MECHANICAL ENGINEERING
M.S. DEFENSE

The Department of Mechanical Engineering presents:

The M.S. Defense of Andrew Wieg

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Current Activated Pressure Assisted Densification (CAPAD) Processing of Ceramics Doped with Rare Earths for Functionality

Abstract: The performance of Solid Oxide Fuel Cells (SOFCs) and Lasers are important to both society and science. With the aim of improving the performance of these devices through materials improvement, aluminum nitride (laser host material) and cerium oxide (SOFC electrolyte) with rare earth dopants Gd_2O_3 and $(RE)_2O_3$ (RE = Sm,Yb,Gd) respectively were densified using the current activated pressure assisted densification (CAPAD) process. To achieve performance improvements in electrolyte materials it is necessary to improve oxygen ion conductivity. This was done by maintaining small grain sizes and doping to create oxygen vacancies. For laser host materials transparency and the ability to accept rare earth dopants are both important. Both AlN and ceria samples were consolidated to near full density. Samples were processed with CAPAD, using direct current ranging from 1600A to 2900A, at pressures of 105MPa and 141MPa with total processing times ranging from 400-800 seconds. Processing temperatures ranged from 1000-1700˚C. Translucency was achieved in both doped and pure AlN samples. The grain size of the doped ceria samples was maintained below 600nm.