

In operando Impedance Spectroscopy: a tool to reveal the influence of Cold Sintering Process parameters on microstructure and electrical properties

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Recent advancements in low-temperature sintering techniques are driven by two key objectives: reducing energy consumption and environmental impact while enabling the synthesis of novel materials, composites, and functional devices. Among these methods, the Cold Sintering Process (CSP) emerges as a highly efficient approach for producing high-density ceramics. This process combines ceramic powders with a transient liquid phase, followed by uniaxial pressing under controlled thermal conditions below 400°C.

However, the underlying mechanisms of CSP remain poorly understood. To address this gap, the development of in operando characterization techniques particularly impedance spectroscopy is critical. This method, distinguished by its experimental accessibility and ability to resolve frequency-dependent electrical responses, provides insights into microstructural evolution by discriminating between grain, grain boundary, and transient liquid phase contributions.

This study demonstrates the application of in operando impedance spectroscopy to investigate CSP using ZnO (a semiconductor) as a model system and YSZ (an ionic conductor) as a technologically relevant material. By analyzing electrical responses during densification, the work explores relationships between processing parameters and the resulting microstructure. The goal is to establish correlations between in operando impedance measurements and fundamental sintering mechanisms.

Professional Status of the Speaker

Doctoral or Master Student

Interest in submitting a paper in a special issue of

Journal of the European Ceramic Society (Elsevier)

Invitation letter for visa

No

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