Abstract

Effect of fiber volume fraction on occurrence, morphology, and spatial distribution of microvoids in resin transfer molded E-glass/epoxy composites is investigated. Three disk-shaped center-gated composite parts containing 8, 12, and 16 layers of randomly-oriented, E-glass fiber perform are molded, yielding 13.5%, 20.5%, and 27.5% fiber volume fractions. Voids are evaluated by microscopic image analysis of the samples obtained along the radius of these disk-shaped composites. The number of voids is found to decrease moderately with increasing fiber content. Void areal density decreased from $10.5\ \text{voids/mm}^2$10.5 voids/mm2 to $9.5\ \text{voids/mm}^2$9.5 voids/mm2 as fiber content is increased from 13.5% to 27.5%. Similarly, void volume fraction decreased from 3.1% to 2.5%. Increasing fiber volume fraction from 13.5% to 27.5% is found to lower the contribution of irregularly-shaped voids from 40% of total voids down to 22.4%. Along the radial direction, combined effects of void formation by mechanical entrapment and void mobility are shown to yield a spatially complex void distribution. However, increasing fiber content is observed to affect the void formation mechanisms as more voids are able to move toward the exit vents during molding. These findings are believed to be applicable not only to resin transfer molding but generally to liquid composite molding processes.