Progress of Making RPCs

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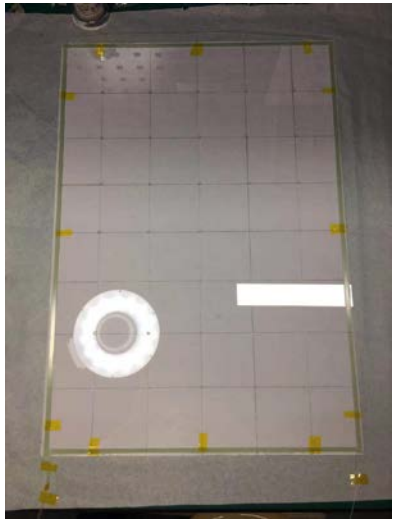
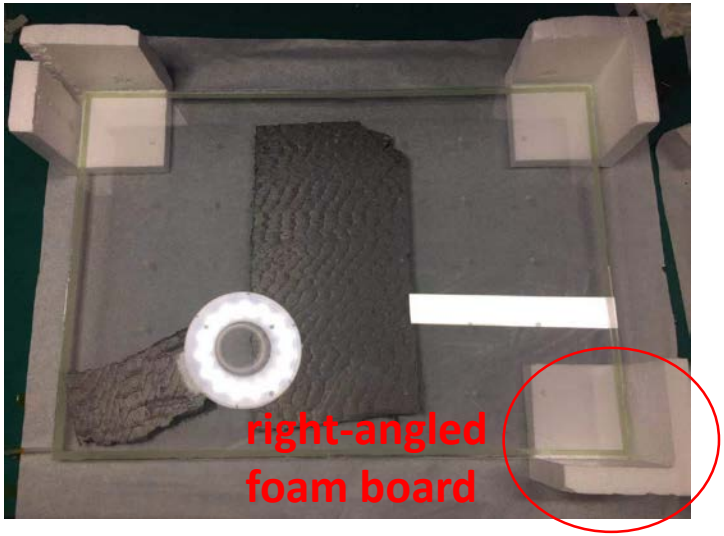
Outline

- Optimization of making bigger RPCs
- Showing silk screen printing
- Testing the graphite ratio
- Summary & Next plans

Optimizations of processes





Simple tricks:

- Made 35cm*50cm gas gap. After fixing the edge strip with tape(yellow part), then apply the glue.
- Use four right-angled foam boards to secure the upper and lower glass sheets.
- HOW to flip the gas chamber more conveniently for the glue???——Problem

- Set three pipes as the outlet from Lyon's group, five pipes of the outlet for bigger RPC 1m*2m.

(**Decrease the inner pressure**)

- Put one pipe to the inlet

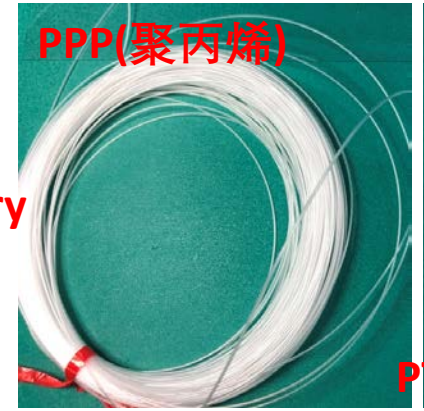
Optimizations of processes

Use these spacers with thickness more precise

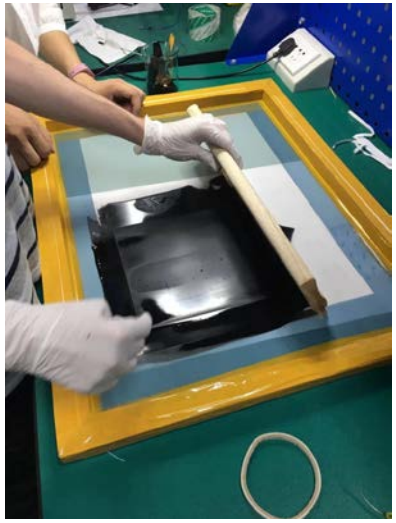
- Size: 4mm*8mm*1.2mm with **±0.02mm**, the tolerance always **less than 0.05mm**
- Wall: FR4 material's thickness **1.2mm with positive tolerance**, a little thicker than spacers and different thickness everywhere! (Previous company is not serious, then NEED to find one better factory making FR4, 1000*40*1.2mm^3)

Use these pipes with outer diameter more precise

- Size: 0.8mm*1.2mm with diameter **±0.02mm**
- **Old:** PTFE material(**soft, mainly for hospital,very weak and easy to break!!!**)
- **New:** PPP material(**hard, suitable for nozzles!**)



Silk screen printing


Test the graphite on 20cm*20cm glass

Use silk screen printing method for coating which is similar to printing a pattern onto clothes.

Frame size: 68cm*53cm **Effective area**: 50cm*35cm (RPC size)

Firstly testing the method with 20cm*20cm glass,

- **Easy way for graphite coating, very convenient and efficient!!!**
- **Better than spraying with air-compressed method in terms of process (very promising way)**

- Hair dryer moving by hand to bake the coating(**bad!!!**) (**10 mins,not uniform**)
- Find one lamp for baking the coating (**170℃, uniform**)

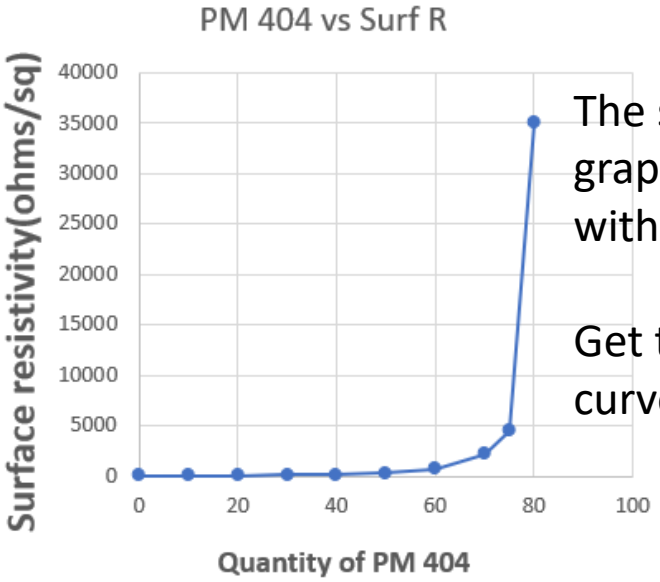
Test graphite mixture ratio

Electrical Properties **From PM-404-EN.pdf**

Sheet Resistivity

Blending ratios of Electrodag™ PM-404™ and Electrodag® 6017SS™, Dried 5 minutes @ 120°C, ohms/sq

Electrodag™ 6017SS™ (% by weight)	Electrodag™ PM-404 (% by weight)	@ 25µm dry coating thickness
100	0	35
90	10	50
80	20	70
70	30	105
60	40	170
50	50	290
40	60	675
30	70	2160
25	75	4500
20	80	35,000
10	90	> 1e9



The surface resistivity of graphite layer increases with PM 404 increasing

Get the ratio through fitting curve and test in the next.

Use silk screen printing method for coating and test with 20cm*20cm glass,

Test configuration: (from Bin)

17g(85%) PM404 & 3g(15%) EDAG 6017SS

Surface resistivity is mainly concentrated in around **50-70MOhm (much larger!!! than Lyon's group 1-2MOhm/□) NEED more trials!!!**

Graphite layer analysis

Graphite ratio depends **on humidity, temperature** etc. (From Imad)
Lyon also has lots of experiments for best ratio.
Layer thickness is less than 10microns**, very thin**. ——300目 silk screen

Next test the graphite ratio from different conditions in order to get the best ratio, taking influence factors into consideration

The reasons of the graphite splitting(**bad adhesion**):

- **Bake fast(10mins) and nonuniformly, just surface drying , not inside. Left the layer all night, then split in the second day.**
- **temperature for hair dryer is not far from enough,** (products require baking at around 170℃ to attain a stable surface resistivity. From Lyon's group)

Summary & Next plans

- ✓ Bigger RPC construction(DONE three RPCs)
- ✓ Screen printing method was used to make graphite layer for the first time,

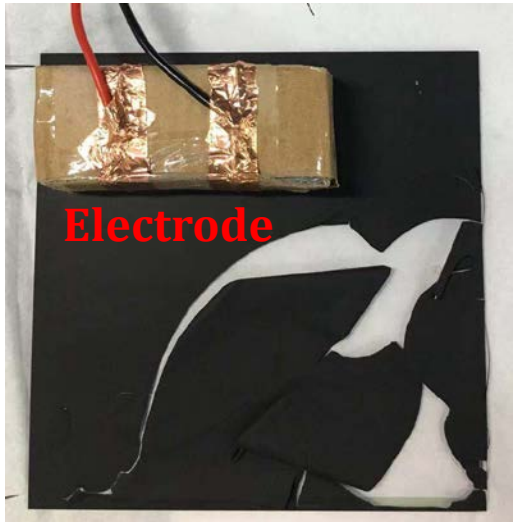
  17g(85%) PM404 & 3g(15%) EDAG 6017SS and tested the coating
- ✓ Optimize the RPC production process

Next plans

- ☐ Test different graphite ratio for the optimal proportion with best surface resistivity and consider the influence of other factors such as temperature, humidity etc.
- ☐ Optimize the silk screen printing method for safety.(including mask and protection suit)
- ☐ Attempt to find better way to wash the Silk Screen Board.

Thanks!

Test graphite mixture ratio



Use the DIY simple electrode to roughly test graphite layer surface resistivity through multimeter