Development of PMN-PZT Ceramic Paste for Direct Ink Writing

*C.A. Fellabaum, C.D. Eadie, B.H. Watson III, M.A. Fanton, B.E. Weiland, and R.J. Meyer Jr.

By engineering the microstructures of ceramics through additive manufacturing, substantial new design spaces are enabled for acoustic transducer development. While tape casting is an effective process for aligning large platelet particles to fabricate textured ceramics by the templated grain growth (TGG) approach, in order to produce rings and shapes with both a large outer and inner dimension there is a significant amount of waste material generated. In addition, tape casting is not easily adapted to the creation of more complex shapes such as cylinders and hemispheres. Additive manufacturing provides a solution by allowing the complex geometries to be formed in the green state, thus reducing waste and improving design freedom.

This presentation will discuss development of an aqueous-based suspension for Direct Ink Writing (DIW) of textured PMN-PZT ceramics. The focus will be on the methodology used to develop a suitable paste for printing and the factors that majorly affect the development. A stable, shear thinning paste with a quick recovery time is critical for DIW applications. Reactivity of PMN-PZT particles in an aqueous environment was studied through ion leaching experimentation in relation to time and pH of the suspension. Stability studies were conducted through various methods, including settling tests, viscosity measurements, sedigraph measurements, and zeta potential.