Abstract

The microcellular foaming of thermoplastics, using supercritical physical blowing agent in a batch foaming process, was first reported by Prof. Nam P. Suh and his students in early 1980s. This technology was then transferred to Axiomatics Corporation, which was later renamed as Trexel Inc. Trexel Inc. began the commercialization of microcellular technology in 1995. The Trexel Inc. was the first to offer this technology in injection molding segment under the trade name of MuCell since 2000. The microcellular injection molding technology is capable of producing cellular molded parts with the average cell size less than 100 micron (typically 5 – 30 microns) with the cell population density as high as $10^8$ cells/ cm$^3$. Conceptually, all the microcellular injection molding technologies are based on dissolution of SCF into the polymer matrix followed by rapid depressurization inside the mold cavity leading to cell nucleation and growth caused by supersaturation of polymer matrix. The difference lies only in the methods of gas injection and dissolution. The MuCell process uses pneumatically actuated injector(s) to meter the SCF directly into the barrel of reciprocating screw injection unit. The microcellular injection molding technologies, commercially offered by Trexel Inc. and some other manufacturers, are primarily a close cell foaming technology. The main aim of this technology is to produce low density thermoplastics parts with high strength to weight ratio. The open cell microcellular foam is another class having great potential for applications like tissue engineering, membrane separation, controlled drug delivery etc. As per the available literature, the three dimensional open cellular foams (molded parts) are prepared at laboratory scale via solid state batch process. The batch process is capable of producing microcellular foam with very high cell density and expansion ratio in comparison to injection molded microcellular foam. High cell population density and expansion ratio are the pre requisites for open cell microcellular foam. Therefore the objective of this research work was to develop a methodology for achieving high cell density and expansion ratio in microcellular injection molding process that may produce the microcellular foam with high void content and interconnection between the cells.