

GEM FOIL DEVELOPMENT AT ECIL

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ECIL, a Public Enterprise under the Department of Atomic Energy, is a multi-product, multi-disciplinary and multi-technology organization providing technology solutions to the strategic users in Defence, Atomic Energy, Aerospace, Electronic Security, IT & e-Governance.



A Brief Tour of the PCB Facility at ECIL

CAD Center

CAD tools : CADSTAR ver.
8.0

Analysis tools: Hyper Lynx
SI, Quiet Expert
(EMI/EMC) , Hyper Lynx
Thermal



High Resolution
Photo plotter
Model. RP725 DL

CNC Drilling

M/s POSALUX



Direct Metallization



- Pre cleaning
- Swill
- Conductive graphite coating
- Fixing
- Drying
- Inspection
- Microetch
- Anti tarnish
- Drying

Imaging or Photo Printing M/s ALTIX



Developing Machine - M/s SCHMID



Chemical Cleaning Machine – M/s. SCHMID



Multi Layer Vacuum Lamination Press - M/s. BURKLE



Post Etch Punch System - M/s. Billows Protocol



AOI - Automatic Optical Inspection (Inner Layer Inspection)



Automatic Pattern Plating of Copper/Tin (Reverse Pulse Plating) – M/s. PAL



SES line (Strip, Etch, Strip) - M/s. SCHMID



Solder Masking Process



Electroless Nickel Immersion Gold - M/s. PAL



Hot Air Solder Leveling



Flying Probe Tester – M/s. ATG



Micro-Sectioning Equipment M/s. BUEHLER



GEM Foil Etching

Double mask procedure:

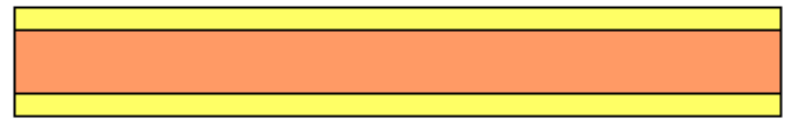
- Suitable up to $\sim 30 \times 30$ cms GEM foils.
- For larger sizes, mask alignment is an issue

Single mask procedure:

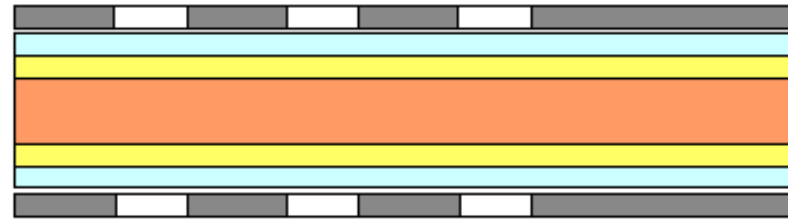
- Suitable for larger sizes
- More process steps

Double Mask Procedure

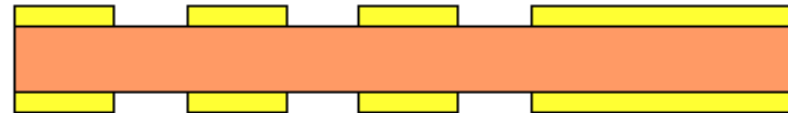
Raw material - 50 micron polyimide with 5 micron copper on both sides



20μ photoresist coating, masking and UV exposure



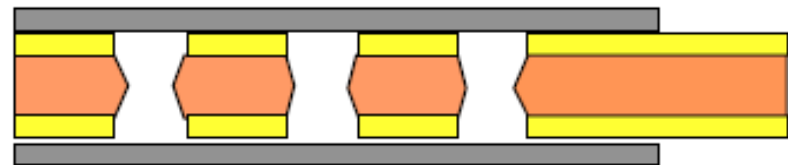
Copper etching



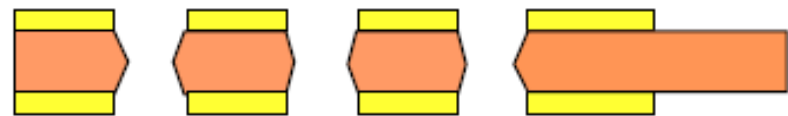
Polyimide etching with special chemistry



Second masking
(to generate borders and HV connection tails)



Copper etching and cleaning



Single Mask Procedure

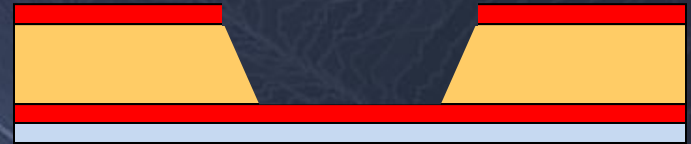
Raw material: 50 μ m polyimide foil , 5 μ m
Copper clad on both sides



Photoresist coating, single mask and UV
exposure



Hole is opened with top side metal
etching and polyimide etching



Bottom side metal etching. Top
side metal is preserved with
Cathodic Protection technique



Back to polyimide etching for a few
secs to get cylindrical shaped hole



Final quick metal etching to
form the rim



GEM foil development Status at ECIL

- Though the development intention was shown more than a year back, we could not devote much time due to other delivery schedules and constraints
- However we revived interest and started trial runs for double mask foils.
- After tuning our process parameters, we could achieve double conical holes in the polyimide with clean copper apertures (though with visible defects at some places).
- Sample double mask GEMs (10 x 10 cms) will be sent to VECC for testing in about 2-3 weeks time.
- Single mask trials will start soon in a months time.

Trial GEM foils made at ECIL



Needs further improvement on hole profile and defects

Additional equipment procurement

Present equipment is good enough for GEM foils up to 30 x 30 cms. For larger foils some additional equipment procurement is planned

	Equipment	Procurement Status
1	400X-USB microscope (5mp)	Ordered (Dino-lite AM7013MZT4)
2	CAEN N1471A HV module	Will be procured before march 2015
3	Laminar flow work tables	Will be procured before march 2015
4	Photoresist laminator (dedicated to GEM use))	Will be procured before march 2015
5	Large area collimated UV exposure unit	Will be procured in 2015
6	Stainless steel/PP tanks (vertical)	Will be procured in 2015

Raw material (polyimide) procurement may still be an issue

GEM foil development at ECIL

Backup slides

Cathodic Protection

