Novel Techniques for Additive Manufacturing of Functional Materials

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Abstract

Additive manufacturing technologies promise to transform the development and production of agile microsystems, but are limited by the ability to print functional materials. This talk will describe progress in the development of novel techniques and classes of materials enabling 3D printing of microelectronic quality interconnect and low-loss dielectric composites.

State of the art 3D printing techniques for conductors cannot yet deliver the feature resolution and electrical conductivity required for high performance microcircuits, and have materials and substrate constraints, as well as post-processing requirements. We describe recent results in the development of a novel atmospheric microplasma sputtering system that can provide direct-write capability of metal interconnects on non-standard substrates, with future extensibility to dielectrics and semiconductors.

We have also developed new classes of 3D-printable low-loss dielectric polymers, ceramic composites, and conductors based on a triblock copolymer system that combines the properties of the matrix and filler components. These hybrid organic/inorganic materials exhibit good electromagnetic properties and we discuss the performance of RF devices that have been demonstrated to operate in the millimeter-wave range (>30 GHz).

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