Nanocomposites may be produced through a variety of processing routes. Dispersion of the reinforcing phase has been a primary issue in developing successful polymer nanocomposites with a processing route that is useful for large volume production. Injection molding and extrusion are two ideal processing methods for mass production of polymer nanocomposites. Both methods have been tested recently with a variety of nano-reinforcements. A well dispersed nano-reinforcement can be observed through many methods. One of the most convenient is optical scattering. Nano-composites which are transparent are particularly attractive in many applications. However, limited information is available on the molecular scale from visible light scattering alone. X-ray diffraction conveniently probes the polymer at a scale of the reinforcement’s lattice parameter. However, once the reinforcement reaches the nanoscale, the diffracting peaks become broad. For example, many researchers report the loss of a diffraction signal from their nano clay or graphene phase as an indicator of dispersion. In our case, a second processing step used in formation of the composite provided orientation to the reinforcement, which improved the intensity of the diffracting reflection. This alignment was also shown favorable for improving mechanical stiffness. In addition, the fiber texture orientation is readily available from diffraction. Using this texture information, the applied loading axis was aligned with the reinforcement axis and displacement of the broad diffraction peaks was used to validate a micromechanics model for the load transfer from the polymer matrix to the reinforcement phase.