

## 附表

表 2.1 金膜與二氧化矽/矽基材之退火溫度時間與附著力關係圖[10]

Annealing time (min)	15'	30'	60'	120'
Temperature (°C)				
< 600	poor	poor	poor	poor
600	poor	poor	improved	good
650	poor	improved	good	good
700	improved	good	good	good

表 3.1 壓力與頻率對離子密度及能量的影響[20]

	離子密度	離子能量	備 註
壓力上升	↑	↓	粒子平均自由徑變短
壓力降低	↓	↑	粒子平均自由徑變長
頻率增加	↑	↓	粒子碰撞頻率增加
頻率減低	↓	↑	粒子碰撞頻率降低

表 4.1 氬電漿實驗參數及水準配置表

Level Factor	Level 1	Level 2	Level 3
A : Time (min)	1	10	30
B : Power (W)	50	100	200
C : Pressure (mtorr)	500	650	800
D : Flow (sccm)	400	600	800

表 4.2  $L_9(3^4)$ 直交表

<b>Factor</b> <b>No. of Run</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>1</b>	1	1	1	1
<b>2</b>	1	2	2	2
<b>3</b>	1	3	3	3
<b>4</b>	2	1	2	3
<b>5</b>	2	2	3	1
<b>6</b>	2	3	1	2
<b>7</b>	3	1	3	2
<b>8</b>	3	2	1	3
<b>9</b>	3	3	2	1

表 4.3 氬電漿實驗參數直交表

<b>Factor</b> <b>No. of Run</b>	<b>A(time)</b>	<b>B(power)</b>	<b>C(pressure)</b>	<b>D(flow)</b>
<b>1</b>	1	50	500	400
<b>2</b>	1	100	650	600
<b>3</b>	1	200	800	800
<b>4</b>	10	50	650	800
<b>5</b>	10	100	800	400
<b>6</b>	10	200	500	600
<b>7</b>	30	50	800	600
<b>8</b>	30	100	500	800
<b>9</b>	30	200	650	400

表 4.4 不同液體表面能參數

the parameter of different liquid (mN/m)				
liquid	surface tension	disperse part	acid part	base part
diiodo-Methane	50.8	50.8	0	0
water	72.8	21.81	25.5	25.5
Ethylen glycol	48	29	1.92	47.01

表 5.1 不同電漿處理刮痕試驗中之臨界載重值

the critical load of without plasma treatment (mN)							
1	2	3	4	5	6	Mean	STD
1.506	1.523	1.549	1.518	1.534	1.507	1.523	0.0165
the critical load of NH <sub>3</sub> plasma treatment (mN)							
1	2	3	4	5	6	Mean	STD
2.057	2.148	2.208	1.981	2.182	2.145	2.12	0.0852
the critical load of O <sub>2</sub> plasma treatment (mN)							
1	2	3	4	5	6	Mean	STD
2.119	1.932	2.058	1.938	2.046	2.015	2.018	0.0726
the critical load of H <sub>2</sub> plasma treatment (mN)							
1	2	3	4	5	6	Mean	STD
10.104	10.254	10.64	9.53	10.469	10.028	10.241	0.2677

表 5.2 不同電漿處理之接觸角

the contact angle of without plasma treatment(degree)					Mean	STD
liquid	1	2	3	4		
diiodo-Methane	38.5	37.7	37	36.4	37.4	0.906
water	7.9	9.4	7.2	9	8.375	1.008
Ethylen glycol	7.1	4.9	4.1	4.4	5.125	1.357
surface energy	45.898	46.277	46.235	46.328	46.185	0.195
the contact angle of NH <sub>3</sub> plasma treatment (degree)					Mean	STD
liquid	1	2	3	4		
diiodo-Methane	42.6	42.8	43.2	42.1	42.675	0.457
water	16.4	13.8	15.4	13.4	14.75	1.399
Ethylen glycol	15.6	11.2	12.7	11.3	12.7	2.051
surface energy	44.589	45.518	45.304	45.465	45.219	0.43
the contact angle of O <sub>2</sub> plasma treatment (degree)					Mean	STD
liquid	1	2	3	4		
diiodo-Methane	38.4	39.8	38.5	39	38.925	0.64
water	10.1	9.1	9.6	9	9.45	0.507
Ethylen glycol	3.5	4.9	5	4.9	4.575	0.718
surface energy	46.432	46.223	46.265	46.229	46.288	0.098

表 5.3 不同氬電漿參數刮痕試驗中之臨界載重值及 S/N 比

No	Measured Critical Load (mN)						Mean	STD	S/N
	1	2	3	4	5	6			
1	1.864	1.74	1.864	1.72	1.762	1.756	1.784	0.634	5.0161
2	1.676	1.564	1.869	1.764	1.665	1.671	1.702	0.104	4.5773
3	1.764	1.936	1.967	1.946	1.949	1.977	1.92	0.087	5.6601
4	3.231	3.322	3.088	2.863	2.964	2.956	3.071	0.177	9.7092
5	2.334	2.271	2.17	2.283	2.318	2.26	2.273	0.058	7.1235
6	3.492	3.49	3.437	3.519	3.469	3.63	3.506	0.067	10.8928
7	8.248	8.601	8.428	8.388	8.118	8.403	8.364	0.165	18.4444
8	49.8	51.56	50.68	49.84	50.96	50.2	50.507	0.69	34.065
9	5.51	5.499	5.225	5.795	5.812	5.795	5.606	0.237	14.9531

表 5.4 不同氬電漿參數正向拉力試驗中之附著力值

No.	Measured Adhesion Force (N)						Mean	STD
	1	2	3	4	5	6		
1	7.84	7.84	7.24	7.24	7.24	7.84	7.54	0.329
2	7.24	7.84	7.24	7.84	7.24	6.64	7.34	0.452
3	8.45	7.24	7.24	7.24	8.45	8.45	7.85	0.663
4	15.09	18.1	15.09	20.52	18.1	15.69	17.1	2.18
5	12.07	12.07	12.07	13.88	11.47	13.28	12.47	0.908
6	16.9	19.31	20.52	25.34	22.93	21.12	21.02	2.914
7	36.81	37.41	29.57	41.64	38.62	33.19	36.21	4.25
8	over the scale							
9	31.38	26.55	30.78	31.98	30.17	27.76	29.77	2.148
without H <sub>2</sub>	7.24	7.24	7.24	7.24	7.24	6.64	7.14	0.245

表 5.5 S/N 比反應表

Factor	A(time)	B(power)	C(pressure)	D(flow)
Level 1	5.0845	11.0566	16.658	9.0309
Level 2	9.2418	15.2553	9.7465	11.3048
Level 3	22.4875	10.502	10.4093	16.4781

表 5.6 氬電漿不同製程溫度刮痕試驗之結果

temperature (°C)	Measured Critical Load (mN)						Mean	STD
	1	2	3	4	5	6		
<b>100</b>	46.4	42	41.6	40	40	45.2	42.533	2.685
<b>150</b>	45.6	47.24	45.52	45.64	45.4	46.16	45.927	0.695
<b>200</b>	48	46	47.12	47.64	47.84	46.24	47.14	0.847
<b>250</b>	49.8	51.56	50.68	49.84	50.96	50.2	50.507	0.69
<b>300</b>	60.48	60.52	61.2	59.6	59.32	60.96	60.347	0.743

表 5.7 氬電漿不同射頻功率刮痕試驗之結果

Power (W)	Measured Critical Load (mN)						Mean	STD
	1	2	3	4	5	6		
<b>50</b>	43.48	42.4	44	46	45.6	43.2	44.113	1.411
<b>100</b>	49.8	51.56	50.68	49.84	50.96	50.2	50.507	0.69
<b>150</b>	53.32	53.44	54.56	55.32	53.15	53.72	53.92	0.846
<b>200</b>	61.44	62.4	62.24	62.6	62.8	62.76	62.373	0.504
<b>250</b>	62.4	62.2	63.08	64.76	62.52	64.24	63.2	1.061

表 5.8 氬電漿不同處理時間刮痕試驗之結果

Time(min)	Measured Critical Load (mN)						Mean	STD
	1	2	3	4	5	6		
<b>2</b>	3.03	3.16	3.02	3.41	3.15	2.98	3.124	0.157
<b>6</b>	5.81	5.19	5.8	5.18	5.46	5.42	5.48	0.278
<b>8</b>	27.52	23.28	26.92	27.32	24.24	25.12	25.733	1.774
<b>20</b>	39.6	38.96	38.72	38.04	38.6	38.44	38.727	0.527
<b>30</b>	49.8	51.56	50.68	49.84	50.96	50.2	50.507	0.69
<b>60</b>	75.08	79.52	74.96	73.6	82.96	75.2	76.887	3.59

表 5.9 氬電漿不同氣體流量刮痕試驗之結果

Flow (sccm)	Measured Critical Load (mN)						Mean	STD
	1	2	3	4	5	6		
<b>400</b>	36.24	38.52	38.92	39.6	38.4	37	38.113	1.254
<b>500</b>	45.08	44.76	44.8	44.64	45.76	43.8	44.807	0.637
<b>600</b>	46.4	46.72	46.64	46.2	47	45.8	46.46	0.424
<b>700</b>	47.64	47.96	47.92	48.16	47.72	47.76	47.86	0.191
<b>800</b>	49.8	51.56	50.68	49.84	50.96	50.2	50.507	0.69

表 5.10 氫電漿不同處理時間接觸角量測之結果

<b>the contact angle of H<sub>2</sub> plasma treatment with 2min (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	44.7	44.1	45.2	45.8	44.95	0.723
water	49.8	48.6	48.3	50.9	49.4	1.192
Ethylen glycol	19.1	18.9	17.4	18.6	18.55	0.802
surface energy	47.232	47.336	47.464	47.158	47.298	0.133
<b>the contact angle of H<sub>2</sub> plasma treatment with 6min (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	28.7	30.3	29.7	29.3	29.5	0.673
water	77.9	77.7	78	78.3	77.975	0.25
Ethylen glycol	11.5	8.5	9	8.7	9.425	1.399
surface energy	47.887	47.384	47.477	47.49	47.559	0.224
<b>the contact angle of H<sub>2</sub> plasma treatment with 8min (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	25.8	25.9	25	24.9	25.4	0.523
water	79.1	78.4	80.2	79.5	79.3	0.753
Ethylen glycol	4.9	4.1	5.6	5.5	5.025	0.69
surface energy	48.282	48.531	48.078	48.406	48.324	0.193
<b>the contact angle of H<sub>2</sub> plasma treatment with 20min (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	20.7	20.5	21.2	20.6	20.75	0.311
water	80.9	79.3	78.6	80.6	79.85	1.085
Ethylen glycol	5.7	5.3	4.1	4.4	4.875	0.75
surface energy	49.058	49.759	49.834	49.196	49.462	0.392
<b>the contact angle of H<sub>2</sub> plasma treatment with 30min (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	20.1	20.6	20.7	20.4	20.45	0.265
water	71.5	73	72.1	72.5	72.275	0.634
Ethylen glycol	4.1	5.4	4	4.6	4.525	0.64
surface energy	52.29	51.791	52.008	51.973	52.015	0.206
<b>the contact angle of H<sub>2</sub> plasma treatment with 60min (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	20.1	20.9	19.8	20.2	20.25	0.465
water	61.3	62.8	66.2	66.3	64.15	2.501
Ethylen glycol	3.1	3	4.8	3.3	3.55	0.843
surface energy	53.744	53.496	53.311	53.244	53.449	0.224

表 5.11 氫電漿不同氣體流量接觸角量測之結果

<b>the contact angle of H<sub>2</sub> plasma treatment with 400sccm (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	22.3	21.3	21.7	21.1	21.6	0.529
water	80.4	82.3	81.6	82.1	81.6	0.852
Ethylen glycol	3.9	4.1	4.3	5.1	4.35	0.526
surface energy	48.8	48.247	48.451	48.411	48.476	0.231
<b>the contact angle of H<sub>2</sub> plasma treatment with 500sccm (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	21.6	21.9	21.3	21.8	21.65	0.265
water	75.1	75	76.7	77	75.95	1.047
Ethylen glycol	3.5	4.4	4.3	4.5	4.175	0.457
surface energy	50.945	50.898	50.498	50.261	50.651	0.328
<b>the contact angle of H<sub>2</sub> plasma treatment with 600sccm (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	18.9	19.1	18.7	20.1	19.2	0.622
water	76.3	76.3	77.8	75.5	76.475	0.96
Ethylen glycol	4.3	5.1	4.5	4.6	4.625	0.34
surface energy	51.226	51.18	50.765	51.194	51.091	0.218
<b>the contact angle of H<sub>2</sub> plasma treatment with 700sccm (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	20.7	20.3	20.7	20.8	20.625	0.222
water	75.7	74.7	73.7	72.6	74.175	1.33
Ethylen glycol	5.6	6.4	4.1	3.1	4.8	1.481
surface energy	50.983	51.385	51.584	51.862	51.453	0.37
<b>the contact angle of H<sub>2</sub> plasma treatment with 800sccm (degree)</b>						
liquid	1	2	3	4	Mean	STD
diiodo-Methane	20.1	20.6	20.7	20.4	20.45	0.265
water	71.5	73	72.1	72.5	72.275	0.634
Ethylen glycol	4.1	5.4	4	4.6	4.525	0.64
surface energy	52.29	51.791	52.008	51.973	52.015	0.206