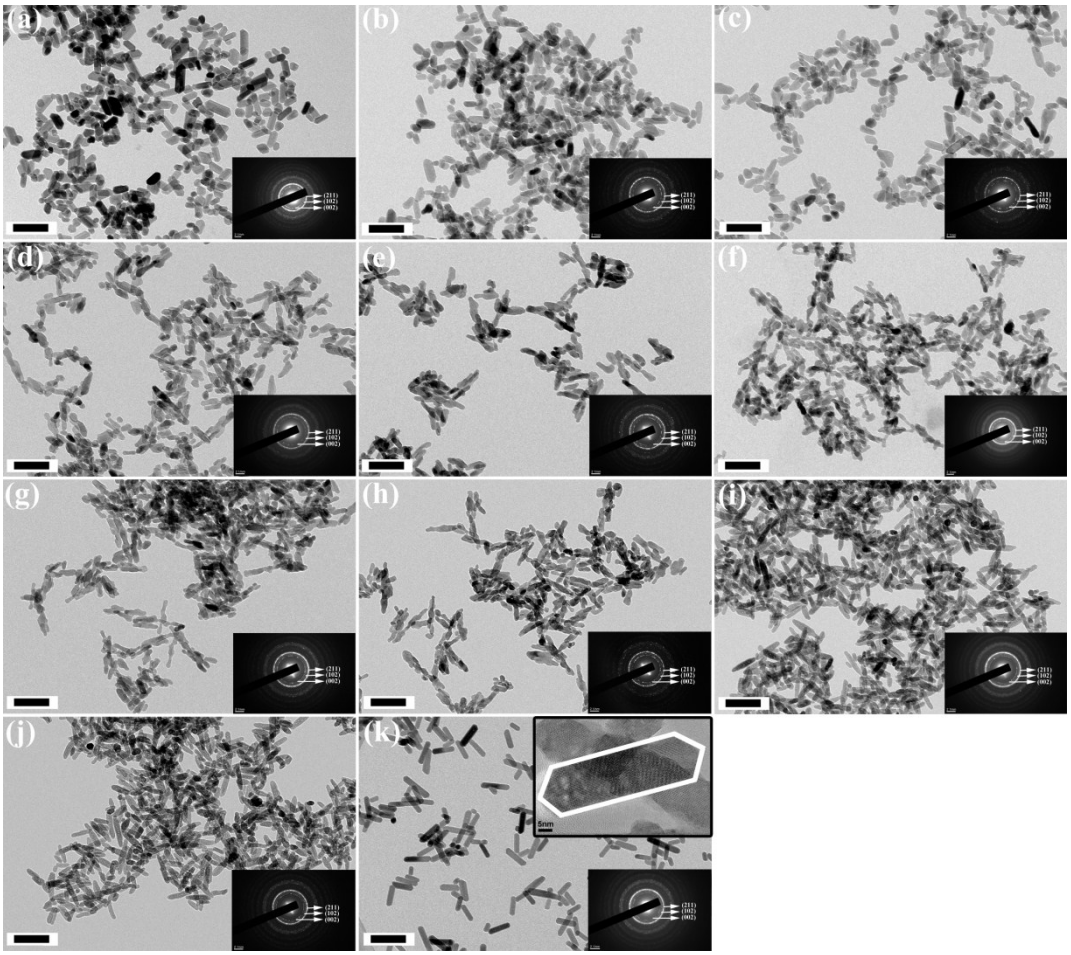

Figure S4 TEM and SAED images of the HA and Sr-substituted HA samples: (a) HA, (b) 10% Sr, (c) 20% Sr, (d) 30% Sr, (e) 40% Sr, (f) 50% Sr, (g) 60% Sr, (h) 70% Sr, (i) 80% Sr, (j) 90% Sr, (k) 100% Sr.Scale bars: 100nm.

Table S1 Lattice parameters and crystallinity of the prepared samples.

Samples	Crystallinity	**2θ** values of (002)	Lattice parameters	
			a axis (Å)	**c** axis (Å)
HA	54.9%	25.855	9.4035	6.8692
10% Mg	34.8%	25.958	9.3892	6.8380
20% Mg	9.2%	26.122	9.3563	6.8072
30% Mg	4.5%	26.183	9.3041	6.7743
40% Mg	0		—	—
50% Mg	0		—	—
10% Sr	54.5%	25.814	9.4522	6.9103
20% Sr	49.7%	25.635	9.4825	6.9496
30% Sr	42.4%	25.486	9.5138	6.9879
40% Sr	40.1%	25.322	9.5367	7.0296
50% Sr	39.0%	25.219	9.5613	7.0712
60% Sr	37.2%	25.035	9.5967	7.1201
70% Sr	41.2%	24.912	9.6346	7.1634
80% Sr	44.3%	24.754	9.6808	7.2054
90% Sr	46.7%	24.583	9.7190	7.2489
100% Sr	48.5%	24.440	9.7532	7.2902