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Microstructure of 3D-Printed Polymer Composites Investigated by Small-Angle Neutron Scattering[1] TAE HUI KANG, Oak Ridge National Lab, BRETT G. COMPTON, University of Tennessee, WILLIAM T. HELLER, VOKER S. URBAN, CHAD E. DUTY, CHANGWOO DO, Oak Ridge National Lab — Polymer composites printed from the large scale printer at Manufacturing Demonstration Facility at Oak Ridge National Laboratory have been investigated by small-angle neutron scattering (SANS). For the Acrylonitrile Butadiene Styrene (ABS)/Carbon Fiber (CF) composites, the microstructure of polymer domains and the alignment of CF have been characterized across the layer from the printed piece. CF shows strong anisotropic alignment along the printing direction due to the flow of polymer melt at the nozzle. Order parameter of the anisotropy which ranges from -0.11 to -0.06 exhibits strong correlation with the position within the layer: stronger alignment near the layer interface. It is also confirmed that the existence of CF reduces the polymer domain correlation length significantly and reinforces the mechanical strength of the polymer composites. For the Epoxy/nano-clay platelet composites, the effect of processing condition, nozzle size, and the addition of the another filler, Silicon Carbide (SC), have been investigated by SANS. Nano-clay platelet shows strong anisotropic alignment along the printing direction as well. Order parameter of the anisotropy varies according to nozzle size and presence of the SC, and difference disappears at high Q region.

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