Fabrication of Interconnecting Through-holes for Polymer Microfluidic Devices in Modular Systems

Abstract

A hot embossing process capable of producing through-holes in a polymer substrate via finite element analysis and experimental embossing was proposed. One of the main challenges of through-hole fabrication via hot embossing is the removal of a residual layer that remains at the bottom of the polymer substrate, without affecting the structure of the mold pins. The classic hot embossing process was modified to increase replication fidelity and the life cycle of the mold insert. A secondary polymer substrate, polysulfone (PSU), was used as a buffer substrate to reduce wear from the mold insert pins. The buffer substrate acted as a residual layer receptor by removing it from the polymer substrate during molding. Process parameters can be controlled to achieve high replication quality by assuring complete removal of the residual layer. Thus, understanding the polymer flow behavior could be used as a stepping-stone in the development of a through-hole manufacturing tool in hot embossing. Through-hole fabrication could be analyzed via finite element analysis to determine the appropriate process parameters before manufacturing. Compared to previous hot embossing processes, this novel technique requires no alignment tools, which facilitates the manufacturing process, and introduces the capability of simultaneous through-hole fabrication in a single-operation process.

Commercialization Forum and Technical Seminar

Biography

Juan Andres Gomez received the degree of Industrial Engineer from Universidad de La Sabana in Bogota, Colombia. He worked in the industry for several years in a variety of roles in researching and developing new products and processes, conducting safety and quality audits, implementing ISO certifications, and developing supply chain operations. Juan joined Texas State University in the fall of 2010 to pursue a master of science in Industrial Technology. His research in new manufacturing processes by analyzing the behavior of substrates using FEM software motivated him to continue his education and join the Materials Science, Engineering, and Commercialization program. Currently, Juan is one of the principal researchers at the Nano and Microsystems group.