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FAST/SPS manufacturing of potassium-beta-aluminas for solid-state K-ion batteries

The development of all-solid-state potassium-ion systems depends on solid ionic conductors that provide sufficient ion transport performance. Potassium-beta-alumina is regarded as a relevant candidate; however, its functional behavior is highly sensitive to processing conditions and to the structure of the resulting ceramic material. The presented work investigates the application of the Field assisted sintering technology/Spark Plasma Sintering for the synthesis and densification of potassium-beta-alumina, with emphasis on understanding how rapid thermal processing influences material structure and properties. Particular attention is directed toward the evolution of phase composition and microstructure under varied processing regimes. X-ray diffraction was employed to assess phase stability, monitor phase evolution, and identify potential secondary phases, while scanning electron microscopy was used to evaluate grain morphology, porosity, and compositional uniformity. In summary, the study highlights the suitability of FAST/SPS for the manufacturing of potassium-beta-alumina ionic conductors and clarifies key processing-property relationships that are essential for their prospective integration into all-solid-state potassium ion systems.

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