Flame Spray Synthesis of nanooxide for energy application

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Abstract
Flame spray pyrolysis (FSP) is considered one of the most scalable and cost-effective technologies for preparing well-controlled nanooxides which find applications as catalysts, biomaterials, sensors, to cite a few [1-2].
Compared to other synthesis techniques such as solid state reaction or wet methods, it has the advantage of avoiding detrimental steps (e.g. grinding, intensive milling, washing, or heat treatment). This method allows obtaining homogeneous nanoparticles as a nucleation process from the gas phase (gas-to-particle conversion). To this purpose economical precursors (e.g. nitrates) and solvents are used to synthesize a wide variety of possible material compositions with high production yields.
In the present work we investigate the relation between FSP solvents and particle formation focusing on solvent parameters such as boiling point, enthalpy of reaction and possibility for carboxylation. To this purpose, XRD, SEM and TEM analysis is performed in order to assess the impact of the solvent on particles size and crystallinity. Examples of the application of these flame-spray synthetized oxide nanoparticles in electrocatalysis for H_2 production are also presented.

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References
1. R Strobel and S. E. Pratsinis, Effect of solvent composition on oxide morphology during flame spray pyrolysis of metal nitrates, Phys. Chem. Chem. Phys., 2011, 13, 9246–9252
2. A. Pozio, F. Bozza, N. Lisi, R. Chierchia, F. Migliorini, R. Donde, S. De Iuliis, Cobalt Oxide Synthesis via Flame Spray Pyrolysis as Anode Electrocatalyst for Alkaline Membrane Water Electrolyzer. Materials 2022, 15, 4626.