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Electrostatically-Assisted Direct Ink Writing for Additive Manufacturing JEVON PLOG, University of Illinois at Chicago — While nozzle-based printing is already arguably versatile, such sub-categories as Direct-Ink-Writing (DIW) are difficult to be used to print materials on rough surfaces. Recently electrohydrodynamic (EHD) elements added new features in droplet positioning but also revealed limitations in the achievable build height due to the need for a grounded substrate or embedded electrode. Here, we introduce an additional electrode added to the printhead generating an electric field between the above-mentioned electrode and printing nozzle. The resulting Coulomb force pulls the extruded ink in the direction of printing allowing faster translational speed, thinner trace widths, and improved deposition on rough surfaces without a decrease in build height. We also developed the electrohydrodynamic theory of the proposed DIW processes. The integration of the electrode to the printhead allowed successful prints at the machine's maximum speed of 500 mm/s for a documented situation in which DIW previously failed in existing literature (also, on rough surfaces where printing was impossible before). Along with new design opportunities, these results unlock speed restriction within nozzle-based printing while significantly expanding versatility and substrate choices.

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