

## Student Speech Contest 2025

# Eco-friendly Fast-facile Synthesis of Nanostructures Calcium Phosphate Bioceramics by Liquid Flame Spray (LFS) Method



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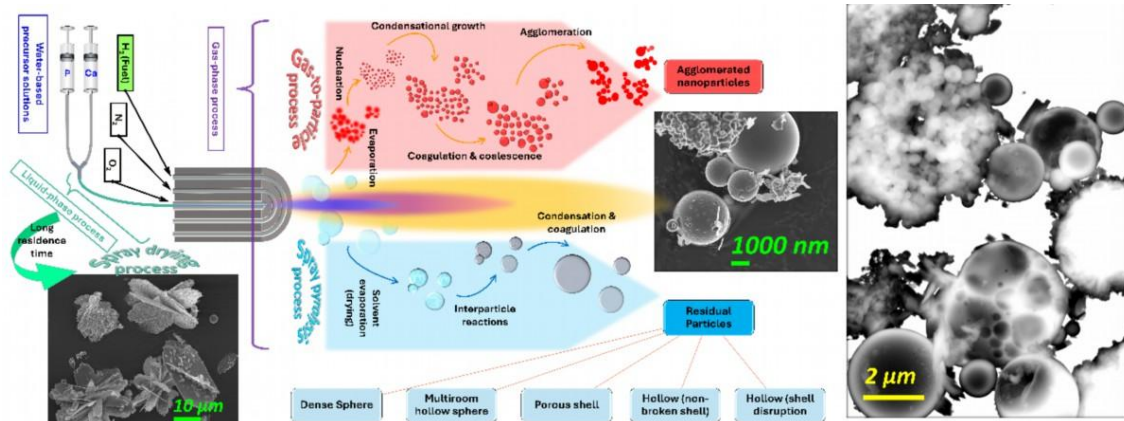
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**Project.** Synthesis of Nanostructured Calcium Phosphate Bioceramics by Liquid Flame Spray (LFS) Method.

**Topic / keyword.** Hydroxyapatite, Monetite, Continuous Synthesis, Eco-friendly.

### Abstract.



Calcium phosphate (CaP)-based bioceramics, especially hydroxyapatite (HAp) and monetite, are widely used in biomedical applications due to their similarity to hard tissues. HAp is the most widely used and finds extensive application in various biomedical fields. Monetite has recently also gained attention for orthopedic applications due to its unique bioproperties, such as bioresorption rates that align with new bone formation. There is growing demand and interest in developing cost-effective, simple, green, large-scale (or fast and continuous), and adjustable synthesis methods for both HAp and monetite bioceramics, particularly those with nanostructures to enhance their bioproperties due to larger surface area and surface reactivity.



Common methods for synthesizing CaP nanostructures are often discontinuous, time-consuming, and complex, primarily due to their dependence on batch or semi-batch reactor systems. Herein, we develop a flame aerosol synthesis method, Liquid Flame Spray (LFS), to produce nanostructured CaP particles through a single-step, continuous, rapid, cost-effective, scalable, and environmentally friendly process. LFS involves feeding a precursor solution into a H<sub>2</sub>-O<sub>2</sub> flame, providing a gas-to-particle and/or droplet-to-particle process for synthesis of nanostructured particles. This study demonstrates the synthesis of HAp nanoparticles and nanoporous monetite bioceramics using the LFS method without the use of organic solvents, surfactants or acids.

### References.

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- A. Charmforoushan, M. Sorvali, T. Ylihärsilä, P. Karjalainen, J.M. Mäkelä, Eco-friendly fast-facile synthesis of single-phase hydroxyapatite nanoparticles by liquid flame spray method, *Ceramics International*. 51 (2025) 65273-65285. <https://doi.org/10.1016/j.ceramint.2025.11.114>