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**Improving the Isotropy of Parts Prepared by Fused Deposition Modeling Through the Introduction of Star Architecture Additives**
NEIKO LEVENHAGEN, University of Tennessee Knoxville, MARK DADMUN, University of Tennessee Knoxville; Chemical Sciences Division Oakridge National Lab — It is well known that 3D printed parts prepared by fused deposition modeling (FDM) exhibit anisotropic characteristics in regards to their mechanical properties. More specifically, mechanical properties when printed orthogonal to the print bed (transverse) are significantly worse than those printed parallel (longitudinal). This behavior is a result of poor layer adhesion from *decreased* diffusion and entanglement of chains across the inter-layer interface. To improve this, our group has implemented a process in which bimodal blends comprised of a parent, high molecular weight polymer and blended with an identical but low molecular weight (LMW) polymer are utilized. These bimodal blends have led to enhancements of up to 66% in the max stress, when printed in the transverse orientation. Additionally, the moduli regardless of print orientation become nearly identical; indicating a more isotropic part. Due to their beneficial flow properties, we have recently begun to study the effect of LMW additives with star architectures on improving the isotropy of 3D printed parts. PLA blends containing 3 arm and 4 arm PLA stars ($M_w$ of arm- ˜11k) at loadings of 3, 10, and 15 mol% were tested under the same protocol as the linear specimens. With the small addition of 3 mol%, A 100% i*ncrease* in the max stress, in the transverse orientation, with nearly identical moduli is observed. A significant improvement in layer adhesion and a significantly more isotropic part is thus realized.

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