1146-76-213 **Tai-Hsi Fan*** (thfan@engr.uconn.edu), 191 Auditorium Road, Storrs, CT 06269. *Phase Field Modeling and Spectral Computation of Powder Bed Fusion Dynamics in Additive Manufacturing Process.*

Recent advances in laser and metallic powder based additive manufacturing (AM) processes are important for producing shape-complicated parts and functional materials. However, the as-manufactured AM parts have rough surface and mechanical strength inferior to wrought materials or machined parts due to the defects or micro pores caused by incomplete melting of powders, lapping, or gas trapping. These defects are subjected to crack initiation and propagation that could lead to early fracture of the parts. A theoretical framework based on phase field method is proposed to analyze the melting and fusion of metallic powders and their interactions with the substrate, as well as transient evolution of the micro pores. The thermodynamically consistent phase field equations coupled with energy and Navier-Stokes-Korteweg momentum equations are resolved by spectral method, demonstrating the interplay of multiphase flow, phase transition, deformable solid-liquid melting interfaces, thermal capillarity, evolution of pores and building up of thermal stress in the substrate. The potential of using phase field method to integrate mesoscale transport with microstructure prediction will be discussed. (Received January 22, 2019)