Engineering the road interfaces in material extrusion from filament design to print path to rapid postprocessing

ABSTRACT
Filament-based 3D printers provide a simple and low-cost route to near net shape manufacture of thermoplastic parts, but the properties tend to be insufficient for many applications. The interfaces between printed roads tend to be blamed for many of these issues. In this talk, the printing process will be examined from a polymer processing perspective to provide some insights into the challenges of 3D printing of thermoplastics. A variety of strategies to manipulate these road interfaces will be described that can improve the mechanical properties. Impact resistant printed parts are demonstrated with core-shell filaments, but even simple filaments can produce ductile parts if the printing is appropriately controlled. The efficacy of these processing schemes is, however, size- and direction-dependent, but these effects tend to be lessened with semicrystalline polymers. Finally, a simple post-recessing route to increase the elastic modulus of 3D printed PEEK composites by a factor of two or more will be discussed within the same framework.

BIOGRAPHY
Bryan D. Vogt is currently a professor in the Department of Chemical Engineering at The Pennsylvania State University. His research interests center around polymer processing and polymers at interfaces. Areas of particular interest include use of block copolymers as templates for functional materials, materials innovation for 3D printing, polymers in nanoconfinement, and structure-properties of hydrophobically modified hydrogels. He received a bachelor of science in chemical engineering from Michigan Technological University and a doctorate also in chemical engineering from the University of Massachusetts-Amherst in 2003. He was the recipient of an NRC postdoctoral fellowship in 2002 at NIST in the Polymers Division, where he spent four years prior to starting his independent academic career. He is a PMSE (ACS) fellow and a fellow of APS. He currently serves as an associate editor for ACS Applied Polymer Materials.