New methods of In-Situ Metrology and Process Control for EBF3 Additive Manufacturing

COSM Advanced Manufacturing Systems, LLC
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OBJECTIVES

The objective of this program builds upon the work performed in our phase I SBIR to apply COSM’s experience in charged particle beam systems technology to add beam-based real-time deposition process imaging to an existing NASA EBF3 platform with the intent of using the information collected for both process control and in-situ metrology. We identified several technologies that were crucial to beam-based sample characterization and developed hardware and software to collect beam-sample interaction data. An experimental plan was developed to explore the viability of and limitations on, collecting beam-sample interaction data. To execute this plan we developed and added new capabilities to the EBF3 tool which served as our program testbed.

ACCOMPLISHMENTS

NOTABLE DELIVERABLES PROVIDED
The Langley Research Center EBF3 Proof of Concept System has been upgraded with COSM hardware and software that is the deliverable for the program. Software to generate user-customizable beam scan profiles. Hardware to execute beam scan profiles and translate profiles into commands the beam scan control can interpret. Software and hardware for capturing and storing high speed signal data synchronously with beam scan command data. Hardware to physically interface various beam-sample interaction signals used for imaging and metrology with beam scan command signals on the EBF3 scan system. Signal collection and conditioning electronics to prepare the raw imaging signal and pass it back to the data capture system.

KEY MILESTONES MET
A program plan duration of 7 quarters with tasks of varying lengths overlapping quarters was successfully completed. Technical results for each task/schedule item were filed for each quarterly report on time. All tasks were completed within the limits of the Proof of Concept System’s capabilities, met the objectives set forth in the program and were concluded to the development plan. An Interim New Technology report was filed that disclosed significant development outcomes.

FUTURE PLANNED DEVELOPMENTS

PLANNED POST-PHASE II PARTNERS
COSM has established business relationships and collaborative R&D efforts with potential commercial customers on technology development. Private equity, strategic corporate and venture capital groups are engaged to fund development of the first commercial system based on the new technology resulting from this program.

PLANNED/POSSIBLE MISSION INFUSION
COSM has submitted a proposal and Statement of Work that details a program to implement the technology developed within this work effort for application in an in-space autonomous self-assembly program. We expect this application and specialized electron beam components for 3D metal printing in space to become a portion of our business.

PLANNED/POSSIBLE COMMERCIALIZATION
COSM’s mission is to become the leading supplier of Electron Beam Wire Feed 3D Printing Systems for large scale parts in space, aerospace, automotive and other industrial applications. The technology developed in this Phase II contract is the enabling element that will transform the excellent proof of concept process of today into a fully certifiable and robust mainstream manufacturing process.

CONTRACT (CENTER)
NNX15CL08C (LaRC)

SOLICITATION-PHASE
SBIR 2014-II

SUBTOPIC
H5.01 Additive Manufacturing of Lightweight Metallic Structures

TA
12.4.1 Manufacturing Processes

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