GEM R&D from Chinese groups

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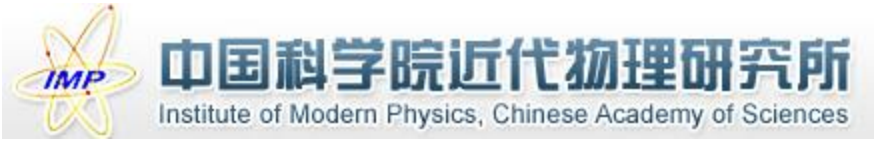
Five Chinese Groups

China Institute of Atomic Energy (CIAE)

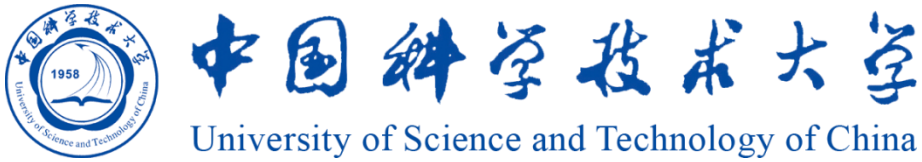
Lanzhou University

Institute of Modern physics



Tsinghua University

University of Science and Technology of China (USTC)



Fund application for SoLID GEM construction

- Didn’t apply for the “973” project this year
  →resume the application next year(zhengguo zhao)
- GEM R&D fund application is ongoing
  →got a lot of support from inside of each institute

中国科学技术大学

University of Science and Technology of China

Activities at USTC

- 6 30cmx30cm GEM foils in hand
- Design of the chamber is finished
- All the devices for assembling the 30cmx30cm chamber are ready
- Stretching the foil at USTC by using NS2 Technology

Fund issues(2013) and manpower at USTC

- Total: 0.8M+0.3M(pending) RMB
  - R&D of Large Area GEM Detector, From NSFC, 300K RMB, Approved
  - Prototype Construction for the 30cmX30cm Large area GEM Detector, From USTC, 300K RMB, Approved
  - Internal Support for the large area GEM project, From State key Laboratory of Particle Detection and Electronics,200K RMB, Approved
  - R&D of Large Area GEM Detector Based on NS2 Technology, From State key Laboratory of Particle Detection and Electronics, 300K RMB, Waiting for approving
- 1 post-doctor and 2 PhD students


IAE
中國原子能科學研究院
China Institute of Atomic Energy

Activities at CIAE

- Interested in GEM foil manufacture
- Finished the training session on how to make the GEM foil at CERN
- Built up a clean room at CIAE for the GEM foil R&D
- PCB factory in Beijing is ready to receive the technology transformation from CERN

Lamination and exposure of dry film photoresist

For large area GEM foil, we will use single mask.

1 -**Photoresist lamination**:

• Clean room is needed.

• The photo-polymerisable resist is sandwiched between an inner polyolefin cover sheet and an outer Mylar protective layer.

•Using a Hot Roll Lamination (HRL) machine, the GEM substrate is laminated by photoresist.

2 - **Exposition**:

• We use negative photoresist for GEM image transfer, unexposed areas are relatively unchanged and easily washed out by solvents during the development.

•To obtain an identical copy of the photo-mask to the photoresist, vertical sidewalls in the resist are important.

Copper and polyimide film etching

3-Top copper etching:

• The solution used to copper etching consists of water, ferric chloride and hydrochloric acid.

•Generally the holes in the resist of standard GEMs are 50 µm of diameter. The favored diameter of holes at copper layer is 70 µm with a pitch of 140 µm.

4-Photoresist removal

5-Polyimide film etching:

• The patterned copper layer provides the mask to etch the holes in polyimide film, taking advantage of the chemical etchability of polyimide.

•The baths for the polyimide etching are composed of isotropic and anisotropic etching constituents.

6-Bottom copper etching:

•Etching from the top, using the holes in the polyimide as mask

Final cleaning and test

7-Final cleaning and chrome coating :

• A high pH bath is used to remove grease or organic deposits.

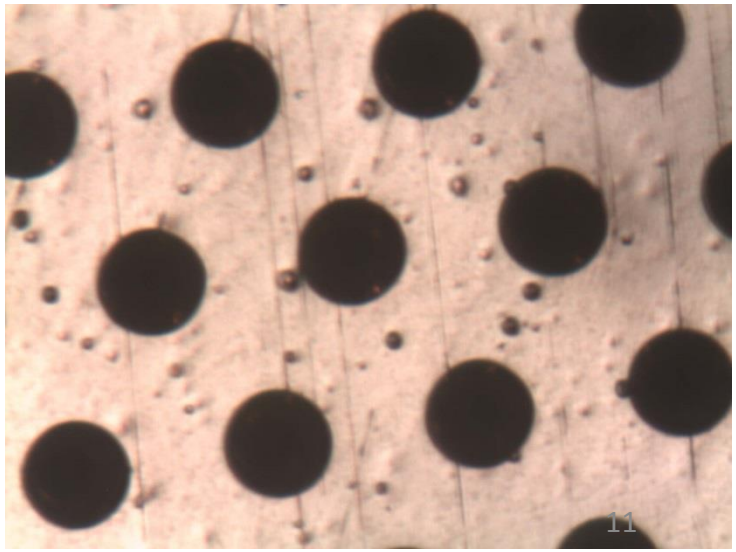
• A bath with sulphuric acid is used to neutralize the strong base of the former bath, reducing the permanganate.

• chrome coating.

Test

• Visible test

• Electrical test



Fund issues and man power at CIAE

- Start Fund form CIAE is used to build the new clean room and order the training session at CERN
- Applying for the funding from NSFC
- 2 students at CIAE
- 5 technicians from the PCB factory

清華大學

Tsinghua University

GEM Status at Tsinghua

- → **VME-Based DAQ with multi ADC modules developed in the last three months.**
- → **Detector activities restarted on Feb. 26, marked by large GEM arrival (45cm *45 cm). It is then shipped to the detector lab in IMP for assembling.**
- → **Readout board and gas vessel being under design, we expect the detector to be assembled in two months.**

Fund issues at Tsinghua

- Large area GEM R&D: fund from Tsinghua