

The Effect of Carbonate on the Crystallization, Phase Composition and Thermal Behavior of Amorphous Calcium Phosphate with Ca/P=1

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Amorphous calcium phosphate (ACP) is a precursor in the crystallization of hydroxyapatite. Therefore, ACP is often used as an intermediate phase in the fabrication of calcium phosphate biomaterials. The effect of carbonate on the crystallization, thermal behavior and phase composition of ACP under various conditions has been widely investigated. It was recently shown that ACP has a heterogeneous composition. The reason and mechanism of the inhomogeneity have been poorly studied. The effect of impurities including carbonate ions on the peculiarities in the composition is also unclear. In most cases, the carbonization of calcium phosphates was carried out by their ageing in carbonate saturated solutions. It often resulted in low carbonization, because the penetration of carbonate ions inside the calcium phosphate particles is complicated.

In this work, the preparation of carbonated ACP with Ca/P=1 was carried out in initial solutions which were previously saturated by carbonate dioxide. Analytical grade calcium nitrate tetrahydrate, $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$, and ammonia hydrophosphate, $(\text{NH}_4)_2\text{HPO}_4$, were used as reactants. The pH values of solutions were within 10–11. The synthesis temperature 50°C, the reaction time was about 1 minute. The slurry appeared after mixing was dried by lyophilization.

The powdered samples were examined as-prepared and upon heating to a given temperature in the range 25–1000°C. XRD, TG-DTA and IR methods were employed.

The as-prepared samples were X-ray amorphous. The effect of carbonate ions on the crystallization, thermal behavior and phase composition of ACP with Ca/P=1 is reported.