

# PDMS-Glass Bonding Report – Anatech

Updated on 02/28/2015

## Critical Factors

- Set Power to 30W, Time to 15s, and O<sub>2</sub> Flow Rate (MFC) to 50sccm
- Ensure the cleanliness of the glass slide before bonding

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## Goal

Test the effects of varying power, etch time, O<sub>2</sub> flow rate and position on the bonding of PDMS to glass in the Anatech Barrel Etcher.

## Materials

- PDMS/PDMS Curing Agent
- Glass Microscope Slides

## Equipment

- Anatech Barrel Etcher

## Protocol

1. Approximately 1 cm x 1 cm x 1 cm cubes of PDMS were cut to be used for testing.
2. One glass microscope slide and one PDMS cube were placed side by side on the stand into the Anatech barrel etcher.
3. Plasma etching was run at the selected parameters for power, etch time and O<sub>2</sub> flow rate.
  - a. Pressure of the chamber was recorded for when the plasma etching began till it ended just for data collection purposes.
4. The microscope slide and PDMS cube were removed from the etcher and the upward faces of both were carefully pressed together and held for approximately 10 seconds.
5. The slide and PDMS were allowed to sit undisturbed for approximately 20 minutes.
6. After 20 minutes, the PDMS-glass bond was subjected to forceful peeling.
7. The PDMS-glass bond was considered successful if a thin layer of PDMS was still adhered to the glass after attempts to forcefully peel it off.

## Results

Power (W)	Duration (s)	O <sub>2</sub> Flow Rate –MFC (sccm)	Pressure (mTorr)	Depth	Glass Set	Peel Test
15	15	25	390 to 450	-	1	Fail
15	15	50	600 to 680	-	1	Fail
15	15	75	880 to 930	-	1	Fail
30	15	25	375 to 450	-	1	Fail
30	15	40	530 to 580	-	1	Fail
30	15	50	600 to 700	-	1	Fail
30	15	50	620 to 700	-	1	Mixed
30	15	60	730 to 800	-	1	Fail
30	15	75	890 to 920	-	1	Mixed
30	15	99	1090 to 1120	-	1	Fail
30	15	99	1100 to 1130	-	1	Fail
60	15	25	400 to 470	-	1	Fail
60	15	50	630 to 710	-	1	Fail
60	15	75	900 to 960	-	1	Fail
60	15	99	1120 to 1200	-	1	Fail
60	15	99	1100 to 1430	-	1	Fail
90	15	75	920 to 990	-	1	Fail
30	5	50	660 to 700	Deep	2	Pass
30	10	50	640 to 700	Deep	2	Pass
30	15	50	610 to 690	Deep	2	Pass
30	30	50	600 to 700	Deep	2	Pass
30	45	50	610 to 700	Deep	2	Pass
40	5	50	630 to 690	Deep	2	Pass
40	10	50	640 to 700	Deep	2	Pass
40	15	50	610 to 700	Deep	2	Pass
40	15	50	620 to 690	Shallow	2	Pass
60	15	50	630 to 710	Deep	2	Pass
120	15	50	710 to 915	Deep	2	Pass

## **Discussion**

The large number of failures in the first half of the results table were caused by using glass microscope slides that seemed clean but actually were not. Cleaning the first set of glass slides may have improved the results of the peel test but this was not investigated. After switching to a brand new box of glass slides, every tested parameter worked with power set to 30W, time to 5s and O<sub>2</sub> flow rate at 50 being the minimal values tested to succeed. One test was done with placing the slide and PDMS very shallow in the etcher to test if the positioning of the samples in the etcher had any effect but it seemingly did not.

A further test was done at 30W power, 50sccm O<sub>2</sub> flow rate and a time of 5 and 15 seconds to test the bonding of a full sized microfluidic device to a glass slide. At 5 seconds of plasma, the tested device showed leaking while at 15 seconds it did not. Therefore, though the peel test was passed at 5 seconds, 15 seconds is the better parameter for usage in bonding.