Available Project:

The proposed project aims to advance the field of additive manufacturing, also known as 3D printing, to overcome existing challenges and enable precise processing of a diversity of materials. Additive manufacturing has revolutionized conventional manufacturing technologies by allowing objects to be created layer by layer from 3D model data. This technology offers significant advantages such as improved logistics, faster product development, and increased material readiness, making it essential for reshaping manufacturing practices in the U.S. However, there are challenges in 3D printing, particularly in precisely controlling structural orders when working with multiple materials at small scales, such as nanomanufacturing in the semiconductor industry. This Faculty Early Career Development (CAREER) award will support research to develop a novel additive manufacturing method, termed Multiphase Direct Ink Writing (MDIW). The MDIW platform aims to achieve layer-by-layer nanomaterial deposition with optional polymers or nanoparticles, overcoming limitations in existing 3D printing methods that rely on external fields for nanoparticle placement.

The multidisciplinary study will encompass research in polymer science (Kenan Song group from UGA), nanoparticle synthesis (Prof. Yuval Golan group from Israel), and interfacial engineering (Prof. Guillaume Miquelard-Garnier from ENSAM in France). By enhancing fundamental knowledge and developing new nanomanufacturing mechanisms, the research team seeks to create submicron-scale structures with controlled nanoparticle distributions and orientations. This advancement in additive manufacturing will have significant applications in sensors, actuators, soft robotics, supercapacitors, batteries, and regenerative medicine (collaborations with Mayo Clinic doctors, including Dr. Jessica Lancaster and Dr. Johnny Yi from Mayo, Scottsdale, AZ).