Structure-Property Relationships in Coextruded Foam/Film Microlayers

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Control of cell size is vitally important in controlling important performance properties of synthetic foams, e.g., mechanical strength, thermal insulation, and acoustic insulation. It has been demonstrated for the first time that microcellular foam structures can be produced using the microlayer coextrusion technology. Cell size can be reduced 10 times by increasing the number of layers from 8 to 64, without adversely affecting the density. The reduction in cell size can be attributed to the enhanced cell nucleation under layer confinement and suppressed coalescence. For each foam/film system, there exists an optimum concentration of gas at which there is maximum expansion with good layer integrity. The gas concentration is determined by the gas solubility in the foam polymer, melt strength of the film polymer and the number of layers. Unique mechanical properties can be achieved through material choice and layer structure. The compressive and tensile stress-strain behavior can be modeled using composite series and parallel models. Cell morphology and the compressive response of these multilayered foam/film structures are similar to that of cork. The tensile toughness of these foam/film systems is much higher compared to the conventional extruded foam systems.