2016-01

Received the masks from toppan with new designs for BCB bridges

Fabrication of new wafer BPC5

last wafer from batch 2602 [100] >10 kΩ.cm
Al etch process
started mardi 05/01
See corresponding BPC5 page for details

Fabrication of development wafers BPCD8 & BPCD9 for multilayers

On standard Si/SiO2 500nm, we develop bi/trilayers to check :
- Tc
- Q factor of resonators
- contact resistance after 2nd litho
- ageing (at high temperature)

- **evap BPCD8 1st step (plassys550): 06/01/2016**

```
pump 2h ->  P_ch / P_sas = 9e-8 / 1.5e-7mb
pump Ti 20nm @ 0.2nm/s -> P_ch / P_sas = 3.8 / 7.5e-8mb
evap Al 102nm @ 1nm/s, P_ch / P_sas = 5 / 6e-7mb (hot) -> 2.0 / 2.4e-7 (c
evap Pt 2.1nm @ 0.1nm/s, P_ch / P_sas = 4 / 4.7e-7mb
~5' wait time between end of Al and shutter open for Pt
```

- **evap BPCD9 1st step (plassys450): 06/01/2016**

```
pump 2h -> P_ch  = 3.9e-7mb
degas Au -> P_ch / sas = 1.5e-6 / 2e-6
degas Cu -> P_ch / sas = 1.1e-6 / 1.4e-6
pump Ti 20nm @ 0.2nm/s -> P_ch /sas = 1.8e-6 / 7e-7 (hot)
evap Al 101.8nm @ 1nm/s, P_ch /sas = 1.1e-6 / 4e-7
evap Cu 2.5nm (manual shunt) @ 0.5nm/s
evap Au 2.5nm @ 0.5nm/s, P_ch /sas = 1.1e-6 / 4e-7
```

jeudi 07/01

Cut part of the development wafers **BPCD8 et 9** to test ageing of the layers.
First observation of BPCD8:
On the side of the layer, I could observe percolation of Al, because there was shadowing

by the clamp
In the bulk, I see grains of typical size 50-200nm (quite big!), and no apparent clusters of Pt.
-> The layer is wetting properly Al, or dissolving in it.
BPCD8_ageing-v1.jpg

First observation of BPCD9:
The average grain size is about the same, the percolation on the edge of the layer also.
Remarkably, now we can see small clusters (<10nm) -tiny white spots- on top of the Al grains.
This might indicate the Cu/Au layer has not wetted the Al.
Note that Pt should have a high contrast with Al, similar to Au (they have about the same weight, neighbours in the table). On BPCD8 we see no white tiny spots.
Pictures: each column is taken at the same location on the sample, for different

magnifications (highest mag on top). The zoom position is shown by a rectangle.
BPCD9_ageing-v1.jpg

After 3h @ 220°C on hot plate
left: BPCD8 (Pt) **right: BPCD9 (Cu/Au)**

BPCD8_ageing-v2.JPG

BPCD9_ageing-v2.JPG

Two different positions on each sample (in the bulk of the layer)
The Al/Pt layer was modified chemically, leading to the appearance of black spots, one can see on the optical microscope as well.
It seems (but hard to say) that the Cu/Au layer is a bit smoother (the tiny clusters may

have formed an alloy with Al). As Denis says, Cu and Au are mixable with Al. On the optical obs, it seems also that the Cu/Au turned a bit more pinky

left: BPCD8, right BPCD9; bottom: fresh, top: aged
BPCD8v1v2_x100.jpg

BPCD9v1v2_x100.jpg

mardi 12/01

- Litho S1813 mask 2013-09 BPCv1

```
bake wafer 1' @ 110°C (solvent evaporation)
spin S1813 60" @ 4krpm
bake 2' @ 110°C
Expo 150mJ/cm2 @ 365nm, Vacuum contact -> 14.5" @ 11mW
Dev MF319 50" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

Done the same for both
On BPCD8, at 50", the Al layer is already etched, I see wavy strips (like level lines on a map) indicating so
I decide to finish etching in the developer: add something like 20" -> **1'10 to develop S1813 + etch 100nmAl/Pt**

Note: There are lots of tiny black peels on the developper and on the water beakers. I think this is the upper layer which has been "lifted". On many places of the wafer there are residues of this thin peel. This corroborates the hypothesis that the Pt top layer was protective against oxidation (-> continuous wetting layer) but not to wet etchant -> extremely reactive below the thin layer.

On BPCD9, everything goes fine, patterns are perfect. Cu/Au is probably not protective against oxidation (probably not continuous). (because it is certainly not protective against wet etch, as Ti 20 / Au 10 is not fully protective - see previous results on BPC2)
After etching is finished, I also see small peeling residues on the sides of the patterns (see pictures) indicating also that the top layer was more 'lifted' than etched away.
This is a problem for this kind of process, unless we first etch out this skin.

- Al-Etch (BPCD9 only). Peremption 2002 (!!)

```
With magnetic agitator in tall beaker (no manual agitation)
etching starts from the edge and reaches slowly towards the center
after 2' the edges seem to be etched
after 2'30 the center seems also
- leave 3', rinse ODI in beaker + 1' water tap
```

BPCD9_S1813_160mJ_MF319-50"_Al-etch-3'_3um_x250.JPG

- add 1', rinse ODI in beaker + 1' water tap

no change

- add 2', rinse ODI in beaker + 1' water tap

no change

- add 3', rinse ODI in beaker + 1' water tap

Can see clearly the overetch (resist on top: 4µm, wire on the bottom: 2µm)

BPCD9_S1813_160mJ_MF319-50"_Al-etch-9'_3um_x250.JPG

Below, after dicing and cleaning, BPCD8 (left), and BPCD9 (right)

BPCD8_final_3um_x50.JPG

BPCD9_final_3um_x50.JPG

BPCD8_final_res_x5.JPG

BPCD9_final_res_x5.JPG

- **Measurements: 23/02/2016**

BPCD8_9_cooldown.jpg

BPCD8-9_Tc.jpg

Fabrication of BPC6 (lift-off process)

wafer from batch 3481 rho>20kohm.cm SSP
started vendredi 08/01
Already measured good resonances after 1st step (Al layer only)
See page BPC6

Test samples for Al resonator on Si

- Layer of Al 20nm

On standard Si/SiO2 500nm, with 20nm Al evaporated on top

```
clean waffer in acetone + IPA for 10min
heat waffer in hotplate at 120deg for 20min to eliminate solvants and wat
spin TI primer 60sec at 4000rpm
bake Ti primer at 120deg for 2min
```

```
spin S1813 for 60sec at 4000rpm
bake S1813 for 2min at 110deg
expose S1813 for 13.5sec (~148.5mJ) on vac contact
develop 55sec in MF139 + clean in DI water
```

After 55sec of development there is still resine in between the lines of the bobine but in the corners the Al can be distinguished.(no picture taken, sorry)

```
develop 15 sec more in MF139 + clean in DI water
```

Litho_S1813onAl_dose13p5sec_dev70sec_1.JPG

Litho_S1813onAl_dose13p5sec_dev70sec_2.JPG

It thought at the beginning that there were still resine traces bat in fact, **it can be observed that Al has been etched in many places. !!!**
1 min or 1min 5sec is enough for developpement !!! (but it is not homogeneous across the wafer)

```
develop 15 sec more in MF139 + clean in DI water -> 1'20
```

Litho_S1813onAl_dose13p5sec_dev85sec_1.JPG

The substrate can be observed in many places; We decide to cut the wafer in four pieces to test different Al etchings.

- **etching by developper (MF319) itself**

- add 90+45sec
  -> the resist is gone and I etch the bobine;

- add only 105sec
  -> apparently OK

FIRST (135s) **before**

TESTa-Litho_S1813onAl_dose13p5sec_dev85sec_1.JPG

TESTa-Litho_S1813onAl_dose13p5sec_dev85sec_2.JPG

FIRST(135s) after 90s

TESTa-Litho_S1813onAl_dose13p5sec_dev85sec_dev90sec_1.JPG

TESTa-Litho_S1813onAl_dose13p5sec_dev85sec_dev90sec_3.JPG

FIRST after 135s (in total is : 55+15+15+135=220sec)

TESTa-Litho_S1813onAl_dose13p5sec_dev85sec_dev135sec_1.JPG

TESTa-Litho_S1813onAl_dose13p5sec_dev85sec_dev135sec_2.JPG

SECOND after 105 sec (in total is : 55+15+15+105=190sec)

TESTb-Litho_S1813onAl_dose13p5sec_dev85sec_dev105sec_1.JPG

TESTb-Litho_S1813onAl_dose13p5sec_dev85sec_dev105sec_2.JPG

TESTb-Litho_S1813onAl_dose13p5sec_dev85sec_dev105sec_5.JPG

TESTb-Litho_S1813onAl_dose13p5sec_dev85sec_dev105sec_3.JPG

TESTb-Litho_S1813onAl_dose13p5sec_dev85sec_dev105sec_4.JPG

lundi 11/01

- **etching by Al etch**

Where etching is done, patterns are OK, but many places where it does not etch.
Means there is resist remaining.
5' -> etched patterns are OK
12' -> etched small patterns are gone. The ones with resist residues are still there

The result of the "Al etch" is the following:

-Resine S1813 is rather resistent to the etchant;

-After 1min 30sec, Al is gone from some places but not from everywere; I wait 5 minutes but still the same. We constate on the microscope that the places were the Al is not gone are still cover by resine. We try a plasma oxigen for 1min to take out the remaining resist.

-After 20min there is not much change; The fine patterns (bobine par example) in the part of the sample where Al was already gone star to leave; That is reasonable since etching continues under the resist.

-> SHOULD IMPROVE RESIST DEVELOPMENT

- **etching by HF**

15" HF:ODI 1:20

Very inhomogeneous: either bobin pattern is gone, or there are still residues of Al

The result of the "HF etch" is the following:

-After 20 sec Al is gone; The result is not homogeneus. The bobine is gone is many places.

Overal it seems that the development was not proper (very inhomogeneous), and that it makes it impossible to properly etch the layer with a solution that does not attack the resist

The result is not homogeneous in the whole waffer.

The other two pieces of the waffer are etched in "Al etch" and in HF solution 1:20 (Helene verified that 100nm of Al are etched in 30sec).

General questions and conclusions:

- Why is the litho so inhomogeneus? Is the spining inhomogeneus? Is the resist old? Is a problem of the development?

-Which is the adecuate dosis for S1813?

Up to now, we have tried 16 sec (overdose) and 13.5 sec (slightly underdose) ; I would try 14 or 14.5 sec and 50-55 sec dev + plasma oxigen 1min

-Which is the etching rate of Al in MF319 ?

We have etched 20nm in 105 sec, in average.

-HF seems to attack very fast also the resist

-MF319 leads to a good result. How long do we need for 100nm?

It seems we would need 525sec (8 min 45 sec) but I dont think the resist is going to stand such a long time.

-Al etch is very sensitive to residues of resist.

- **Layer of Al 100nm**

Si doped 100ohm.cm, unoxidized
Evap 100nm Al @ 0.1nm/s

```
heat waffer in hotplate at 120° for 15min to eliminate water
spin TI primer 60sec at 4000rpm
bake Ti primer at 120° for 2min
spin S1813 for 60sec at 4000rpm
bake S1813 for 2min at 110deg
expose S1813 for 14.5sec on vac contact
develop 50sec in MF139 + clean in DI water + tab water
```

TEST100-Litho_S1813onAl_dose14p5sec_dev55sec_1.JPG

TEST100-Litho_S1813onAl_dose14p5sec_dev55sec_3.JPG

TEST100-Litho_S1813onAl_dose14p5sec_dev55sec_4.JPG

TEST100-Litho_S1813onAl_dose14p5sec_dev55sec_5.JPG

This time resine has good aspect and litho seems homogeneus in the waffer. Dose is correct and development time is right.

Cut two pieces of the waffer to masure approximate etch time in MF319 and "Al etch" previous removal of resist in acetone heated at 60° for 10min.

-MF319 --> 100nm gone in 6min10sec
-Al etch --> 100nm gone in 5min

```
clean resis residues in 1min plasma Oxigen (0.2mbar, 100W, 41cc)
etch Al in Al etch for 5min30sec+DI water + water tab
```

TEST100-Litho_S1813onAl_dose14p5sec_dev55sec_etch5min30secAletch_1.JPG

TEST100-Litho_S1813onAl_dose14p5sec_dev55sec_etch5min30secAletch_3.JPG

TEST100-Litho_S1813onAl_dose14p5sec_dev55sec_etch5min30secAletch_4.JPG

TEST100-Litho_S1813onAl_dose14p5sec_dev55sec_etch5min30secAletch_5.JPG

The result seems quite convincing ---> this waffer is called **BPCd10**

lundi 19/01

- **BCB step**

  I put some BCB in the syringe as soon as possible to let all the possible bubbles go.

  ```
  bake wafer 5' @ 110°C
  spin AP3000 - 3" @ 1000rpm acc 300rpm/s; 60" @ 6000rpm ; bake 1' @
  spin BCB4024-40 - 3" @ 1000rpm acc 300rpm/s; 60"@5000rpm ; bake 2'3
  align layer 2 from mask with layer one
  Expo 71mJ/cm2 @ 365nm, Vacuum contact -> 6.5" @ 11mW
  pre-bake wafer 30" @ 65°C before inmediate development
  ```

```
Dev DS3000 at 31-32°C (very important) for 3min 30sec
(previous check with test waffers), rinse ODI 60" beaker + 30" wate
```

Result: oh fuck! The mask was inverted ! Alignment is right otherwise

BCPtest_1.PNG

BCPtest_4.PNG

mardi 19/01

- **removing BCB**

  After the mistake with BPC5 (i tried to use AZ400 dev which etches Al and damages Si).

remove BCB in Remover 1165 @ 60°C for 20min + clean in DI H2O

I can observe the resist that leaves slowly (like in a lift off); I use short intervals of ultrasound to help this process.

- **BCB step (second time)**

```
bake wafer 5' @ 110°C
spin AP3000 - 10" @ 500rpm acc 250rpm/s; 60" @ 6000rpm ; bake 1' @ 110°C
spin BCB4024-40 - 10" @ 500rpm acc 250rpm/s; 60"@5000rpm ; bake 3'30 @90°
align layer 2 from mask with layer one (with the right orientation this t
Expo 71mJ/cm2 @ 365nm, Vacuum contact -> 6.5" @ 11mW
pre-bake wafer 30" @ 65°C before inmediate development
Dev DS3000 at 31-32°C (very important) for 4min
(previous check with test waffers), rinse ODI 60" beaker + 30" water tap
```

Result: NICE!

```
bake BPCD10 at 200°C for 1h.
```

Test BCB

mardi 12/01

We prepare a little bottle with the new BCB4024-40. Since we take it out from the fridge, we have to wait for thermalization.

On standard Si/SiO2 500nm,

```
spin AP3000 - 3" @ 1000rpm acc 500rpm/s; 60" @ 6000rpm ; bake 1' @ 110°C
spin BCB4024-40 - 3" @ 1000rpm acc 500rpm/s; 60"@5000rpm ; bake 2'30 @90°
```

I guess that since there many bubbles in the bottle inseide the fridge, they remain in the spinning. So **there are many bubbles after the spinning**;

I test the development time of the complete waffer. According to previous test fringes are gone at 1min30sec aprox. I first tried with the developer DS3000 at cleanroom temperature but the times are very long.

I re-start (take out bcb and re-spin) and try with the developer kept at 30°C (I had observed before that this was appropriate) and then **I obtain 1min25sec**. This would indicate that the development time is 3min;

```
expose BCB4024-40 with 50,71 and 93mJ in vacuum contact using IEF mask;
develop in DS3000 at 30°C for 3min (at this time I observe that the resis
 i.e. fringes dissapear)
```

(50mJ dose - 3min dev)

Litho_BCB_49mJ_3min_1.PNG

A similar result can be observed in the optical microscope for the different doses.

mercredi 13/01

I cleave the waffer to obseve part of it in the SEM.

resume1.jpg

In the SEM image it is clear that 3 min dev if fine to get well defined patterns but one mone minute helps to get the right undercut. This undercut is more pronounced with less dose; After developing 6 min (3+3) the patterns are washed away.

jeudi 14/01

I bake the sample that was developed 3 min and the one that was developed 3+1

`bake BCB4024-40 for 1h at 200°C`

resume2.jpg

There are several combinations that are appropriate to do the third step after. **I think that 71mJ is the right dose and 3-4 min is OK**.

Once I have this process more or less stablished, I repeated the process in test waffer of standar Si (Si/SiO2 500nm)

```
heat the waffer at 110°C for 5min to eliminate water and solvents
spin AP3000 - 3" @ 1000rpm acc 300rpm/s; 60" @ 6000rpm ; bake 1' @ 110°C
spin BCB4024-40 - 3" @ 1000rpm acc 300rpm/s; 60"@5000rpm ; bake 2'30 @90°
expose with doses 51mJ and 71mJ using IEF mask
heat waffer at 65°C before develop
develop 4 min in DS3000 @30°C
```

I cut the waffer in four (2 of 51mJ and 2 of 71mJ); I bake one of each 1h at 200°C. The observation in SEM is surprising: **The Result has nothing to do with the previous one**

resume3.jpg

What happened is that the **development time changed due to the aging of the resist**.

venerdi 15/01

The results are still not conclusive. I start with a new test waffer of standar Si (Si/SiO2 500nm) and

```
heat the waffer at 110°C for 5min to eliminate water and solvents
spin AP3000 - 3" @ 1000rpm acc 300rpm/s; 60" @ 6000rpm ; bake 1' @ 110°C
spin BCB4024-40 - 5" @ 500rpm acc 250rpm/s; 60"@5000rpm ; bake 2'30 @90°C
heat waffer at 65°C before develop
develop unexposed waffer in DS3000 @30°C --> fringes are gone after 3min5
```

OBS: In agreement with Helenes recommendation, I should now take 6min10sec as the nominal dev time.
I spin resists again on the same waffer.

```
heat the waffer at 110°C for 5min
spin AP3000 - 3" @ 1000rpm acc 300rpm/s; 60" @ 6000rpm ; bake 1' @ 110°C
spin BCB4024-40 - 5" @ 500rpm acc 250rpm/s; 60"@5000rpm ; bake 2'30 @90°C
expose four patterns: 50-71-93-115 mJ
develop in DS3000 @30°C for 6min. I observe that the fringes dissapear at
clean water DI
```

I cut the waffer, bake the half of each chip and look at SEM

resume4.jpg

resume5.jpg

These results are more consistent with the previous findings. The conclusion is that much care has to be taken in how long has been the resist out of the fridge. It is convenient to perform a test of an unexposed waffer (from which and approximative dev time can be obtained) and a litho test from which this time can be verified. Taking 2 times the time at which the interference fringes dissapear from the unexposed waffer seems to work quite fine.

Test spinning on BCB for third etape

lundi 18/01

I add more BCB from the fridge to the little bottle and let it thermalize.

On two standard Si/SiO2 500nm BCB-TEST1 and BCB-TEST2,

```
heat waffer at 110°C for 10 min
spin AP3000 - 3" @ 1000rpm acc 300rpm/s; 60" @ 6000rpm ; bake 1' @ 110°C
spin BCB4024-40 - 3" @ 1000rpm acc 300rpm/s; 60"@5000rpm ; bake 2'30 @90°
```

Not so many bubbles.

I test the development time of the complete waffer.

```
develop BCB-TEST1 in DS3000 at 30°C --> approx 1min 40sec
```

As the resist has been just taken out from the fridge, the time is like at the beginning of the tests (mardi 12/01);

```
expose BCB-TEST2 dose 71mJ (6.5 sec at 11mW) in vac contact
heat waffer at 65°C for 30sec previous to dev
develop in DS3000 @30°C for 3min30sec. I observe that the fringes dissape
clean water DI;
```

IMAGES

```
bake BCB-TEST2 for 1h at 200°C
```

Test LOR+AZ5214 for third step

jeudi 21/01

I want to test the litho process using LORXB +AZ5214E . We want to use it for the third step on our fab. We have some requirements: 1- it has to go up the BCB (max 4 microns) ; 2- we need good undercut since it is a lift-off process; 3- we need a good contact with the mask to define the motifs; 4- we need a development that does not damage the Al.

spinLOR.jpg

So, LOR5B is 500nm at 3000rpm and LOR20B is 2000nm; both are conformal which means that they follow the shape of what is below. This would mean that in one case we would have 500nm or 2000nm of LOR on top of the 4microns of BCB, respectively. AZ5214 is just 1.4 microns; I think it is better to test with LOR5B.

bakeLOR.jpg

With respect to the time and baking temperature(150-200°C), I think 170°C is reasonable (to get the largest undercurt in the shortest time) during 5min;

- On a standard Si/SiO2 500nm, which I call **LORAZ-T1**

```
bake wafer 5' @ 110°C (solvent evaporation)
spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C
Expo 31mJ/cm2 @ 365nm (2.8" @ 11mW), Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 27"
Dev MIF726 55" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

resume_litho1_55.jpg

It can be observed that some parts of the litho are gonne due to the strong undercut. Acording to the measurements, the undercut was about 5 microns. I observed that the resist was gonne after 30sec so in 25sec the undercut etch was then 5000nm/25s=200 nm/s (for a bake at 170deg C). I do 15 sec more to get a relative measurement

```
Dev MIF726 15" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

resume_litho1_55plus15.jpg

After 15 sec the undercut has changed from 5.5 to 8.9 micronsm thus 230nm/s which is consistent with the previous result.

```
Remov Remover PG @ 60°C for 30min, rinse ODI 60" beaker + 30" water tap
```

Restart --> **change bake Temp for LOR5B** (this is suppose to reduce the rate for the undercut)

```
bake wafer 5' @ 110°C (solvent evaporation)
spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 180°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C
Expo 31mJ/cm2 @ 365nm (2.8" @ 11mW), Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 27"
Dev MIF726 45" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

resume_litho2_45.jpg

Result: I observe that resist is gone after 30 sec of development; The undercut is between 1.3 and 2 microns. the rate is then approx 100nm/s. The line of the TL is still there. I do 10sec more to compare with before;

```
Dev MIF726 10" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

resume_litho2_45plus10.jpg

resume_litho2_45plus10b.jpg

Result: The rate is much slower;

- On a standard Si waffer, which I call **LORAZ-T2**

```
bake wafer 5' @ 110°C (solvent evaporation)
spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 180°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C
Expo 31mJ/cm2 @ 365nm (2.8" @ 11mW), Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 27"
Dev MIF726 40" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

resume_litho3_40.jpg

Here the undercut is very small, I could not measure it; It is maybe just the limit time to develop the AZ

resume_litho3_40b.jpg

venerdi 22/01

I reprocess both test waffers

- On **LORAZ-T1**

```
remove resist in Remover PG @ 60°C for 30min
```

- On a standard Si waffer, which I call **LORAZ-T2**

```
remove resist in Remover PG @ 60°C for 30min
```

- **Etching rate of Al in MIF-726**

Hélène did an ion millig test on a waffer with 100nm of Al. After the etching, Al is gone in the center of the waffer but remains on the edges. I cut some pieces of this waffer to check the etching rate of Al in the developper we are using for AZ5214 which is MIF726.

I obtain the series of times: 1'40" , 1'10", 2'05", 1'20",2'40", 2'30" depending on the width of the Al in the chips; if the longest time has 100nm, the rate is 0.6nm if not less, **rate <= 0.6nm/s**.

I want to do a test now of the lithography on Al and on BCB. I will prepare four waffers simultaneously: LARAZ-T1 and LORAZ-T2, a clean waffer with 100nm Al and BCB-TEST2.

- On **LORAZ-T1**

```
bake wafer 5' @ 110°C (solvent evaporation)
spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C
Expo 31mJ/cm2 @ 365nm (2.8" @ 11mW), Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 27"
Dev MIF726 35" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

resume-litho4b.jpg

Result: Litho is perfect, maybe to much undercut. In the other LORAZ-T2 I try just 30sec.

- On a standard Si waffer, which I call **LORAZ-T2**

```
bake wafer 5' @ 110°C (solvent evaporation)
spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C
Expo 31mJ/cm2 @ 365nm (2.8" @ 11mW), Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
```

Flood expo 27"
Dev MIF726 **30**" @ 19.0°C, rinse ODI 60" beaker + 30" water tap

resume-litho5.jpg

Result: This is the right time;

- On waffer with 100nm Al which I call **LORAZ-AL**

bake wafer 5' @ 110°C (solvent evaporation)
spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B **5min at 170°C**
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C
Expo 31mJ/cm2 @ 365nm (**2.8" @ 11mW**), Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 27"
Dev MIF726 **30**" @ 19.0°C, rinse ODI 60" beaker + 30" water tap

resum-lor-al-a.jpg

Result: The undercut is much smaller;

I decide to add 10" more to the development

Dev MIF726 10" @ 19.0°C, rinse ODI 60" beaker + 30" water tap

resum-lor-al-b.jpg

Some motifs are much better resolved. Why we need more dev?

- On **BCB-TEST2**

```
bake wafer 5' @ 110°C (solvent evaporation)
spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C
Expo 31mJ/cm2 @ 365nm (2.8" @ 11mW), Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 27"
Dev MIF726 30" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

resum-lorazBCB.jpg

Result: It is hard to say whether AZ is on top of BCB; it seems that the resine on top of BCB is more "weak" and leaves easily with the developer. That would indicate that the dose on top of BCB is not enough for a good reticulation and crosslinking. This has to be tested.

We decide to add 10" more to the development

```
Dev MIF726 10" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

The undercut in the Si part has increased a lot but we don't observe this undercut on top but on the contrary, just the fact that the pattern on top in larger than nominal.

We try another dose of flood exposure and 15 sec of dev

```
Flood expo 27"
Dev MIF726 15" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

resum-lorazBCB2.jpg

Result...

We observe then at the profilometer and observe two things: 1-LOR+AZ gives almost 2microns width which is as expected. 2- The profil of BCB is very extrange, like it had really spilled a lot. Which is not what I would expect according to the parameters.

```
remove resist in Remover PG @ 60°C for 30min
```

BCB does not seem to be damaged.

I check the profile in the stepmeter and got what was expected for the BCB. When we had done the same measurement but with the resine on top, the mountain was very extended and very tall, only 1.4 microns

lundi 25/01

I prapare three waffers with BCB to test the litho parametters in paralell with BCB-TEST2

- On **LORAZ-BCB1**

heat waffer at 110°C for 10 min
spin AP3000 - 3" @ 1000rpm acc 300rpm/s; 60" @ 6000rpm ; bake 1' @ 110°C
spin BCB4024-40 - 3" @ 1000rpm acc 300rpm/s; 60"@5000rpm ; bake 2'30 @90°
Flood expose dose 71mJ (6.5 sec at 11mW) in vac contact
bake for 1h at 200°C

spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C

Expo 4 times IEF mask: **31mJ/cm2 (2.8" @ 11mW) - 46mJ/cm2 (4.2" @ 11mW) - 62mJ/cm2 (5.6" @ 11mW) - 77mJ/cm2 (7.0" @ 11mW)** , Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 45"
Dev MIF726 **30"** @ 19.0°C, rinse ODI 60" beaker + 30" water tap

The pictures are organized from lower dose on top to higher dose in the bottom;

Left is 30sec develop and right is 30+10sec

resume-bcb1aa.jpg

resume-bcb1ba.jpg

resume-bcb1ab.jpg

resume-bcb1bb.jpg

This result indicates that a higher dose is necessary when there is BCB in the bottom; 5.6 s and 7.0 s give almost the same result. In addition, 30 sec seems reasonable.

- On **LORAZ-BCB2**

heat waffer at 110°C for 10 min
spin AP3000 - 3" @ 1000rpm acc 300rpm/s; 60" @ 6000rpm ; bake 1' @ 110°C
spin BCB4024-40 - 3" @ 1000rpm acc 300rpm/s; 60"@5000rpm ; bake 2'30 @90°
Flood expose dose 71mJ (6.5 sec at 11mW) in vac contact
bake for 1h at 200°C

spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C

- On **LORAZ-BCB3**

heat waffer at 110°C for 10 min
spin AP3000 - 3" @ 1000rpm acc 300rpm/s; 60" @ 6000rpm ; bake 1' @ 110°C
spin BCB4024-40 - 3" @ 1000rpm acc 300rpm/s; 60"@5000rpm ; bake 2'30 @90°
Flood expose dose 71mJ (6.5 sec at 11mW) in vac contact
heat waffer at 65°C for 30" previous dev
Dev DS3000 @31°C for 5min20"
bake for 1h at 200°C

spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C

Expo 4 times IEF mask: **31mJ/cm2 (2.8" @ 11mW) - 46mJ/cm2 (4.2" @ 11mW) - 62mJ/cm2 (5.6" @ 11mW) - 77mJ/cm2 (7.0" @ 11mW) ,** Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 45"
Dev MIF726 **30"** @ 19.0°C, rinse ODI 60" beaker + 30" water tap

The pictures are organized from lower dose on top to higher dose in the bottom;

Left is 30sec develop and right is 30+10sec

resume-lorazBCB3aa.jpg

resume-lorazBCB3ba.jpg

resume-lorazBCB3ab.jpg

resume-lorazBCB3bb.jpg

When the BCB has been developed and then baked, the previous result holds. A higher dose is still necessary and the same develp time leads to a similar result. I decided to use 7sec for the exposure and 30sec for the development.

- On **BCB-TEST2**

```
heat waffer at 110°C for 10 min
spin LOR5B (per 12/01/2014) 60" @ 3krpm
bake LOR5B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C

align and expo with dose 77mJ/cm2 (7.0" @ 11mW), Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 45"
Dev MIF726 30" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

Result is not as I expected...

resum-lorazBCB-litho2a.jpg

resum-lorazBCB-litho2b.jpg

resum-lorazBCB-litho2c.jpg

mardi 26/01

I prapare a test with LOR30B instead;

- On **LORAZ-30B**

```
heat waffer in hotplate at 120°C for 20min to eliminate solvants and wate
spin TI primer 60sec at 4000rpm
bake Ti primer at 120°C for 2min

spin LOR30B (per //) 60" @ 3krpm
bake LOR30B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C

Expo 62mJ/cm2 (5.6" @ 11mW) , Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 45"
Dev MIF726 30"+10"+45" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

Developement takes longer; LOR30B from Camille bottle maybe has some crystalized resine!!

resume-LOR30B.jpg

```
Remove remover PG @60°C for 30min
```

- On **BCB-TEST2**

```
Remove remover PG @60°C for 30min
heat waffer in hotplate at 120°C for 10min
spin TI primer 60sec at 4000rpm
bake Ti primer at 120°C for 2min
```

spin LOR30B (per //) 60" @ 3krpm
bake LOR30B 5min at 170°C
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C

Expo 62mJ/cm2 (5.6" @ 11mW) , Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 45"
Dev MIF726 **1min** @ 19.0°C, rinse ODI 60" beaker + 30" water tap

litho3_60sec_1.PNG

I was not well aligned... this will reflect after the lift

Evapotate 300nm Al @ 1nm/s in old evap

We cut a piece of the waffer to observe the undercut in SEM and we remove the resine for the rest

loraz_1.JPG

loraz_2.JPG

loraz_4.JPG

loraz_6.JPG

loraz_7.JPG

loraz_8.JPG

```
Lift-off resist in Remover PG @60°C for 1h+ultrasound (not a good idea)
```

mercredi 27/01

- On **PMGIAZ-T1 (standard non oxidized Si waffer)**

I prapare a test with PMGI -SF8 ; this resist is 1 micron width at 1000rpm (I will spin 3 times)

```
heat waffer in hotplate at 120°C for 20min to eliminate solvants and wate
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 215°C (in oven)
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 217°C
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
```

bake 5' @ 217°C
---After Check of profile in **ALTEST**
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 210°C
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 212°C
---After Check of profile in ALTEST
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 218°C
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 214°C
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 218°C

---
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C

- On **ALTEST- BPCd10**

heat waffer in hotplate at 120°C for 20min to eliminate solvants and wate
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 215°C
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 217°C
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 217°C

---Check profile in profilometer; There is still 1micron of heigh differe

spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 210°C
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 212°C

---check profile, now there is 0.5micron difference
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 218°C
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 218°C
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 1000rpm 60"
bake 5' @ 218°C

---check profile, **it seams very flat**

```
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C
```

The good news is that it is possible to planarize. The bad news is that it is very annoying to spin and bake 8 times. We have to get PMGI-SF11 or SF15. The other negative problem is that I had some cristalized ugly residues in the border of the waffer. I don't know the origin but I think it has to due with the oven.
Due to this border it was impossible to try the lithography so I decided to remove the resist in Remover PG

- On **PMGIAZ-T1**

```
Remove resist Remover PG @60°C + clean water
```

- On **ALTEST- BPCd10**

```
Remove resist Remover PG @60°C + clean water
```

When I was taking out the waffer from the water I accidentaly cleave it. So ..... I'm the king of fucking it up.-

Fabrication of wafer for junction ox and bilayer contact resistance tests

mardi 12/01

New wafer Si-P batch rho=1-10ohm.cm, 100nm oxide

expo with 2015-01_JJox + cap mask

- Negative resist :

```
bake wafer 1' @ 110°C (solvent evaporation)
spin AZ5214E (per 16/12/2014) 60" @ 4krpm
bake 1'30 @ 110°C
Expo 31mJ/cm2 @ 365nm (2.8" @ 11mW), Vacuum contact
bake 3' @ 120°C (=setpoint). (Increase time because resist perempted)
Flood expo 27"
Dev MIF726 50" @ 19.0°C, rinse ODI 60" beaker + 30" water tap
```

- Residue removal

```
1' ozone plasma @ 100W, 200µb
```

mercredi 13/01

- Evaporation Ti/Au

```
old plassys
5nm Ti @ 0.1 nm/s
50nm Au @ 1nm/s
```

- Lift warm aceton, 20min

perfect

- PMGI/PMMA Bilayer spin

```
bake 120°C 10'
spin TI prime @ 4000rpm 60"
bake 120°C 1'
spin PMGI SF8 (batch 12060407, exp. 7/1/2013) @ 3000rpm 60"
bake hot plate setpoint 180°C, 5', under beaker (measured: 159.6°C, same
spin PMMA A6 (batch 14020130, exp. 3/1/2015) @ 6000rpm 60"
bake hot plate setpoint 180°C, 15', under beaker
spin UV III (viven bottle) @ 4000rpm 60"
bake hot plate 140°C, 90"
```

- Dice on scriber

OK, only a few samples lost

Tests for making contact on oxidized Al layer

I take the same drawing that I will use for JJox tests. In the center I also put some dose tests for the junctions
JJox_mask-dose.jpg

WJOX1_1

vendredi 15/01

exp 30keV, 300µC/cm2
/!\ during expo, the SEM diffusion pump was making noise (shot noise)
dev standard for PMGI/PMMA bilayer (1'30 MIBK, 1' MIF 726)
WJOX1_1_dev-std.jpg

(NB: for this first chip, I forgot to put correct contact pads on the bottom JJ)

lundi 18/01

- evap 1st layer

```
Al 30nm @ 1nm/s, 0°
```

- oxidation

```
2h on hot plate 110°C under beaker
```

mardi 19/01

- etch + evap 2nd layer

```
etch 500V, 65mA, 2'
Al 50nm @ 1nm/s, 35°
```

- lift

```
30' in remover PG @ 60°C
3" US at the end, when the layer is fully lifted
```

WJOX1_1_sem.jpg

WJOX1_2

lundi 18/01

exp 30keV, 300µC/cm2
/!\ I waited for a quiet moment of the SEM diffusion pump to launch exposition

dev standard
WJOX1_2_dev-std.JPG

- evap 1st layer (old plassys)

```
Al 30nm @ 1nm/s, 0°
```

- oxidation

```
one night: from 16h on monday to 11h on tuesday
```

- etch + evap 2nd layer

```
no etch
Al 50nm @ 1nm/s, 35°
```

- lift

```
20' in remover PG @ 60°C
3" US at the end, when the layer is fully lifted
```

WJOX1_2_sem.jpg

WJOX1_3

lundi 18/01

exp 30keV, 300µC/cm2
/!\ I waited for a quiet moment of the SEM diffusion pump to launch exposition, but it turned back on during expo, close to the end; probably junctions were finished but not center patterns.
dev standard
WJOX1_3_dev-std.JPG

mardi 19/01

- clean resist residues

30" ozone plasma, 200µb (40cc O2), 100W

- evap two layers (new plassys)

Al 30nm @ 1nm/s, 0°
Al 50nm @ 1nm/s, 35°

- lift

20' in remover PG @ 60°C
3" US at the end, when the layer is fully lifted

WJOX1_3_sem.jpg

CONCLUSION OF WJOX1_1-2-3:
it seems that the etching damages a lot the mask, even the simple ozone plasma
Or maybe the litho is not reproducible
The noise on the pump might be affecting a bit the deposited dose (see comparison of pattern center 1 for WJOX1_2: dose OK and _3: underdosed)

WJOX1_4

mercredi 20/01

Design was sightly modified for the doses of the connecting pads, and the width of the island
Also, I added a new design to test junctions in line without having an overlap of the island

JJox_mask_dose_2016-01-20.jpg

JJox_mask_dose_zoom_2016-01-20.jpg

exp 30keV, 300µC/cm2
/!\ I waited for a quiet moment of the SEM diffusion pump to launch exposition
dev 30" in MIF726 instead of 1' -> undercut is ~1µm instead of 2µm

WJOX1_4_dev-30".JPG

NO CLEANING

- evap 1st layer (new plassys)

```
Al 30nm @ 1nm/s, 0°
```

jeudi 19/01

Oxidation 1 night (from 18h mercredi to 10h jeudi)

- etch + evap two layers (old plassys)

```
etch Ar: Vbeam= 532V, Vacc=32V, Ibeam = 5mA, P=3e-4mb, 50", 0°
Al 50nm @ 1nm/s, 35°
```

- lift

```
3h in remover PG @ 60°C
3" US at the end, when the layer is fully lifted
```

WJOX1_4_sem.jpg

WJOX1_5

mercredi 20/01

exp 30keV, 300µC/cm2
/!\ I waited for a quiet moment of the SEM diffusion pump to launch exposition, but some people were there and talked in the SEM room

dev 30" in MIF726 instead of 1' -> undercut is still ~1µm instead of 2µm
WJOX1_5_dev-30".JPG

jeudi 19/01

- evap 1st layer (new plassys)

```
Al 30nm @ 1nm/s, 0°
```

Oxidation from jeudi 11h to 17h

- etch + evap 2nd layers (old plassys)

```
etch Ar: Vbeam= 532V, Vacc=32V, Ibeam = 5mA, P=3e-4mb, 2', 0°
Al 50nm @ 1nm/s, 37° (should give ~25nm more displacement)
```

- lift

```
20' in remover PG @ 60°C
3" US at the end, when the layer is fully lifted
```

WJOX1_5_sem.JPG

WJOX1_6

Put the face to face junctions closer to each other
Modify design on B to make it less sensitive to ion etching -be sure that the connection

wire is still conducting
JJox_mask_dose_2016-01-26.jpg

NB: For _6 and _7, I made a mistake, the spacing was smaller (was 280nm on the left, and 330 on the right, I think)

mardi 26/01

- exp 30keV, 300µC/cm2

/!\ I waited for a quiet moment of the SEM diffusion pump to launch exposition,
The last 15 patterns are exposed with noise
dev 30" in MIF726

mercredi 27/01

- evap 1st layer (old plassys)

```
Al 30nm @ 1nm/s, 0°
```

- Oxidation from mercredi 12h to jeudi 16h

jeudi 28/01

- etch+ evap 2nd layer (old plassys)

20160128_wjox1_6.jpg

50nmAl_Al2O3_18'.JPG

```
etch: 532 Vbeam -32V acc, 5mA, 5'30
Al 50nm @ 1nm/s, +35°
```

- lift

```
1h in remover PG @ 60°C
3" US at the end, when the layer is fully lift
```

WJOX1_6_sem.jpg

The mask was badly injured by ion milling, but there remains on most patterns a gap, so the contact resistance can be measured. It seems that the Al layer was not etched away, even at tiny places (it could be that etching is more uniform than I feared)
Contact resistance is perfect. We could recover the same values as unoxidized chip (WJOX1_3)

WJOX1_7

mardi 26/01

- exp 30keV, 300µC/cm2

/!\ I waited for a quiet moment of the SEM diffusion pump to launch exposition,
All patterns are exposed during quiet time
dev 30" in MIF726

mercredi 27/01

- evap 1st layer (old plassys)

```
Al 30nm @ 1nm/s, 0°
```

- Oxidation from mercredi 12h to mardi 02/02 12h30
- etch + evap 2nd layer (new plassys)

```
etch 500V 130mA 1'20 (no spinning)
Al 50nm @ 1nm/s, 35°
```

Note that after etch, I notice the Al layer is transparent (either gone or oxidized)

- lift

```
15' in remover PG @ 60°C
5" US at the end -> small residues. Layer was not fully lifted, but I was
```

WJOX1_7_sem.JPG

The mask was badly injured by ion milling, but there remains a gap.
Contact resistance is >1GOhm on all!
Not enough milling, or too much???

WJOX1_8

mardi 20/01

- exp 30keV, 300µC/cm2

/!\ I waited for a quiet moment of the SEM diffusion pump to launch exposition,
Almost all patterns are exposed with noise
dev 30" in MIF726

mercredi 27/01

- evap 1st layer (old plassys)

```
Al 30nm @ 1nm/s, 0°
```

- Oxidation from mercredi 12h to mardi 02/02 16h30

- etch + evap 2nd layer (new plassys)

```
etch 500V 130mA 1'40 (no spinning)
Al 50nm @ 1nm/s, 35°
```

Note that after etch, I notice the Al layer is transparent (either gone or oxidized)
wjox1_8_etched.jpg

- lift

```
1h in remover PG @ 60°C
3" US at the end when layer is fully lifted
```

WJOX1_8_sem.JPG

probe station: Could get a perfect contact back!

WJOX1_9

This one is meant for determining if the etch is homogeneous, and if 1'40 is sufficient to take contact on the edge of the wafer

09/02

exp 30keV, 300µC/cm2
/!\ I waited for a quiet moment of the SEM diffusion pump to launch exposition,
But all patterns were exposed with noise
dev 30" in MIF726
WJOX1_9_dev-30".JPG

- evap 1st layer (old plassys)

```
Al 30nm @ 1nm/s, 0°
```

- Oxidation from mardi 09/02 15h to mercredi 24/02 15h
- etch + evap 2nd layer (new plassys)

wjox1_9_init.jpg

```
etch 500V 130mA 1'40 (spinning 16°/s)
Al 60nm @ 1nm/s, 35°
```

- lift (25/02)

```
20min in remover PG @ 60°C
3" US at the end when layer is fully lifted
```

WJOX1_9_sem.jpg

probe station: Could get a perfect contact back, even though the mask was not deformed!!

Summary

evap 1st layer: 30nm @ 0°
evap 2nd layer: 50nm @ 35°
etch process: 500V, 5mA in old evap -- 520V, 130mA, 16°/s planetary rotation in new evap
measurement setup: my own polar box, with different bias resistor to choose to limit current, and a convenient potentiometer to progressively apply bias.

sample	oxy (h)	etch time (s)	evap	R_A (Ω)	S_A 10^{-3}µm^2	nb sq A	R_B (Ω)	S_B 10^{-3}µm^2	nb sq B	R_C (Ω)	S_C 10^{-3}µm^2	nb sq C	R_D (Ω)	S_D 10^{-3}µm^2	nb sq D	average $R_{contact}$ (Ω*µm^2)	comment
WJOX1_2	15	0	old	**	19.6		**	20		**	141.4		**	55.4		**	
WJOX1_3	no	0	old	24.8	23.9		23.6	22		19.9	174.3		23.7	62.3		**1.5 +/- 1.37**	
WJOX1_4	15	50	old	**	7		**	8.2		**	126.4		**	41.2		**	side of ion beam
WJOX1_5	6	120	old	**	6.7		**	7.5		**	105.5		**	39.2		**	side of ion beam
WJOX1_6	28	330	old	67.8	18		16.5	10		43.7	73.5		3.3*	*		**1.5 +/- 1.5**	max of ion beam

sample	oxy (h)	etch time (s)	evap	R_A (Ω)	S_A $10^{-3}\mu m^2$	nb sq A	R_B (Ω)	S_B $10^{-3}\mu m^2$	nb sq B	R_C (Ω)	S_C $10^{-3}\mu m^2$	nb sq C	R_D (Ω)	S_D $10^{-3}\mu m^2$	nb sq D	average $R_{contact}$ ($\Omega*\mu m^2$)	comment
WJOX1_7	144	80	new	**	10.1		**	14.8		**	100.9		**	56.7		**	max of ion beam (center of plate)
WJOX1_8	148	100	new	5*	*		12.6	18.8		24	97.6		27.8	59.9		**1.4 +/- 1.07**	max of ion beam
WJOX1_9	360	100	new	90	1	21	56.7	1	17	59.3	111.1	18	74.2	40	18		edge of wafer

* Shorted on SEM
** OL on the 4W fluke (limited to 1GΩ). To be measured again, with high enough voltmeter internal impedance, and with higher bias resistance to make a proper division bridge.
*** Open on SEM
NB: for all before WJOX1_9 should revise the analysis accounting for number of squares and square resistance in series with the contact (if contact is perfect, what we measure should be the sheet resistance of the Al wire * number of squares).

discussion avec Marco sur les interfaces Al - métal noble:
facteur de stoner Pd : pair breaking important. bande d, paramagnons, susceptibilité magnétique non nulle. Etats dans le gap.
idem Pt.
Raisonnable d'estimer Tc avec toute la DOS de la bande d.
Al-Pd nanotubes. Avait l'air de garder Al supra. 5nm OK.
As: chauffe à 200-250°C dans evap, et s'en va. Utilisé pour protéger.