

BCP Sintering: Preserve the Final Phase Ratio

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Abstract. Verify the HA/ β -TCP ratio after sintering, including the effect of cooling. This note separates feed composition from final phase composition and identifies the records and measurements needed to compare firing programs. Peak temperature alone is an incomplete process description.

Keywords: BCP; sintering; cooling; phase composition; HA; β -TCP

1. Compare complete thermal histories

In one BCP sintering study, additional α -TCP appeared above 1100 °C. A modified schedule with a 900 °C hold removed α -TCP for the tested 1250 and 1275 °C programs while preserving the HA/ β -TCP balance [1]. These are results for that material and schedule, not universal firing instructions.

For a new powder, first map the existing production cycle: ramp rates, peak dwell, load arrangement, cooling rates and any intermediate hold. Furnace setpoint alone does not establish the temperature history inside a thick part or a densely loaded furnace.

A useful first comparison keeps forming method, green density and peak program constant while changing only a justified cooling step. Measure shrinkage and final phase composition together. If the objective is a particular phase ratio, accepting a dense-looking part without phase analysis leaves the main requirement untested.

2. Build a usable sintering window

2.1 Calculate shrinkage consistently. Linear shrinkage is $100(L_{\text{green}} - L_{\text{fired}})/L_{\text{green}}$. An illustrative 10.00 mm dimension becoming 8.50 mm gives 15.0%. If shrinkage were equal in all directions, the corresponding volume reduction would be $1 - 0.85^3 = 38.6\%$. That is not 38.6% open porosity: mass, density and closed pores remain separate quantities.

Table 1. Development comparison and interpretation controls.

Stage	Measurement	Interpretation
Starting powder	Quantitative XRD	Define the true feed phases
Green component	Mass, size and green density	Separate forming variation
Fired component	Shrinkage and density	Assess consolidation
Final material	XRD and microstructure	Confirm phase balance and grains

Scope. The cited temperatures are a study-specific example. Establish dwell times and thermal limits on the actual powder, component and furnace.

References

1. Brown O, McAfee M, Clarke S, Buchanan F. Sintering of biphasic calcium phosphates. J Mater Sci Mater Med. 2010;21(8):2271-2279. doi:10.1007/s10856-010-4032-6.

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