

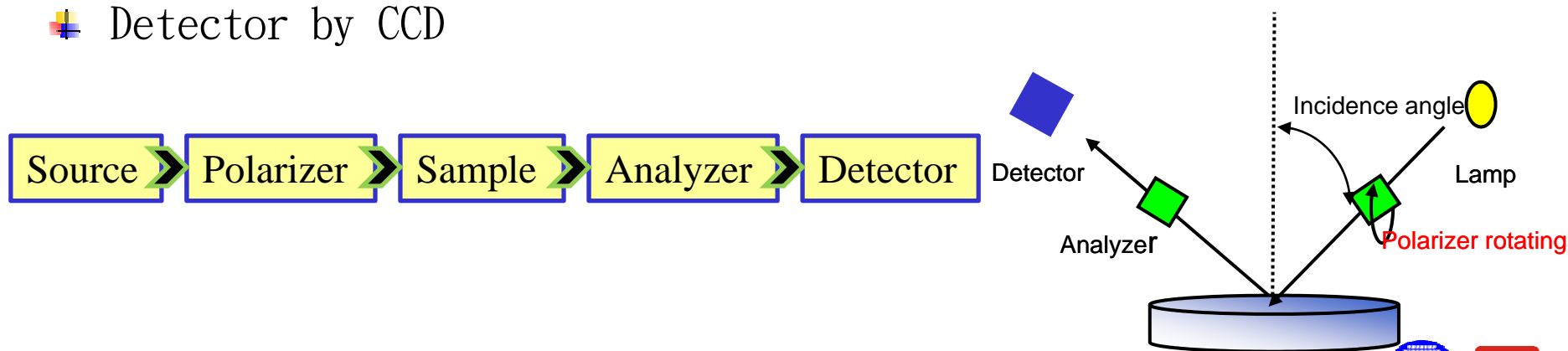
M2000 橢圓測厚儀 儀器簡介

Agenda

- ✚ 系統簡介
- ✚ 橢圓儀原理
- ✚ 量測與分析

系統簡介

- 量測波段範圍：193 nm ~ 1690 nm (e.v. * nm =1240)
- 光源：XLS-100 type
 - 30W D2 (Deuterium) for UV/VIS，壽命約1500hr
 - 5W QTH (Quartz Tungsten Halogen) for VIS/IR，壽命約2000hr
- Spot size：0.3mm~5mm
- Scan angle：45°~75° with probe， 45°~90° without probe
- Polarizer (Analyzer)：偏光鏡，由兩個稜鏡組合而成，將光源轉換為單一方向的光(P & S)
- Sample size：最大至8 inch wafer，最小至1x1 cm 破片
- Detector by CCD



提供光譜範圍：193nm-1690nm(UV/VIS/NIR) 690 個波長

	A	B	C
1	192.24289	37.338764	107.20974
2	193.8287	37.302826	107.77364
3	195.41458	37.259106	108.32195
4	197.00052	37.22775	108.81159
5	198.58656	37.212105	109.37609
6	200.17265	37.2152	109.90732
7	201.75883	37.211674	110.350464
8	203.34511	37.271023	110.74814
9	204.93143	37.306873	111.065994
10	206.51785	37.357044	111.352516
11	208.10432	37.36281	111.753456
12	209.69087	37.377872	112.20011
13	211.2775	37.347954	112.72253
14	212.86418	37.30433	113.31248
15	214.45096	37.26991	113.899864
16	216.03781	37.20564	114.50521
17	217.62471	37.177563	115.17845
18	219.2117	37.116734	115.87843
19	220.79875	37.063618	116.55162
20	222.38586	36.994408	117.2535
21	223.97307	36.93792	117.94197
22	225.56033	36.83516	118.68568
23	227.14766	36.714348	119.45321
24	228.73503	36.512268	120.15703
25	230.32248	36.294617	120.759315
26	231.91003	36.060913	121.12198
27	233.4976	35.891727	121.333565
28	235.08528	35.771812	121.44388
29	236.673	35.690117	121.60416
30	238.26079	35.726933	121.84235
31	239.84863	35.772354	122.093155
32	241.43655	35.818867	122.39925

	A	B	C
214	530.9838	19.348614	175.00322
215	532.57495	19.323158	174.97028
216	534.1661	19.288084	174.99503
217	535.75714	19.267794	175.03922
218	537.3482	19.224787	175.04523
219	538.9392	19.186625	175.08371
220	540.5302	19.137556	175.12613
221	542.1212	19.108477	175.13385
222	543.7121	19.076124	175.18059
223	545.30304	19.053024	175.13683
224	546.8939	18.99384	175.17952
225	548.48474	18.983475	175.17723
226	550.07556	18.957407	175.17815
227	551.66626	18.934486	175.16808
228	553.257	18.891088	175.18422
229	554.8477	18.866869	175.25458
230	556.43835	18.819983	175.22258
231	558.029	18.79798	175.27458
232	559.61957	18.749321	175.27281
233	561.21014	18.739334	175.29408
234	562.80066	18.699173	175.27698
235	564.3912	18.682297	175.30865
236	565.98157	18.656538	175.32082
237	567.572	18.615091	175.34692
238	569.1624	18.59762	175.354
239	570.7527	18.578554	175.36557
240	572.343	18.553774	175.41483
241	573.9332	18.504812	175.3638
242	575.52344	18.491846	175.36385
243	577.11365	18.466124	175.39485
244	578.70374	18.439922	175.39659
245	580.2938	18.411781	175.4071

	A	B	C	D
677	1581.4943	14.996697	178.14313	
678	1584.9661	14.87551	178.14537	
679	1588.4385	14.867114	178.12273	
680	1591.9113	14.968471	178.15694	
681	1595.3845	14.873562	178.10909	
682	1598.8582	14.914246	178.17233	
683	1602.3323	14.813961	178.09924	
684	1605.8068	14.887195	178.13893	
685	1609.2817	14.898752	178.22227	
686	1612.7571	14.864287	178.16081	
687	1616.233	14.998583	178.17943	
688	1619.7092	14.878915	178.19597	
689	1623.1859	14.923994	178.15662	
690	1626.6631	14.826689	178.19972	
691	1630.1406	14.799215	178.18907	
692	1633.6187	14.914901	178.1543	
693	1637.097	14.861743	178.22351	
694	1640.5759	14.825865	178.19806	
695	1644.0553	14.858638	178.16449	
696	1647.5349	14.939361	178.22887	
697	1651.0153	14.947739	178.17572	
698	1654.4957	14.943806	178.21826	
699	1657.9768	15.000098	178.16898	
700	1661.4583	14.876003	178.27068	
701	1664.9402	14.740712	178.22855	
702	1668.4225	14.732529	178.21057	
703	1671.9053	14.856343	178.24687	
704	1675.3884	14.951012	178.22813	
705	1678.8721	14.819538	178.22177	
706	1682.3562	14.803858	178.28746	
707	1685.8406	14.808801	178.2747	
708	1689.3256	14.885617	178.23166	

光譜範圍：192.24289 - 1689.3256 nm , 708 個波長解析度於

IR : 1689.3256- 1685.8406 nm =3.485 < 3.7nm

VIS : 580.2938-578,70374 nm= 1.58646 < 2.17nm

UV : 241.43655-239.84863 nm=1.58792 < 2nm).

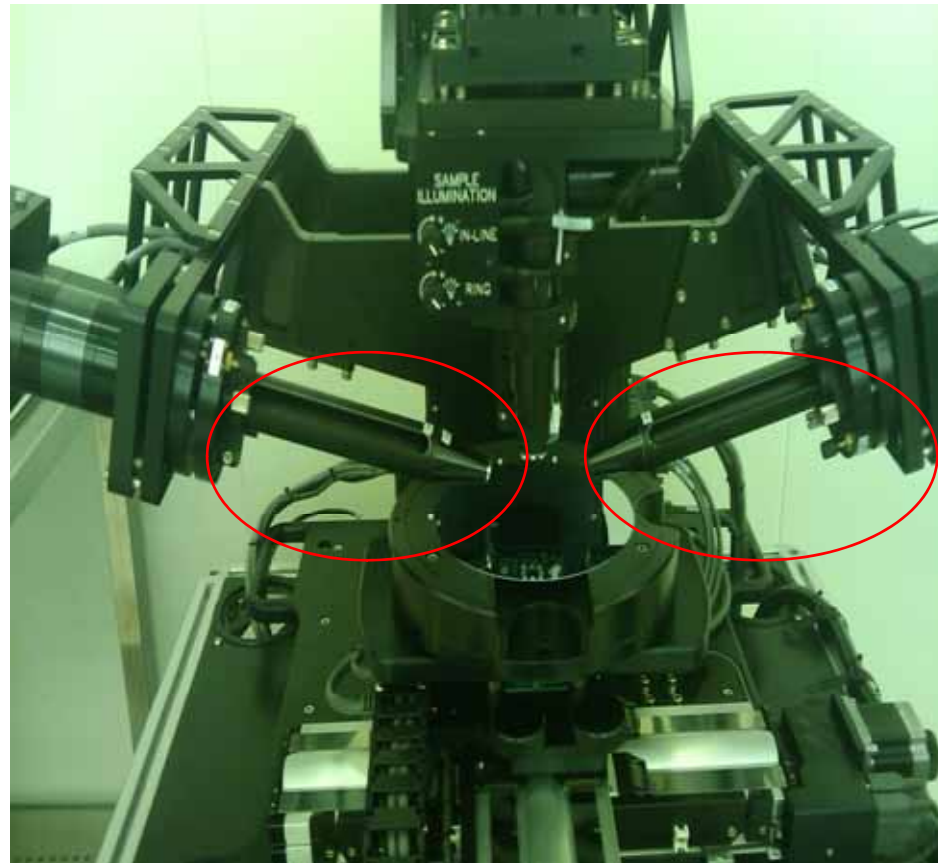
光點 (spot size) 直徑為 0.3-5mm

標準光斑大小：3-5mm，透過聚焦配件可進一步縮小到0.3mm

(光斑大小會隨不同波長而有所變化)

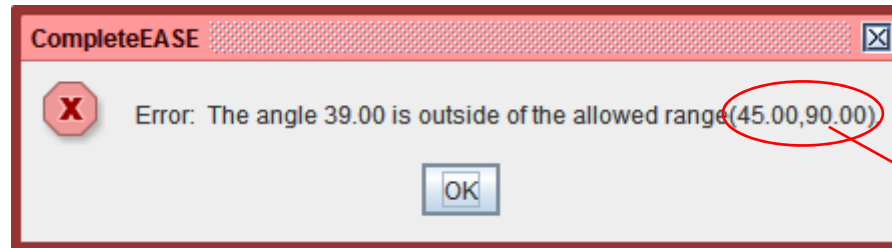


聚焦配件

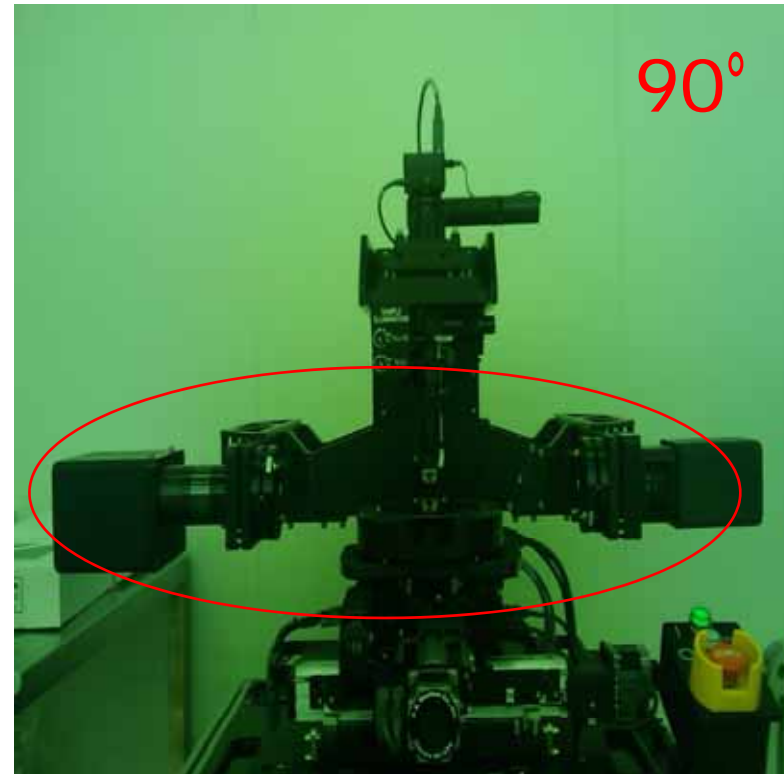
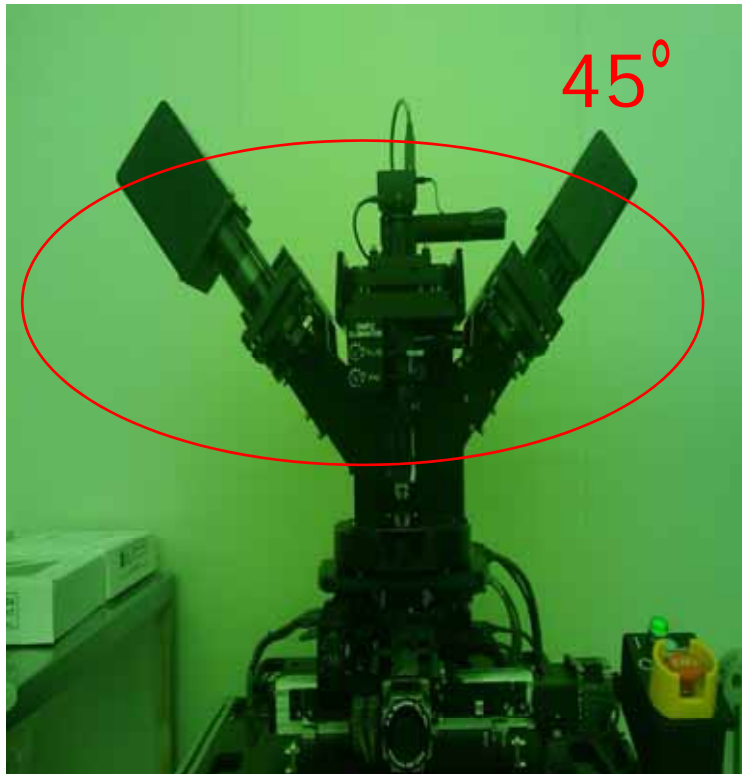


裝設於系統上

量測角度：電腦自動調整角度變化，變化範圍 45° - 90°

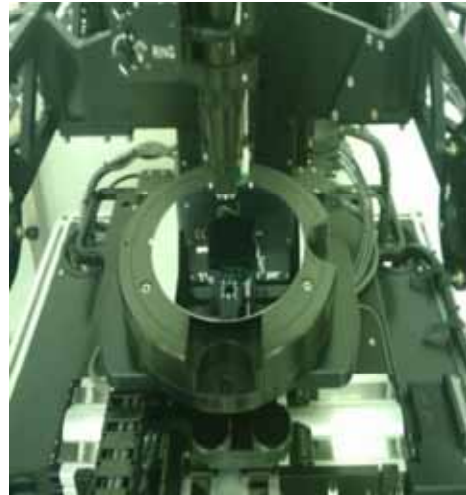


設定 39° ，但系統提示只能 $45\sim 90^{\circ}$



行程200mm程式化控制XY平移台 (本平台需可量測200mm 以下之晶圓)

X=0 Y=0 原點位置

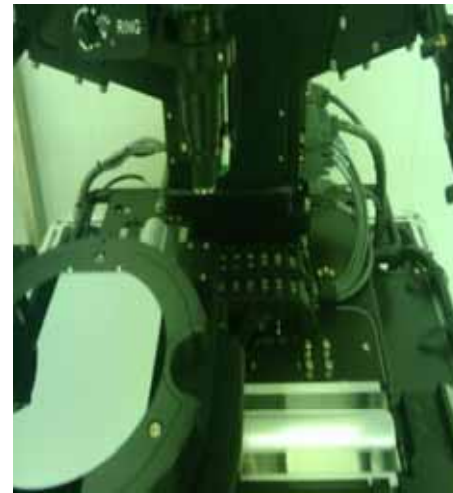


移動到 X=-10cm Y=-10cm 位置



移動到 X=10cm Y=10cm 位置

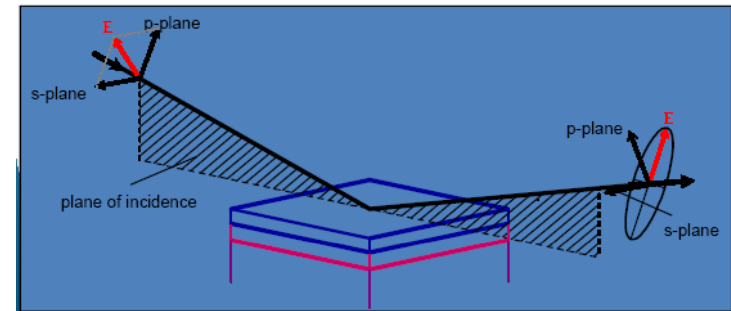
XY可移動範圍從-10~10cm(200mm)



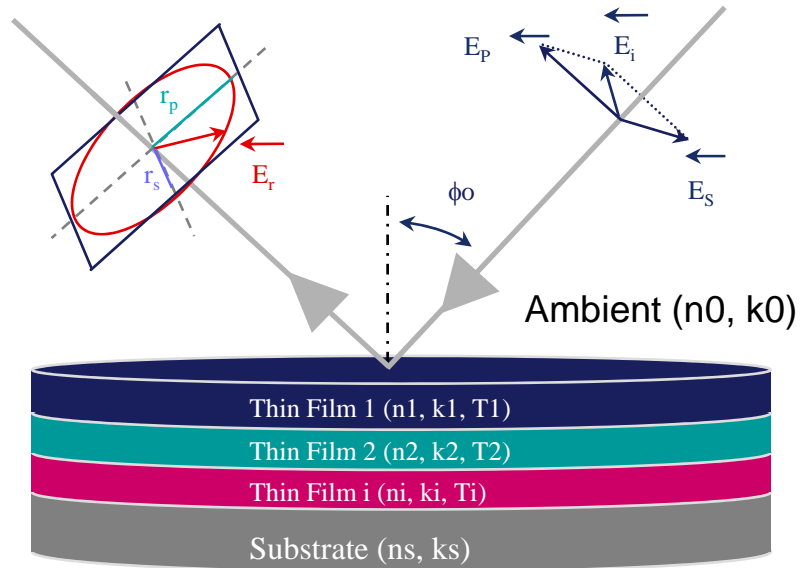
橢圓儀原理

光藉由非零度入射角至樣品表面而反射, 因為樣品的厚度及對光的反應(吸收或透明...)而產生極化狀態的改變 (產生相位及振幅的改變), 此量測方式我們稱為橢圓儀量測

- 量測時對於每個波長, 我們得到兩個獨立的參數
- ψ and Δ
(相變化 Δ 在10nm薄膜內有非常高的靈敏度)
- 絕對性量測:
 - 我們不需任何參考參數.
 - 非破壞且間接的量測技術:
 - 不能直接得到樣品的 N, K, T .
 - 使用模組公式來描述樣品的物理參數,
 - 求得 N, K, T .



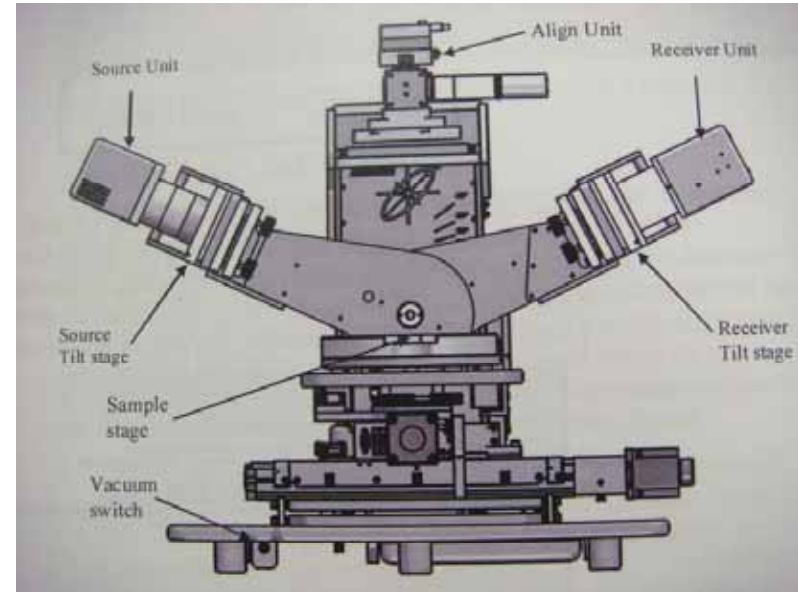
橢圓儀原理



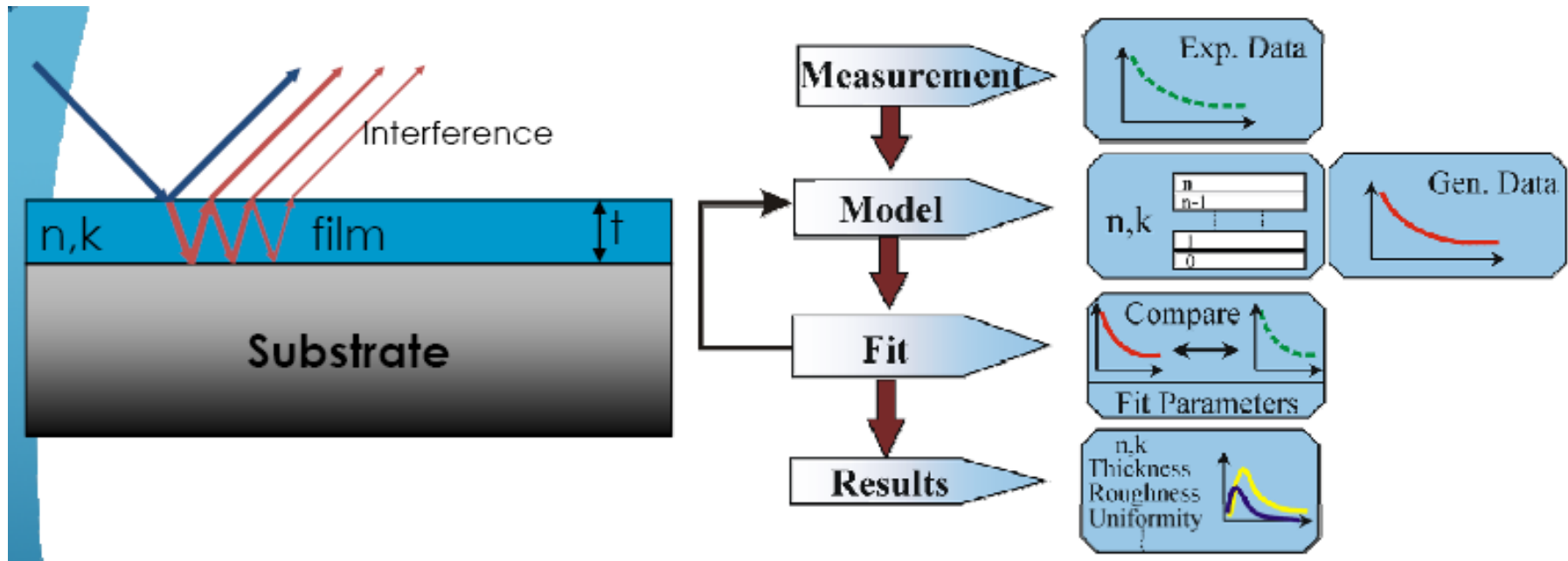
$$\rho = \frac{r_p}{r_s} = \tan(\Psi) \cdot e^{j(\Delta)}$$

Measured Parameters

Tan Ψ and Cos Δ



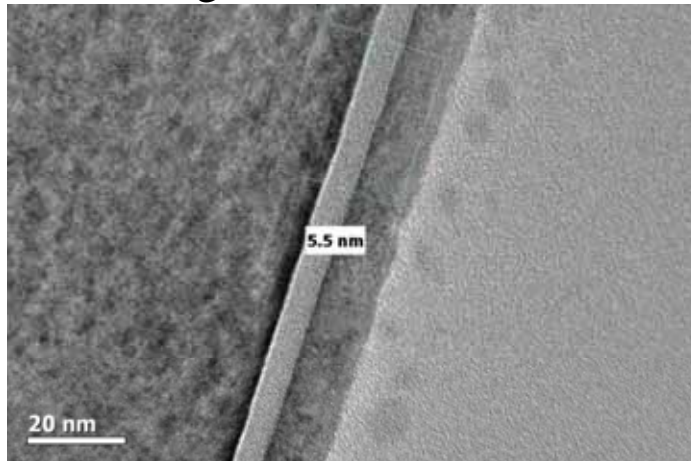
量測與分析



量測與分析

55A SiO₂ (Dry Oxide) deposited in Vertical furnace at 980°C

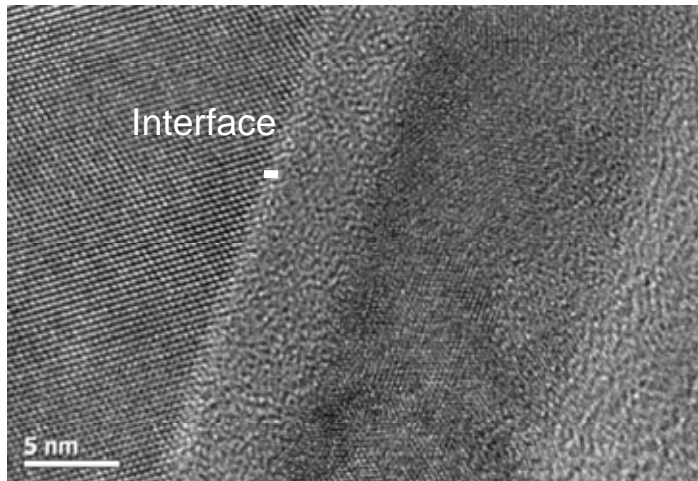
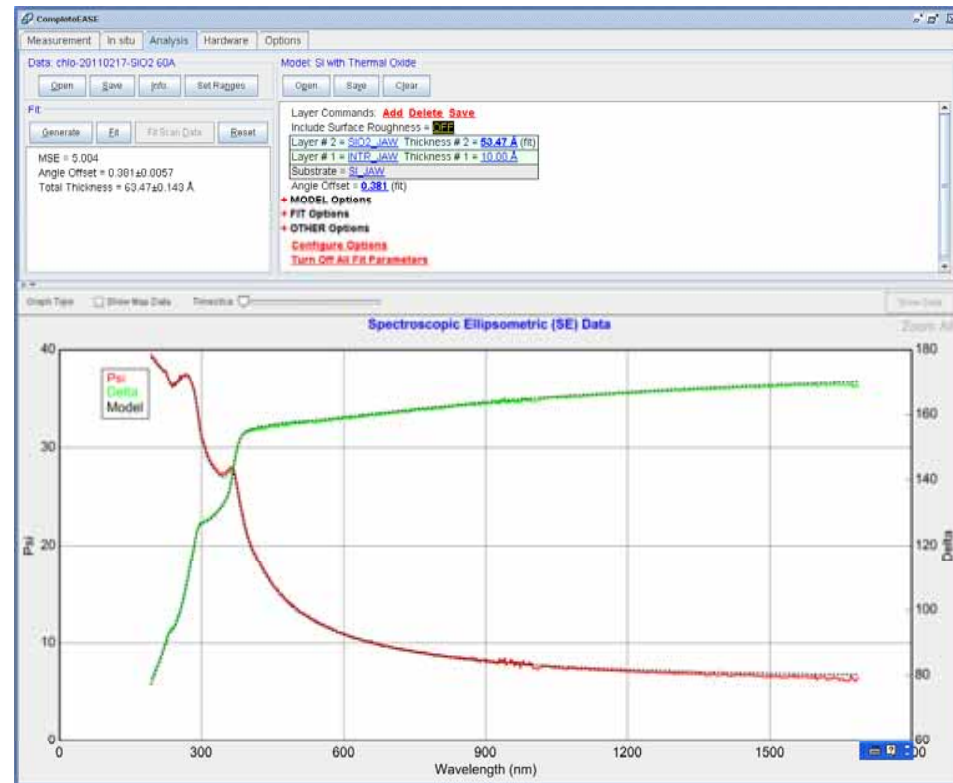
TEM image



Layer#2 SiO₂ Thickness = 53.47Å

Layer#1 Interface Thickness = 10Å

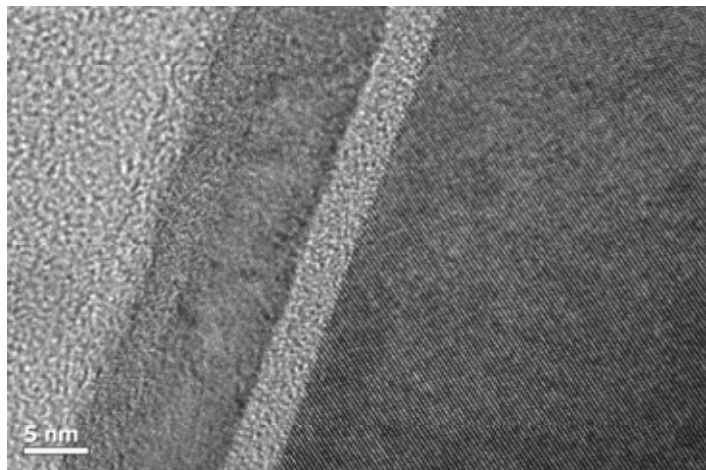
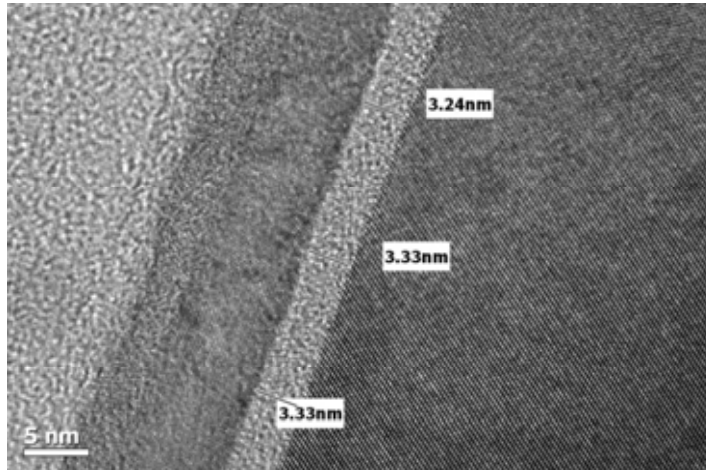
Ellipsometer M2000 analysis



量測與分析

33A SiO₂ measurement data

TEM image



Layer#2 SiO₂ Thickness = 29.95 Å

Layer#1 Interface Thickness = 10 Å

Ellipsometer M2000 analysis

