

Bonding Polycarbonate (PC) Devices

Materials:

- Embossed PC device with inlet/outlet holes drilled
- 2 blank, clean steel wafers
- DI water (squeeze bottle)
- Solvent (1:3 DMF:IPA or 1:2 MEK:IPA)
- 4" diameter circle of cured PDMS
- Syringe with blunt hypodermic needle filled with ~2ml of solvent
- Optional: 1:1 DMF:IPA solvent

1. Remove excess plastic from holes on device
2. Cut blank PC (or piece with electrodes) to the same size as the polycarbonate device
3. Clean both polycarbonate pieces with IPA and DI water, dry thoroughly
4. Carefully align PC devices on stainless steel wafer, using microscope to ensure electrode and channel alignment
5. Place a few drops of DI water on the back of a second steel wafer and stick it to the top platen.
6. Set platen temperatures to 130°C
7. Place a wafer-sized piece of cured PDMS on the bottom platen, and then carefully put the steel wafer with aligned pieces on the PDMS
8. Bring top platen barely into contact with the device (pressure gauge should not move)
9. When platens reach 130°C, use syringe to spray a small amount of solvent between the wafers along all edges of the device
10. Apply a **small** (very small, almost inappreciable) amount of pressure to platens
11. Wait ~30 seconds
12. Repeat step 9, applying a few more squirts of solvent towards all sides of the device
13. Repeat steps 9-11 until ~2ml of solvent have been used
14. Total pressure applied should be very low (< 0.5 tons) to avoid collapsing channels – the bonding is a result of temperature and solvent, not pressure
15. Turn off platen heaters, turn on fans
16. Wait until 40°C (room temperature) to release pressure and remove the device
17. If some areas of device are still not sealed, the pressure/heat/solvent process may be repeated

Additional suggestions:

To enhance bonding of large pieces with no embedded electrodes:

- a. After step 3 above, cover the surface of the blank PC piece with drops of solvent (1:1 DMF:IPA). Do not do this on PC with embossed microchannels or embedded electrodes!
- b. Let sit for 1-2 minutes
- c. Remove all solvent and thoroughly dry with stream of nitrogen
- d. Align the device with the solvent-treated side as one of the bonding surfaces

For stronger/more complete bonds:

- a. Prior to step 15, the device can be left under pressure at 130°C for an extended period of time (~30 minutes or more)