Hybrid Desktop Process for Integrated Deposition and Low-cost, In-situ Sintering of Metallic and Non-metallic Conductive Nanoparticles

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Abstract

Microscale continuous thin films or patterned conductive structures find applications in thin film electronics, energy generation and functional sensor systems. An emerging alternative to conventional vacuum based deposition of such structures is the additive deposition and sintering of conductive nanoparticles, to enable low temperature, low-cost and low energy fabrication. While significant work has gone into additive deposition of nanoparticles, the realization of the above potential needs nanoparticle sintering methods that are equally low-cost, in-situ, ambient condition and desktop-sized in nature. This research demonstrates the integration of non-laser based, low-cost and small footprint optical energy sources for ambient condition sintering of conductive nanoparticles, with wide-area aerosol jet based additive printing of nanoparticle inks. The nanoparticle sintering is characterized by quantifying the sintering temperatures, sintered material conductivity, crystallinity, optical properties, thickness and microscale morphology in terms of the sintering parameters.

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