WHAT IS CLAIMED IS:

1. A method for producing particles, comprising:

mixing a first substance containing phosphorus and a second substance containing calcium and feeding, into a heated atmosphere, droplets of a liquid containing an amorphous reaction product, obtained by the reaction between the first substance and the second substance, to bring the reaction product into a gaseous state; and

crystallizing the reaction product in the gaseous state to obtain particles mainly composed of a calcium phosphate-based compound.

2. The method for producing particles as claimed in claim 1, wherein the first substance contains as a main ingredient, at least either phosphorus oxide or phosphoric acid ester.

3. The method for producing particles as claimed in claim 1, wherein the second substance contains as a main ingredient, at least either calcium alkoxide or calcium salt.

4. The method for producing particles as claimed in claim 1, wherein the amount of impurities contained in the calcium phosphate-based compound is 5 wt% or less.

5. The method for producing particles as claimed in claim 4, wherein the impurities mainly contain at least either a by-product other than the reaction product or a decomposition product of the calcium phosphate-based compound.

6. The method for producing particles as claimed in claim 1, wherein the heated atmosphere contains plasma produced by ionization of an ambient gas.

7. The method for producing particles as claimed in claim 6, wherein the temperature of the plasma is in the range of 2,000 to 15,000°C.

8. The method for producing particles as claimed in claim 1, wherein the crystallizing step further comprises the step of forcibly cooling the reaction product in the gaseous state.

9. The method for producing particles as claimed in claim 1, wherein the particles are substantially spherical in shape.

10. The method for producing particles as claimed in claim 9, wherein the average particle diameter of the spherical particles is in the range of 5 to 300 nm.

11. The method for producing particles as claimed in claim 1, wherein the calcium phosphate-based compound is hydroxyapatite or tricalcium phosphate.

12. Particles produced by the method for producing particles as claimed in claim 1.

13. Particles mainly composed of a crystalline calcium phosphate-based compound, which have an average particle diameter of 5 to 300 nm and an average roundness coefficient C represented by the following formula (I) of 0.8 to 0.99:

$$C = 4\pi S/L^2 \quad \cdots \quad (I)$$

where S (nm^2) represents an area of a projection image of a particle as a measuring object, and L (nm) represents a circumferential length of the projection image of the particle as a measuring object.

14. The particles as claimed in claim 12, which contain hollow particles in the proportion of 5 to 40 %.

15. The particles as claimed in claim 13, which contain hollow particles in the proportion of 5 to 40 %.

16. A sintered body obtained by sintering a molded body of the particles as claimed in claim 12.

17. A sintered body obtained by sintering a molded body of the particles as claimed in claim 13.