

# Summary

What I have done in the past month

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- ① preparation
- ② outside glove box
- ③ inside glove box
- ④ prospect
- ⑤ Summary of the summary

# 1 preparation

previous work

article

device

## 2 outside glove box

## 3 inside glove box

## 4 prospect

## 5 Summary of the summary

# 1 preparation

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## 5 Summary of the summary

- build displacement table outside glove box
- draw line outside glove box
- build a gas circuit inside glove box
- can't draw line inside glove box

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## 5 Summary of the summary

Try to solve the problem of drawing line inside glove box, we refer to NUS article " Tension-driven three-dimensional printing of free-standing Field' s metal structures"

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Because we can't get the same device as NUS on time , we try to build device ourselves.



图 1: metal syringe

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manual  
software
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We complete this part of work quickly, because we know it can be done due to NUS article. And we didn't try to build the best result either, because our real challenge is inside glove box. I consider this part of work as a warm-up to familiarize the project.

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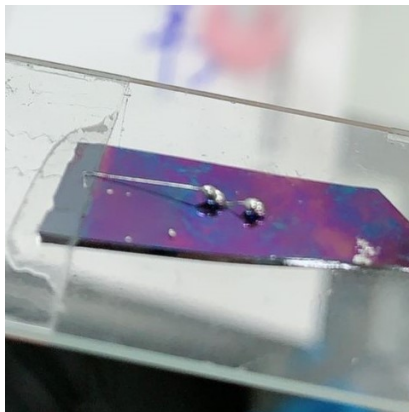


图 2: line in the air by hand

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图 3: line in the air by displacement table

As you see ,this one is far from our requirement ,but it can prove that we can draw line using program outside glove box.

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- 3 inside glove box**
  - air pump approach
  - piston approach
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For most time ,we try to use air pump to push the liquid out of the syringe ,but finally we found that is not the best way to do it.However, its result is still worth mentioning

using air pump ,we found some favourable factors

- low temperature is favourable for viscosity
- high speed is favourable for thin line
- And flat needle can help liquid flow out

These are the best results

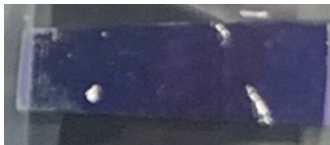


图 4: result 2

These are the best results

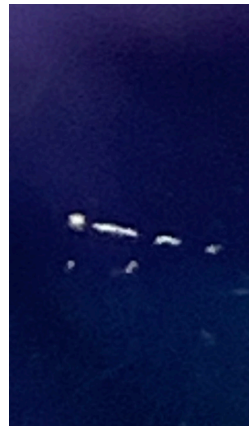
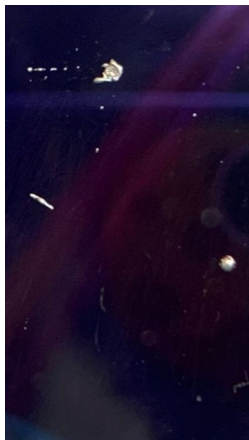


图 5: result 3

These are the stable results(which can be repeated easily)



图 6: 26G flat needle

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## advantages of piston approach

- can be use in uhv
- perform better than air pump.
- can be exquisitely controlled



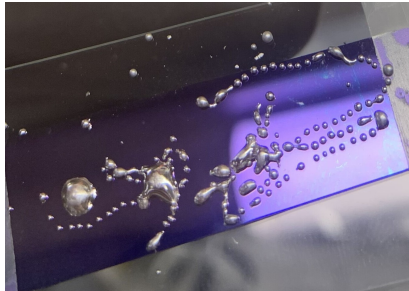


图 7: 26G short flat needle 1

Though the result is not good enough, we can see the potential of this approach. The liquid flows out uniformly, so I think applying an exquisite controller can make it better. This is the video video

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- using exquisite controller
- build printing system model used in glove box in solidworks
- find the best parameter to draw line.

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- And special thank for jingjing who play badminton with me.

And I have upload all the description about my project.  
<https://github.com/IcarusIcarusIcarus/fudan>

*Thanks for a thousand times!*