Abstract

The California Nanosystems Institute (CNSI) is a multi-disciplinary research facility that invests significant resources towards the research and development of novel microfluidic devices. These devices often require the alignment of microchannels or reservoirs on opposite sides of a substrate and this poses significant difficulty in accurately fabricating such devices.

Design Objectives

The goal of this project was to develop a lab-ready fixture for use in the laser fabrication of microfluidic chips on circular 100mm diameter glass substrates. It was critical that the fixture align scribed features with a precision of 50 microns and that it be easy and intuitive to operate.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment Accuracy</td>
<td>The alignment accuracy of identical scribed cuts</td>
<td>50 microns</td>
</tr>
<tr>
<td>Flatness Accuracy</td>
<td>The flatness of a substrate when rotated</td>
<td>+/- 0.1 mm</td>
</tr>
<tr>
<td>Fixturing Capacity</td>
<td>Diameter of the substrate held by the fixture</td>
<td>100 mm</td>
</tr>
<tr>
<td>Operation Time</td>
<td>Time required to properly operate fixture for one use</td>
<td>&lt;1 minute</td>
</tr>
</tbody>
</table>

Table 1. Lists several design objectives.

Testing

Nine total trials were conducted using the Precision Alignment Fixture to flip the substrate. The substrate was placed in the fixture, scribed on one side, flipped, then scribed on the opposite side. The alignment accuracy of the scribed lines was measured using an optical microscope and image analysis software. The alignment accuracy of the fixture was then compared to when the substrate was flipped by hand (Figure 4).

Results/Conclusions

The Precision Alignment Fixture was determined to have an average alignment accuracy of 25 microns and be operable in under 1 minute. After validating that the fixture met all customer needs, it was determined that the Precision Alignment Fixture is ready for immediate laboratory use.

Acknowledgments

Special thanks to Steve Laguette, Dave Bothman, Andy Weinberg, John Clark and Steven Wehmeyer, Sean MacKenzie, Thomas Cisneros, Junji Ogawa, Todd Linhoff, Dante Dorantes, Thomas Cisneros, Junji Ogawa, Todd Linhoff, Dante Dorantes.

References

[1] Image Credit: ALineinc.com

Figure 2. Precision Alignment Fixture.

Figure 3. SolidWorks model of Precision Alignment Fixture holding a 100mm diameter glass substrate. The axis of symmetry (white dashed line), prisms (red edges) and v-grooves (green lines) are all indicated.

Figure 4. Difference in alignment accuracy of scribed lines when the substrate is flipped using the Precision Alignment Fixture (left) or when flipped by hand (right).