SuperScrypt - Next Generation Additive Manufacturing System

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Abstract

The US Army and nScrypt have partnered to design and develop a next generation Additive Manufacturing System, “SuperScrypt”, with expanded upon nScrypt's standard 3Dn Series gantry system. In addition, tool changing was added to allow the multi-material, multi-function capability. This multi-technology printing system integrates process controls, multi-axis manipulation, numerous fabrication, inspection, and scanning capabilities. Utilizing the patented SmartPump™ technology, this system can print very low viscosity inks to extremely high viscosity pastes to allow the widest range of electronic materials to be printed. The system also includes nFD™ thermal plastic extruder, capable of thermal plastic and composite thermal plastic objects from a 1.75 mm filaments. The system allows for complete fabrication so you can “Print what you can, and place what you can’t!”, thus providing a complex manufacturing solutions. While many groups are talking about heterogeneous potential and developing a printer that is capable of mixing structures and electronics. With Scan-to-print capability, the SuperScrypt can deposit on complex curves, or build 3D shapes from scan data. Inverse kinematics enabled 6-axis motion control allows for true 3D printing instead of stacking 2D layers. Robust hardware allows for +/- 100nm precision. The tool has the widest range of material options available for any printed electronic tool. There are more than 10,000 commercially available materials that can be utilized. Feature sizes range from as small as 20 microns to as large as millimetres. Material properties range from conductors, resistors, dielectrics and even materials with permeable properties. The nScrypt tool is printing silver, gold, platinum, copper, nickle and alloys as part of the metal printing process. A number of dielectrics to include ceramic and polymer are also printed. Additionally, resistors are standard prints for this tool. The Army has successful used the SuperScyrpt for Fuze components, munitions systems, antennas, prognostics and diagnostics, High-G circuitry, embedded sensing, and numerous other applications to support current and future projects and programs. The system has also allowed for revolutionary improvements for the integration of Flexible Hybrid & Printed Electronics with 3D structures. With the multi-material capabilities and the addition of pick and place, this tool has exceeded standard prints making complex Phased Array Antennas, Munitions Sub-systems, Fuze Components, and Unmanned Systems possible, proven and functional. The system will be described as well as how it is being utilized to develop integrated, printed Fuze Components and Sub-systems for DOD applications.