abstract

Essential knowledge of co-continuous composite material properties is explored in this thesis. Mechanical characterization of these materials gives a detailed outlook to use them in design, manufacture and tailor make the products.

Soft and hard polymer materials have extensive properties individually, when combined to make a single structure, they give exceptional combination of properties. In this study, Polymer materials used are in the form of Co-Continuous structures (i.e., both soft and hard polymers are continuous throughout the microstructure) fabricated into several microstructures namely, Simple Cubic (SC), Body Centered Cubic (BCC) and Face Centered Cubic (FCC) shapes. An experimental process is designed and fine-tuned from existing methods to understand and record the mechanical response of this co-continuous polymers. Experimental testing is used to gather detailed information about several constituencies namely stress behavior and damage progression. A 3D imaging technique, Microtomography is used to visualize damage initiation and progression in the sample. Variations in energy absorption, fracture initiation and damage propagation in samples are observed and correlated analysis is performed to provide a logical explanation. Comparative studies are performed as well for different structures.

Based on the Knowledge gained from the above study on co-continuous polymer composites, several conclusions are drawn, and future work directions are suggested.