

Materials Day
Abstract Guide
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**Using ultrasound to improve assessment of the cold sintering process in support of
eco-friendly ceramics manufacturing**

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Abstract: The Cold Sintering Process (CSP) is an emerging manufacturing process originally developed at Penn State in 2016 that uses a liquid phase to create bulk materials at significantly lower temperatures than conventional sintering. However, this process is not yet fully understood, and cold sintered samples often lag their conventional counterparts in mechanical properties and homogeneity. Common characterization techniques provide bulk property measurements and often miss small-scale defects. Localized measurements can be used to characterize these flaws but are unfeasible over large volumes. In this work, ultrasonic nondestructive evaluation was used as a holistic flaw detection method in conjunction with scanning electron microscopy. Cold sintered Na₂Mo₂O₇ samples were created at 8 different diameter and thickness combinations and ultrasonic properties (i.e., longitudinal wave speed and attenuation) were measured for samples at all different scales. Delamination flaws caused by inhomogeneities during preparation were detected ultrasonically facilitating revisions to the CSP preparation process which reduced the likelihood of future flaws. High wave speeds and low attenuations, commonly associated with microstructural uniformity, were supported by consistent dielectric relative permittivity of 12 to 14 using both high-frequency spectroscopy and low-frequency capacitance measurements. These results confirm CSP as a scalable manufacturing process for the next generation of advanced ceramics.

Abstract Deadline ~ September 22, 2023 *Late submissions will be considered on a "space available" basis.

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