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Advanced Manufacturing with Atmospheric Pressure Plasmas: Electrostatic Focusing of Printed Silicon Nanocrystals REBECCA ANTHONY, ALEXANDER HO, Michigan State University — Among methods for nanocrystal (NC) synthesis, plasmas are among the most competitive for their versatility, facile operation, and high quality products. However, most processes for using these NCs in applications still require multiple steps including synthesis, collection, surface modification, deposition, and patterning. Here we present our work on combining these steps for an advanced manufacturing tool that couples the synthesis process with direct deposition into patterned layers using an RF microplasma operated at atmospheric pressure that is driven using an additive manufacturing platform. Using this method, we can create directed patterns of tunable-size silicon NCs, sidestepping the intermediate processing steps for a streamlined on-demand synthesis and deposition approach. The linewidth we can achieve is limited by gas flow and reactor geometry–unless we exploit the inherent charge carried by the NCs produced in plasmas and use electrostatic focusing to narrow the deposition. Our results indicate that applying a DC electric field to the deposition stage allows improved coherence of the NC deposition. This electrostatic focusing allows us to tighten the linewidth of our Si NC patterns across a range of sizes and conditions, with applied voltages tuned according to an assumed particle charge of ˜3e. This points towards an increasingly competitive method for additive manufacturing of NC patterns using plasmas.

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