

Design and test UHV printer for writing electrode field metal method

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① current work

② summary

difficulties

analysis

solutions

outcomes

plan

2 summary

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- ② summary

difficulties

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- The ratio pressure valve can't output a stable pressure.
- many device can't be fixed easily in the glove box

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analysis

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- The low viscosity may caused by the absence of the oxide layer on the surface of the field metal.
- other problems are technique problems.

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solutions

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- to solve the low viscosity problems, we try to low the temperature of the field metal to increase the viscosity.
- because of the unstable problem of the pressure valve ,I gave up the pressure valve and use the pressure provided by the lab instead.

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golden surface

we didn't observe the obvious difference between the golden surface and the silicon surface.

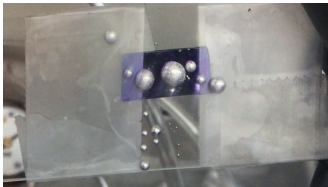


图 2: silicon substrate

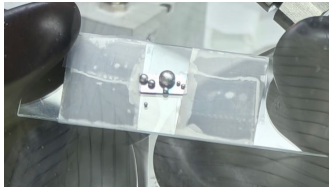


图 3: golden surface

Besides, in the experiment I found that it is not easy to get the metal out of the substrate. As the spherical shape indicates total un wetted, I am very confused that why the metal can't be removed easily.

In the former experiment, we use the temperature set 110°C , and the actual temperature is near 100°C due to the limitation of the heater. And in this experiment, we set the temperature 85°C , and the actual temperature is near 85°C .



图 5: 85 °C

low temperature



图 6: 110 °C



图 7: 85 °C

Compared with the former experiment, I think low temperature may have positive effect. However, as we didn't control other conditions very well like the speed and the pressure, so I think it needs further study. And the difficulties for us to do exquisite experiment is the uncontrollability of the metal getting out of the nozzle. To solve it, we need advance pressure controller and a deep understanding of the liquid metal's properties.

high drawing speed

I think it is a very important parameter in the experiemnt ,but we didn't control it very well.As I complete the experiment most time only by myself ,so the time between I apply pressure and move the nozzle is also not very well controlled.But in general,as we increase the speed ,the line gradually approach our requirement.



图 8: result 1

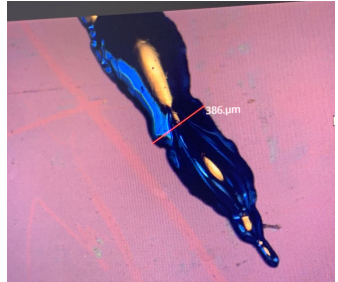


图 9: result 2

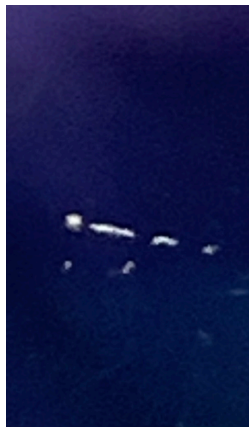


图 10: result 3

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- For future study ,I think we should get a exquisite pressure controller to make quantitative experiment to find suitable parameters. And a high speed drawing table is also needed.

plan

To use different nozzle mentioned before ,I build a true syringe in solidworks,and I will find a factory to build it.

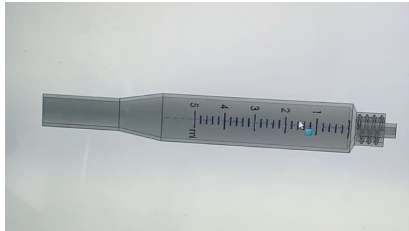


图 11: metal syringe

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summary

- I think the experiment we have done primarily verified the feasibility of the field metal method. As we can somehow draw thin line in the glove box like FIG:16 and FIG:17 .
- our current problem is how to control the pressure and drawing speed to make quantitative experiment. In other words, we can't repeat the result easily in recent stage.
- because the next week is the last week I stay in Shanghai ,so I decide to use different nozzle and try to draw line in the glove box to find some new phenomenon, not to improve the system or find best parameters which need more time.

Thanks!