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**Fundamental characterization of soft matter 3D printing processes** KALMAN MIGLER, JONATHAN SEPPALA, CHELSEA DAVIS, KAITLYN HILLGARTNER, NIST — In fused filament fabrication (FFF), a material extrusion 3D printing method, thermoplastic filament is extruded through a rastering nozzle on the previous layer. The resulting strength of the FFF produced part is limited by the strength of the weld between each layer. While numerous factors can affect the weld strength, the temperature of the extrudate and the previous layer dictate the amount of interdiffusion and thus the weld strength. Temperature measurements were performed using forward looking infrared imaging. Interdiffusion estimates were calculated from temperature profiles, normalized using horizontal shift factors from offline rheological measurements of the neat polymer. Weld strength was measured directly by Mode III Fracture using a simplified geometry limiting the measurement to a single weld. Since the processing conditions are known a priori this approach provides the data needed to estimate the final build strength at time of design. The resulting agreement between interdiffusion estimates and weld strength for a range of printing conditions are discussed.

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