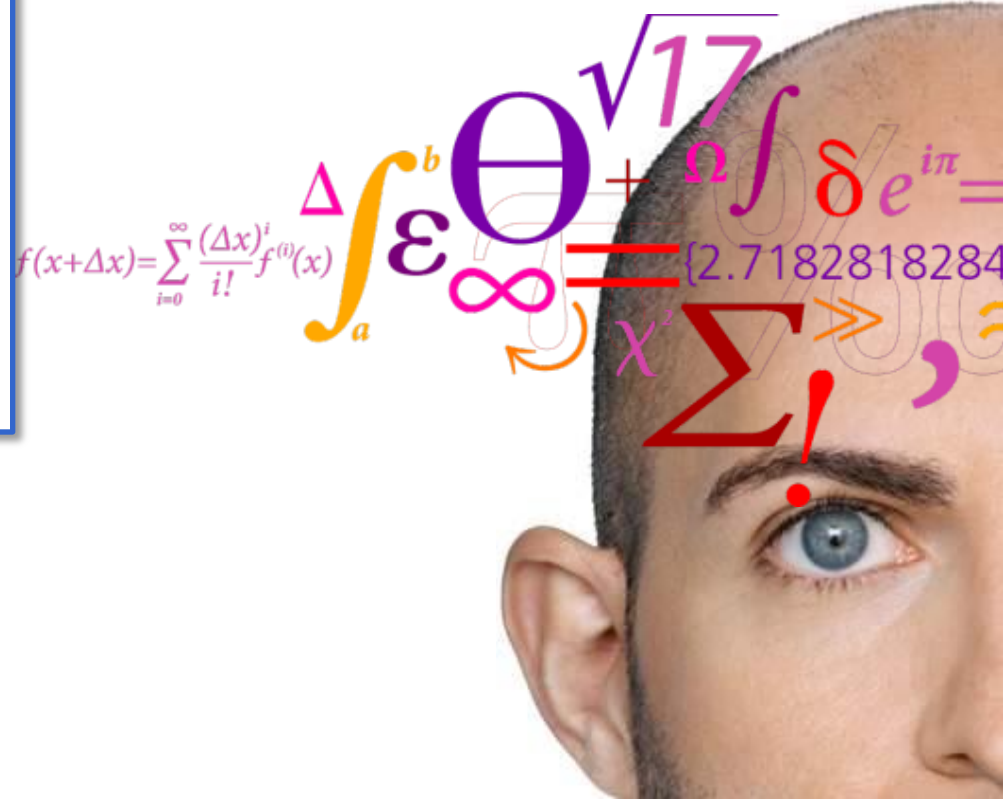


Danchip Cross Contamination System

Attribute-based cross contamination control

This slide show was used in connection with a presentation given at DTU Danchip in august 2014.

During the talk other presentation tools where used (drawings, online access) so it may not give a coherent view on the topic.



Outline

- How to access the Cross Contamination Sheet in LabManager
- Why care about cross contamination?
- The principle behind the Cross Contamination system.
 - An example
 - Details of the Cross Contamination sheet
- How to use the system in LabManager
- How does it affect my work in the clean room?
- Answer questions.

How to access the Cross Contamination Sheet in LabManager

- Go to the "Equipment Info" page
- Select the tool
- Click on the button "Cross Contamination Sheet"

The screenshot displays the 'LabManager for DTU Danchip & D' interface. At the top, there is a navigation bar with buttons for 'Front Page', 'Use equipment', 'Info', 'List', 'Change Status', 'Booking', 'Booking (New)', and 'Time'. Below this is the 'Equipment Info' section, which includes a search box for 'Equipment' and filter buttons for 'CEN (All)', 'DCH (All)', 'Last Used', and 'Last Used (Pr)'. The main content area is titled 'Properties for 0-TestTool' and contains a 'Go to' section with several buttons: 'Status Log', 'Service Log', 'Process Log', 'Usage Log', 'Error Log', 'Change Status', 'Cross Contamination Sheet', 'Edit', 'Accessories', and 'Edit Log parameters'. A red arrow points to the 'Cross Contamination Sheet' button. Below the 'Go to' section is a 'Documents' section.

Complexity

- We can do a lot of different things in the clean room
- We need to simplify
- So we have grouped things ...



4 Groups in the system

Substrate

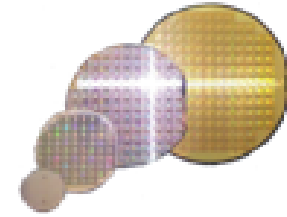
Film

Trace

Misc.

Substrate				Film				Trace				Misc.			
Substrate	In	+	Out -	Film	In	+	Out -	Trace	In	+	Out -	Misc	In	+	Out -
Clean	✓	-	-	Photoresist/polymer	✓	⚠ ₂	⚠ ₃	Photoresist/polymer traces	✓	+	-	Alkali traces	✓	-	-
III-V	✗	-	-	Aluminum	✓	-	-	Aluminum traces	✓	+	-	n++ predoped Si	✓	-	-
Glass Tg > 600C	✗	-	-	Chromium	✗	-	-	Chromium traces	✓	-	-	p++ predoped Si	✓	-	-
Polymer High Tg > 180C	⚠ ₁	-	-	Titanium	✗	-	-	Titanium traces	✓	-	-	BPSG	✓	-	-
Polymer Low Tg < 180C	✗	-	-	TitaniumSilicide	✗	-	-	TitaniumSilicide traces	✓	-	-	Bulk contamination	✓	⚠ ₄	-
Other substrates	✗	-	-	Type I	✗	-	-	Type I traces	✓	-	-	Graphene	✗	-	-
				Type II	✗	-	-	Type II traces	✓	-	-	Nanotubes	✗	-	-
				Type III	✗	-	-	Type III traces	✓	-	-	Dust	✗	-	-
				Type IV	✗	-	-	Type IV traces	✗	-	-	KOH etch residuals	✓	-	-

Handouts !



The substrate (Group 1/4)

The substrate type is characterized by the material characteristics of the given sample.



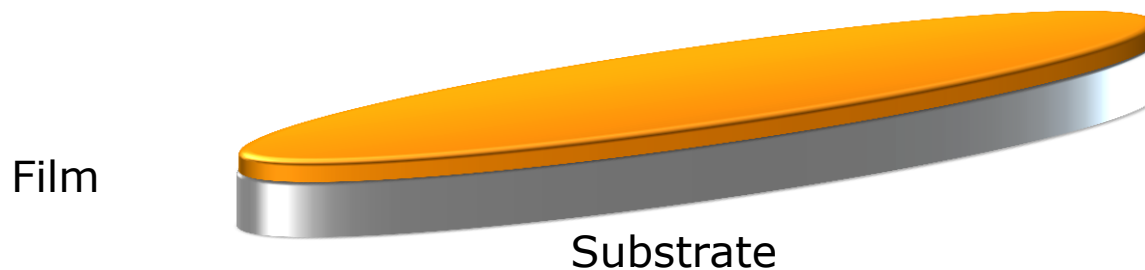
Substrate



Film (Group 2/4)

A film type is characterized by the material characteristics of any films on the given sample.

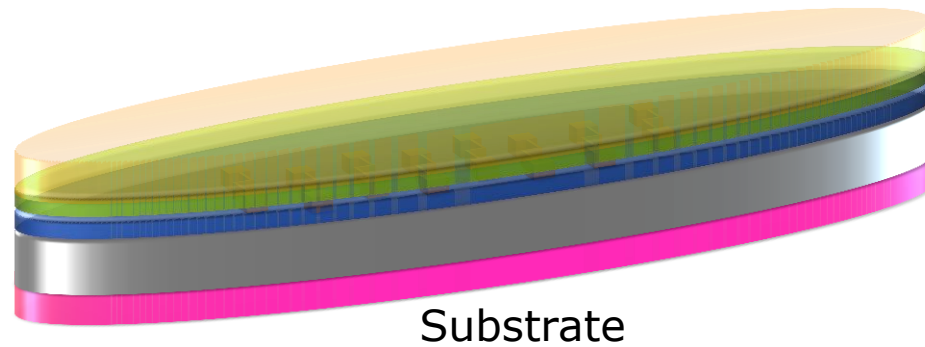
A film need not be complete, a part does however need to be more than one atom thick and several nm wide in the plane – if it can be seen in a SEM it is probably a film – if it can be seen in a microscope it is definitely a film

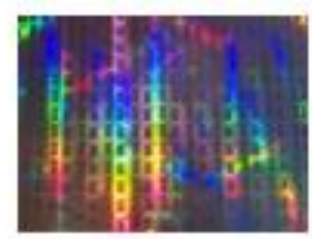




There can be more than one film

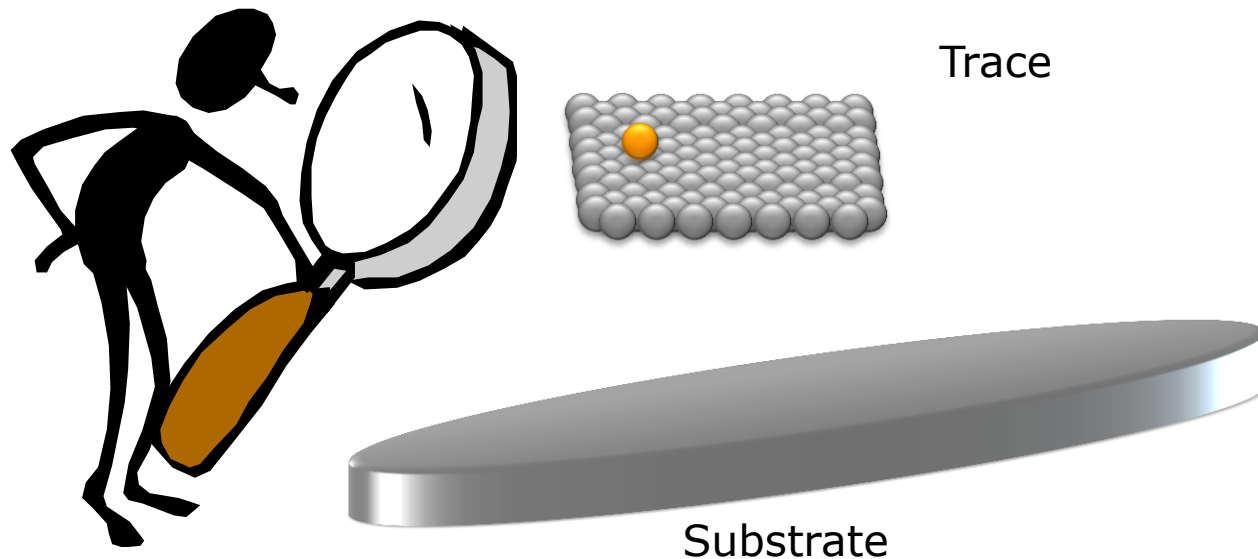
- Film 4
- Film 3
- Film 2
- Film 1
- Film 5

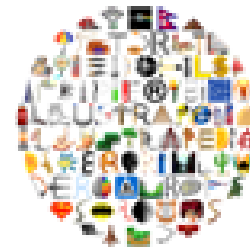




Trace (Group 3/4)

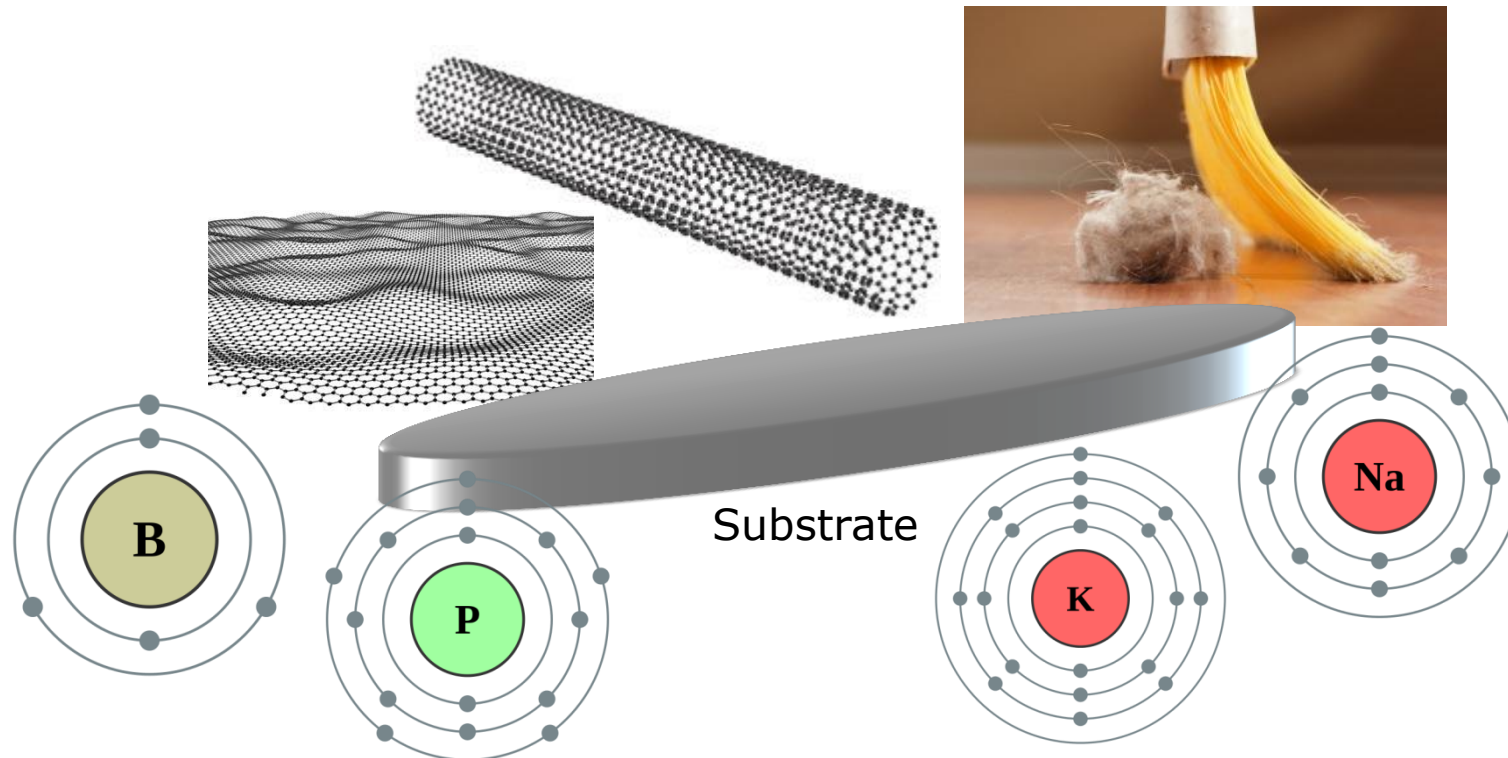
A trace type is characterized by the material characteristics of any material found in low concentrations on the given sample.





Misc (Group 4/4)

Misc is a dimension used for contaminants which didn't fit in the other categories



Many different attributes

Substrate			Film			Trace			Misc					
In	+ Out	-	In	+ Out	-	In	+ Out	-	In	+ Out	-			
Clean	✓	-	-	Photoresist/polymer	✓	⚠ ₂	⚠ ₃	Photoresist/polymer traces	✓	+	Alkali traces	✓	-	-
III-V	✗	-	-	Aluminum	✓	-	-	Aluminum traces	✓	+	n++ predoped Si	✓	-	-
Glass Tg > 600C	✗	-	-	Chromium	✗	-	-	Chromium traces	✓	-	p++ predoped Si	✓	-	-
Polymer High Tg > 180C	⚠ ₁	-	-	Titanium	✗	-	-	Titanium traces	✓	-	BPSG	✓	-	-
Polymer Low Tg < 180C	✗	-	-	TitaniumSilicide	✗	-	-	TitaniumSilicide traces	✓	-	Bulk contamination	✓	⚠ ₄	-
Other substrates	✗	-	-	Type I	✗	-	-	Type I traces	✓	-	Graphene	✗	-	-
				Type II	✗	-	-	Type II traces	✓	-	Nanotubes	✗	-	-
				Type III	✗	-	-	Type III traces	✓	-	Dust	✗	-	-
				Type IV	✗	-	-	Type IV traces	✗	-	KOH etch residuals	✓	-	-

Explanations:
 ✓ ALLOW
 ✗ PROHIBIT
 + ADD
 - REMOVE
 ⚠ PROCESS/SAMPLE DEPENDENT

Note Text	
1	use carrier
2	special recipes - ask for advice
3	Long O2 plasma cleaning required
4	Metal exposed to plasma will give bulk contamination



Attribute	Details
Clean	Fused silica, Sapphire, SiC, Silicon, {supplied by Danchip}
Glass Tg > 600C	Borofloat, LithiumNiobate, Microscope slides
III-V	GaAs, GaN, InP, with epitaxial layers
Other substrates	Copper, Steel
Photoresist/polymer	if in doubt, ask Danchip Customer Support
Type I	Mo, Nb, Ta, W
Type II	As, C, Ga, In, Mg, P, Sb, Zn
Type III	Ag, Au, Cu, Fe, Ge, Ir, Mn, Ni, Pd, Pt, Sn, V
Type IV	Pb, Te

How it looks for the ASE



Labmanager name

ASE

e-mail to

dryetch@danchip.dtu.dk

Room

B-1

Responsible group

Dry Etch

Labmanager ID

3.002

27-Aug-2014 15:39

Substrate				Film				Trace				Misc.			
Substrate	In	+ Out	-	Film	In	+ Out	-	Trace	In	+ Out	-	Misc	In	+ Out	-
Clean	✓	-	-	Photoresist/polymer	✓	⚠ ₂	⚠ ₃	Photoresist/polymer traces	✓	+	-	Alkali traces	✓	-	-
III-V	✗	-	-	Aluminum	✓	-	-	Aluminum traces	✓	+	-	n++ predoped Si	✓	-	-
Glass Tg > 600C	✗	-	-	Chromium	✗	-	-	Chromium traces	✓	-	-	p++ predoped Si	✓	-	-
Polymer High Tg > 180C	⚠ ₁	-	-	Titanium	✗	-	-	Titanium traces	✓	-	-	BPSG	✓	-	-
Polymer Low Tg < 180C	✗	-	-	TitaniumSilicide	✗	-	-	TitaniumSilicide traces	✓	-	-	Bulk contamination	✓	⚠ ₄	-
Other substrates	✗	-	-	Type I	✗	-	-	Type I traces	✓	-	-	Graphene	✗	-	-
				Type II	✗	-	-	Type II traces	✓	-	-	Nanotubes	✗	-	-
				Type III	✗	-	-	Type III traces	✓	-	-	Dust	✗	-	-
				Type IV	✗	-	-	Type IV traces	✗	-	-	KOH etch residuals	✓	-	-

Explanations:

✓ ALLOW

✗ PROHIBIT

+

- REMOVE

⚠ PROCESS/SAMPLE DEPENDENT

Note Text

1	use carrier
2	special recipes - ask for advice
3	Long O2 plasma cleaning required
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Attribute

Details



Clean	Fused silica, Sapphire, SiC, Silicon, {supplied by Danchip}
Glass Tg > 600C	Borofloat, LithiumNiobate, Microscope slides
III-V	GaAs, GaN, InP, with epitaxial layers
Other substrates	Copper, Steel
Photoresist/polymer	if in doubt, ask Danchip Customer Support
Type I	Mo, Nb, Ta, W
Type II	As, C, Ga, In, Mg, P, Sb, Zn
Type III	Ag, Au, Cu, Fe, Ge, Ir, Mn, Ni, Pd, Pt, Sn, V
Type IV	Pb, Te



You gotta ask yourself...

- Is a sample with this particular attribute allowed in the tool?
(Allow/Prohibit)  
- Does the tool contaminate the sample with this particular attribute, when a sample is processed using the tool in its intended way? (Add) 
- Does the tool remove all of this particular contamination from the sample, when a sample is processed using the tool in its intended way? (Remove) 
- Always consider the tool to be working and used correctly by a skilled user where a meaningful process has run to completion.
- These are not legal documents – it is an attempt to preserve our tools in known states.

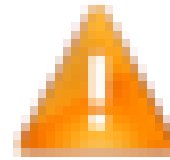
Add/remove are not really symmetric

-  **Add (add any):** if the sample becomes contaminated with some of this attribute contamination, the tool adds this attribute
-  **Remove (remove all):** if the sample is cleaned of all contamination of this attribute, then the tool "removes" this attribute

If the attribute is added to some part of the wafer the whole wafer has the attribute

Only when every part of the attribute contamination is no longer on the sample after the process, it is considered removed

And now a little more complication



In some cases things are unfortunately not so simple and the decision is dependent on the particular process done in the machine.

You can for example deposit many kind of metal films in the Alcatel. So whether you add an aluminum or gold film to your sample depends on the particular process you run.



Process/sample dependent: can be set for both in-going and out-going properties i.e. allow/prohibit, add and remove cases