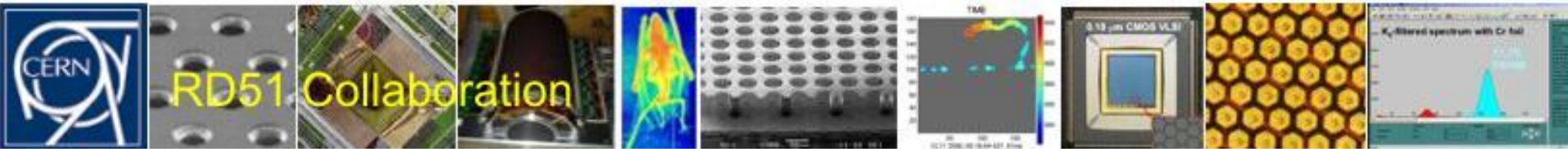


THGEM-process

Rui De Oliveira

RD51 22/11/2011

WG6

THGEM PROCESS STEP BY STEP

- *Base material selection*
- *Drilling*
- *De-smearing*
- *Brushing*
- *Micro etching*
- *Curing*
- *Soft de-smearing*
- *Cleaning*
- *Testing*

- ***Base material***
- *Drilling*
- *De-smearing*
- *Brushing*
- *Micro etching*
- *Curing*
- *Soft de-smearing*
- *Cleaning*
- *Testing*

-Any base material can be used

-The technical reasons for a particular choice are not yet clear

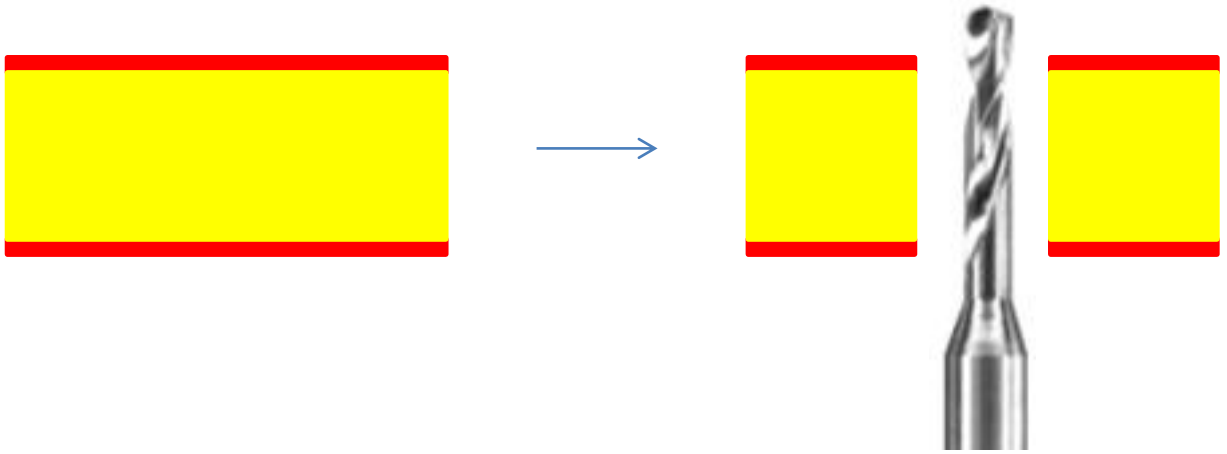
-At CERN we have imposed ISOLA DE156 (halogen free)

-The copper thickness should be at least 2 times larger than the RIM

-Other possible Base material :

- **-Glass epoxy**
- **-Glass Polyimide**
- **-Glass Teflon**
- **-Pure polyimide**
- **-Ceramic Teflon**
- **-Poly-aramid epoxy**

- *Base material*
- ***Drilling***
- *De-smearing*
- *Brushing*
- *Micro etching*
- *Curing*
- *Soft de-smearing*
- *Cleaning*
- *Testing*



-All the parameters from drill supplier should be respected:

-Spindle speed

-Z axis speed

-Max hole count per drill bit

-Correct entry and output foils/boards should be selected

-Avoid stack drilling

- *Base material*
- *Drilling*
- ***De-smearing***
- *Brushing*
- *Micro etching*
- *Curing*
- *Soft de-smearing*
- *Cleaning*
- *Testing*

-This step is needed to remove thin layers of epoxy deposited on copper edges during drilling escape

-6 baths are needed:

sweller (60deg, 6 min)
DI water rinse
potassium permanganate (200gr/l @80deg, 10min)
DI water rinse
neutralizer(H_2O_2 + H_2SO_4)
DI water rinse

- This process can be replaced by a plasma treatment

Do not start to play with chemistry if you are not a chemist
DI water : 10Mohms

- *Base material*
- *Drilling*
- *De-smearing*
- ***Brushing***
- *Micro etching*
- *Curing*
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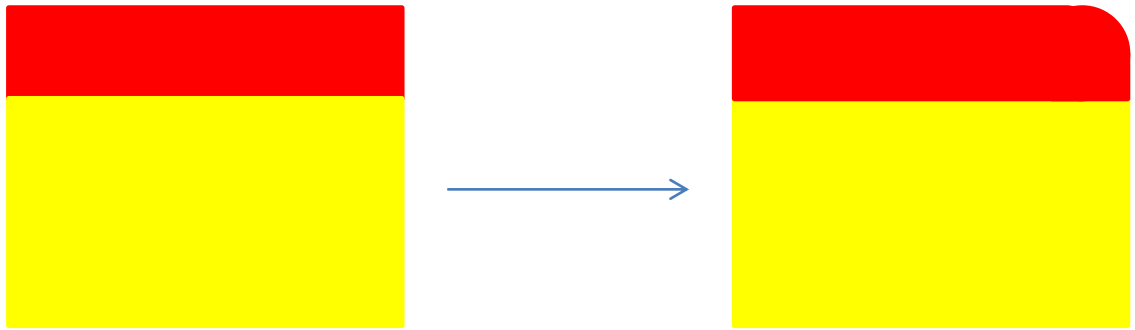

-This step is needed to round the edges of the metal

-At CERN we use a conventional brushing machine .

- we brush the pieces in the 4 directions

-many times till we see clearly the rounding effect

- The abrasive agent is neutral pumice

- *Base material*
- *Drilling*
- *De-smearing*
- *Brushing*
- ***Micro etching***
- *Curing*
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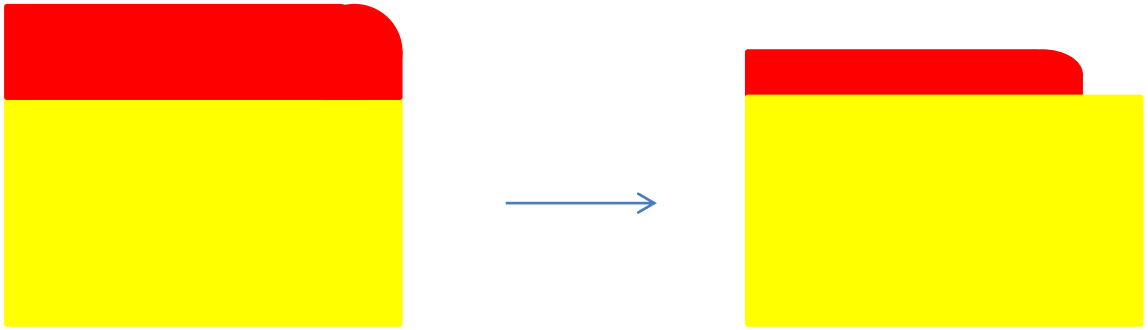
- *Cleaning*
- *Testing*



-This step is needed to reduce the copper thickness and create the rim

-Different chemistries can be used

-Ammonium persulfate (Rim up to 40um)
-Chromic Acid (Rim up to 10um)
-Ferric perchloride (Rim up to 100um)

-This step could be performed in a dead bath with lateral agitation

-The piece should be inspected during the process to reach the desired value

- *Base material*
- *Drilling*
- *De-smearing*
- *Brushing*
- *Micro etching*
- ***Curing***
- *Soft de-smearing*
- *Cleaning*
- *Testing*

-A lot of base material are not fully polymerized

-To complete this curing :

180 deg in air during 3 hours

curing horizontally or vertically

- *Base material*
- *Drilling*
- *De-smearing*
- *Brushing*
- *Micro etching*
- *Curing*
- ***Soft de-smearing***
- *Cleaning*
- *Testing*

-This step is needed to remove a thin layer of epoxy exposed to chemistries in the holes during precedent processes

-4 steps are needed:

High pressure DI water rinse
potassium permanganate dip (200gr/l @60deg, 3min)
DI water rinse
neutralizer dip (H_2O_2 + H_2SO_4)
High pressure DI water rinse

- This process can also be replaced by a plasma treatment

Do not start to play with chemistry if you are not a chemist
DI water: 10 Mohms

- *Base material*
- *Drilling*
- *De-smearing*
- *Brushing*
- *Micro etching*
- *Curing*
- *Soft de-smearing*
- ***Cleaning***
- *Testing*

-This step is needed to passivate the copper

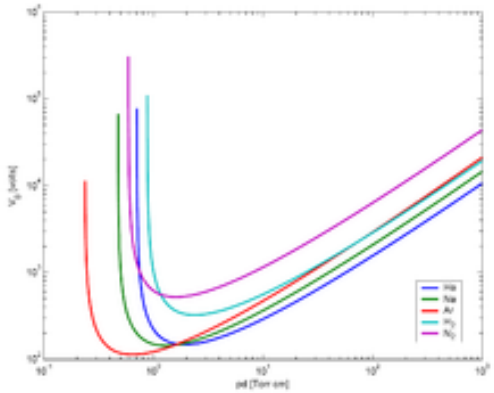
-3 steps are needed:

High pressure DI water rinse
Chromic acid dip (30sec)
High pressure DI water rinse

-Drying @ 100deg during 1h

-If an oxide grows during drying , repeat the above steps

- *Base material*
- *Drilling*
- *De-smearing*
- *Brushing*
- *Micro etching*
- *Curing*
- *Soft de-smearing*
- *Cleaning*
- ***Testing***



-**2 parameters to measure:**

-sparking voltage → should follow Pashen curves
the rim should be taken in account

-leakage current @ 90% of the sparking voltage
should be smaller than 10nA in air @ 35% RH

-The sample should stabilized at room temp at least 1 h before testing

Thank you