



NASA STTR 2018 Phase I Solicitation

T12.02 Extensible Modeling of Metallurgical Additive Manufacturing Processes

Lead Center: JPL

Technology Area: TA12 Materials, Structures, Mechanical Systems and Manufacturing

The subtopic of modeling of additive processes is highly relevant to NASA as NASA is currently on a path to implement additive processes in space flight systems with little or no ability to model the process and thereby predict the results. In order to reliably use this process with a variety of materials for space flight applications, NASA has to have a much deeper understanding of the process. NASA is currently considering these processes for MOXIE, SHERLOC, ion engines and other spacecraft structural and multifunctional applications.

Additive manufacturing of development and flight hardware with metallic alloys is being developed by NASA and its various partners for a variety of spacecraft applications. These components are expected to see extreme environments coupled with a need for high-reliability (e.g., manned spaceflight), which requires a deeper understanding of the manufacturing processes. Modeling of the additive processes to provide accurate dimensional designs, preferred microstructures and defect-free is a significant challenge that would dramatically benefit from a joint academic-industry approach. The objective would be to create process models that are compatible with current alloys systems and additive manufacturing equipment which will provide accurate prediction of outcomes from a variety of additive manufacturing process parameters and materials combinations. The primary alloys of interest to NASA at this time include: Inconel 625 & 718, stainless steels, such as 304 and 316, Al10SiMg, Ti-6Al-4V, and copper alloys (GrCop-84). It is desired that the modeling approach address a focused material system, but be readily adaptable to eventually accommodate all of these materials. Therefore, the model should incorporate modest parameter changes coupled with being easily extensible for future alloys of interest to NASA. NASA is interested in modeling of the Selective Laser Melting (SLM), Electron Beam Melting (EBM) and Laser Engineered Net Shaping (LENS) processes.