**Machine Learning Workflow for Microparticle Composite Thin Film Process-Structure Linkages**

**Peter Griffiths1 and Tequila A. L. Harris1**

 **1George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA**

Presented at the 20th International Coating Science and Technology Symposium

September 20-23, 2020

Minneapolis, MN, USA

ISCST shall not be responsible for statements or opinions contained in papers or printed in its publications.

**Extended Abstract:**

Microparticle composite thin films (MPCTFs) have applications in a variety of fields, ranging from water filtration, to advanced energy storage, to medical devices. Variations in processing parameters during casting and solidification have been demonstrated to lead to morphological and therefore property changes in the final film. However, the wide range and number of possible combinations of parameters can make robust Process-Structure (PS) linkages a complex problem. Material Informatics has shown to be well suited for developing PS linkages in other materials, but there are challenges that must first be addressed for MPCTFs given the lack of separation between the characteristic length scales of the microstructure (i.e. particles, pores, etc.) and the film thickness. The objective of this work is to identify reduced order spatial models and machine learning algorithms to address these problems. To achieve this, simulated microstructures of microparticle distributions based upon slot die coating simulation have been generated. Reduced order representations of the microstructures were then created to capture variation in the microstructure across small slices through thickness the film using two-point statistics and principal component analysis. Results showed that robust, predictive PS linkages can be created using regression analysis between the final film morphology and processing parameters.