Photo-Patternable and Adhesive Material for Wafer-Scale Thick Film Polymer-Microfluidics

ウェーハスケール厚膜ポリマー・マイクロ流路のための感光性接着材

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Abstract

In the last few decades, we have seen a rapid growth in MEMS and microfluidics technologies. To support the growing need for better microfluidic materials with improved properties, a thick photo-sensitive adhesive (PA) material with adhesive function for wafer-scale thick film microfluidics has been proposed. Not only allows this new material to fabricate thick film microfluidic channels on a Si-wafer, using optical lithography, it also permits to bond directly with a cover glass on top of the microfluidic channel without additional adhesives. Using the thick PA film, deep channels from 20µm to 100µm can be fabricated. These dimensions allow the on-chip manipulation of large molecules such as proteins. Extensive studies of both the patterning properties and bonding strengths of the thick PA material indicate this new material is a very promising material for wafer-scale bio-MEMS (Lab-on-Chip) applications.

Wafer-Scale thick film polymer-microfluidic process flow

The fabrication process flow is shown in Fig.1. Photolithographic process takes place by spin-coating (a), exposure, and development (2.38wt% TMAH) (b) to realize the desired microfluidic structures. In a final step, the channels can be bonded to a glass cover by applying a short heating step (200°C/ 2MPa/ 2sec) (c). SEM cross-sectional images of both 50µm and 80µm lines are presented in Fig. 2. These pictures show the structures with a nice vertical profile and a clean and smooth surface. PA was also found to be biocompatible, transparent and heat resistant.

Summary

A thick film photo-patternable and adhesive material (PA) is introduced. We strongly believe PA is an ideal material candidate for wafer-scale production of microfluidic devices, allowing the easy transfer from prototyping to high volume manufacturing.

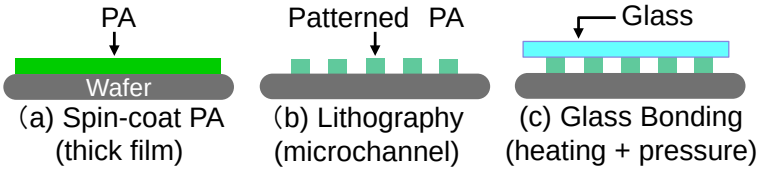

Fig.1 Process flow of wafer-scale polymer-microfluidic.

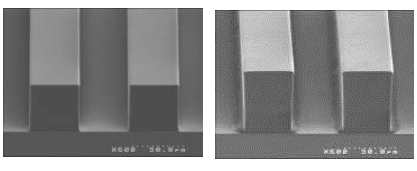

Fig.2 Thick polymer-microchannels.