MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Advancements in Materials Applications and Rapid Prototyping (9)

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THE APPLICATIONS OF ADDITIVE MANUFACTURING IN SPACE DEVELOPMENTS

Abstract

Additive manufacturing (AM), also known as solid freeform fabrication or generative manufacturing, is one of the most exciting emergent technologies available to global industry today. It is a process of making a three-dimensional solid object of virtually any shape from a digital model in a variety of polymeric, metallic, ceramic and even organic materials. AM is made up of several different processes variously described as selective laser melting (SLM),laser engineered net shaping (LENS),direct laser fabrication(DLF),electron beam manufacturing(EBM),3D Printing, etc. It allows companies to manufacture ever more complex and optimized components, holding the promise of drastically decreasing the time to market for new products and of reducing the life cycle costs for existing products. The advantages that AM brings are already being commercially exploited by organizations such as Siemens, BMW, NASA, Lockheed Martin, Boeing, Los-Alamos national laboratory and many other research institutes. This paper is a discussion of the work being done worldwide on the applications of additive manufacturing in space development:

- Space launch system: NASA's Marshall Space Flight Center in Huntsville, Alabama, has created nickel alloy parts for the J-2X and RS-25 rocket engines using selective laser melting (SLM) technique, which might boost larger manufacturing trend in astronautics.
- International Space Station: Additive manufacturing techniques have potential applications in the fields of ISS repairs, upgrades and life extensions, in-situ manufacturing on-demand, and small spacecraft assembly.
- Moon exploration: A team of materials scientists and additive manufacturing engineers at Washington State University have fabricated parts using the lunar regolith stimulant, pursuing the possibility to produce components on the moon.