**A multiscale analysis of interface properties in 3D printed composites**

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In polyjet printing discrete photopolymer droplets are deposited on a build tray, leveled off by a roller and cured by UV light. State-of-the-art printers can deposit 20 µm sized droplets of two photopolymers simultaneously. This enables the fabrication of multi-material composites with soft and stiff polymers combined in a countless variety of arrangements. Considering the layer-by-layer nature of 3D printing, interfaces between different photopolymers can be formed either before or after UV curing. In the first case, droplets of different photopolymers are jetted simultaneously within the same layer and come into contact before polymerization. In the second scenario, droplets are deposited dephased on a partially polymerized layer. The properties of the corresponding interfaces are unexplored. Here, we analyzed interfaces in polyjet bimaterial composites (Objet260, Stratasys) at two different length scales: we used nanoindentation (TI 980, Hysitron) to measure spatial variations in mechanical properties across the interfaces at the micrometer level and dynamic mechanical analysis (DMA, RSA3, TA Instruments) to investigate dynamic properties and transition temperatures at the millimeter level. Displacement controlled nanoindentation was performed at interfaces between soft rubbery and rigid glassy polymers using a berkovich tip. Interfaces formed after curing showed a sharp transition in Young’s modulus across a region having thickness comparable to droplet size. Interface formed before curing had blending of the two materials over a length scale several times bigger than droplet size. DMA analysis in a 3-point-bending configuration (temperature range: -40 °C to 70 °C) was done on bar-shaped specimens containing alternating layers of soft and rigid polymers. We considered both homogenous bars as well configurations where layers were formed either before or after UV irradiation. DMA results confirmed the presence of strong blending for interfaces formed before polymerization and indicated that interface transition temperatures were dominated by the hard polymer.