

Feb27 – Mar6

Try with PTFE 0.002" sheet: [Attach:Photo\\_PTFE\\_trial.png](#)



Can adhere with acrylic film very well without any glue.

The stretch of acrylic film can be maintained by covering both side with this sheet,  
doesn't need glue and also easy to peel off.

Comment:  
That's a good thing  
to reduce failure rate  
of fabrication

Can be a good way for stretched acrylic film manipulation.

Multi-layer fabrication investigation

Result: made a 5-layer EAP ([Attach:Photo\\_5layer\\_EAP.png](#))

by trying two different ways of fabrication in batch ([Attach:Photo\\_fabrication\\_in\\_batch.png](#))  
and deal with the connection problem.



First method: using transferring frame to separate the acrylic film into independent areas for ceasing the tearing propagation ([Attach:Photo\\_transferring frame.png](#)).

Glue the base on one cell, cut it off, glue on another one,  
so as to increase the layers on the base.

The base is made from one eighth acrylic plate,  
difficult to have all continuous edges glued on the film.  
Glue problem also occurred between two acrylic layers  
([Attach:Photo\\_layers\\_adhering\\_failure.png](#)).

Comment:  
I can't understand what  
Happened to this process  
Could you tell me a little  
Bit more with simple figure

Feb27 – Mar6

## Multi-layer fabrication investigation

Second method: glue thin supporting frames to each layer just on one side, cut them off as units and pile them up with glue ([Attach:Photo\\_piling\\_units.png](#)).



A supporting frame with flexibility (0.01" fiberglass currently, could be even thinner) can be much better and more easily glue on the acrylic film than rigid acrylic plate.

After cutting the cells out, the acrylic film edges warp and curl little bit ([Attach:Photo\\_cell\\_edge\\_curl.png](#))

, which will increase the overall thickness when these cells are piled up.

Need to find ways to prevent it.

Electrical connection: ([Attach:Photo\\_electrical\\_connection.png](#))

Conductive tape should be thin and flexible, not easy to wrinkle.

The thickness of tape is bad for evenly touching and gluing between two layers, better to extend the electrode line and put the conductive tape outside the frame.

Suggestion: How about using Electrolytic copper foil( 0.009mm thickness )

As adhesive tape,

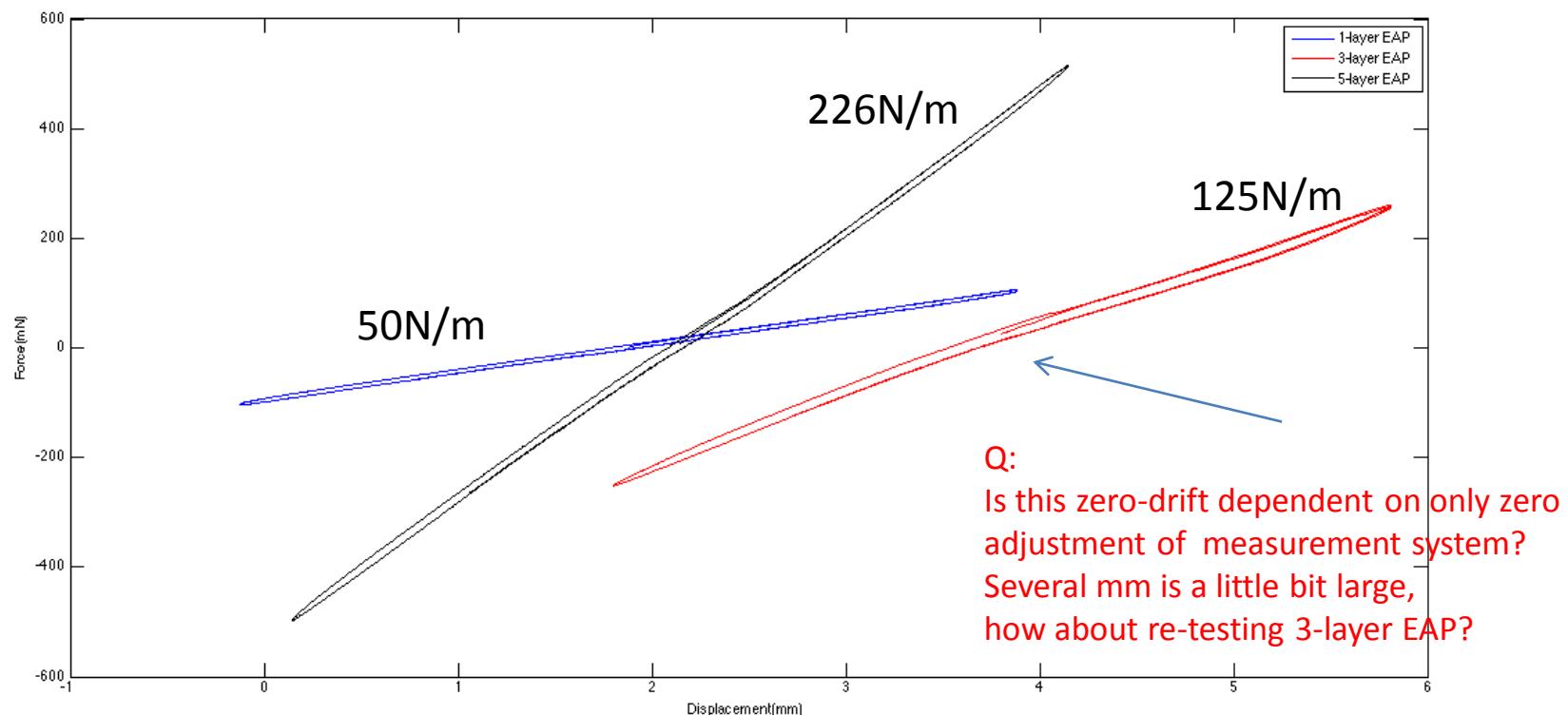
I found a product ([copper adhesive tape example](#)). Please check it.

## Experiment

Hysteresis and stiffness of 1, 3, 5-layer EAP  
(supporting frame of 3-layer one has been strengthen)

[: Attach:Plot\\_hysteresis\\_and\\_stiffness\\_0.4Hz\\_2Amp.png](#)

The hysteresis doesn't actually scale up with the increase of layer number.  
Need to mention, each layer in 3-layer EAP has only one side electrode  
while 1 and 5-layer have two-sided electrode.



## Experiment

Hysteresis of 5-layer EAP under different frequencies:

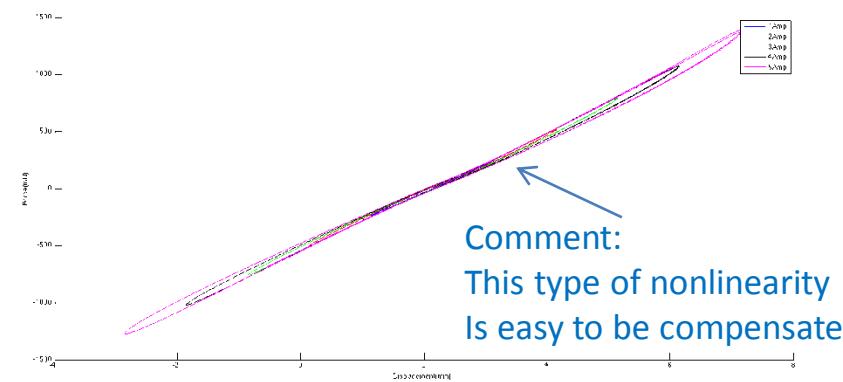
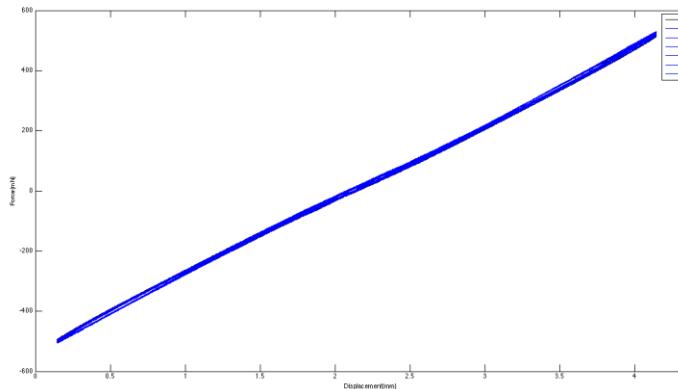
[Attach:Plot\\_hysteresis\\_different\\_frequencies.png](#)

Hysteresis of 5-layer EAP under different amplitudes:

[Attach:Plot\\_hysteresis\\_different\\_amplitudes.png](#)

Q:

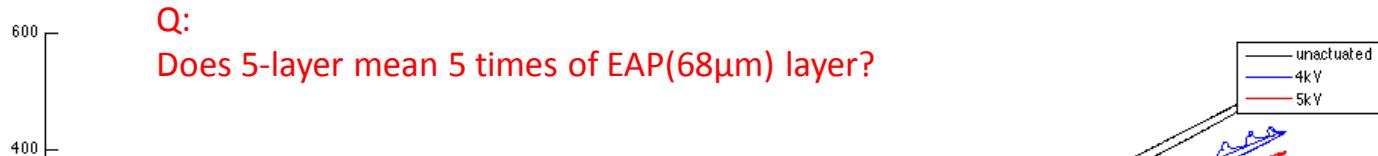
How large the range of frequency  
In this experiment?



Comment:  
This type of nonlinearity  
Is easy to be compensated

## Experiment

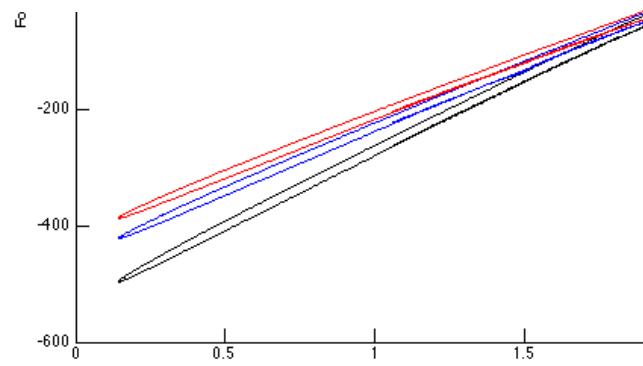
Actuated 5-layer EAP: [Attach:Plot\\_actuated\\_tests\\_Mar5.png](#)



Comment:

It might be possible to release pre-strain in multiple-layer fabrication.

According to force/strain character of raw EAP film, this device might need more voltage .



Suggestion:

1. Please check whether measuring device works correctly.
2. Please re-testing this.
3. If the result is same to previous one, how about testing 3-Layer EAP?  
And in experiment measuring electrical current helps you to guess whether all of the layer are charged or not.

The stiffness range is small, which is because of:

- 1) one of the layer doesn't work because of lack of conductive tape.
- 2) no electrical connection strengthen between two adjacent layers.
- 3) short occurred because of acrylic sheet contamination during fabrication and cannot actually generate the input voltage  
(the plot legend is for input voltage, not actual value)