ELECTROACTIVE POLYMER ACTUATORS

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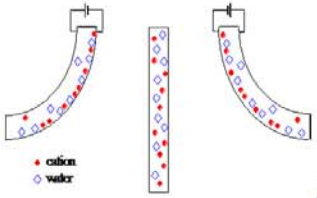
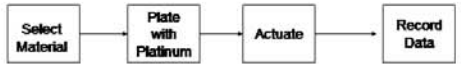
POLYMER ACTUATORS

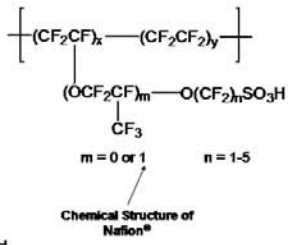
- A Polymer Actuator is a thin strip of a polymer film which actuates under an applied voltage.
- Actuation is induced by the applied voltage.
- A volume change occurs as the cations and their solvent shells shift across the film.
- Further deformation occurs due to electrostatic repulsion.
- Critical factors include operating voltage, operating current, and cation size.



EXPERIMENTATION



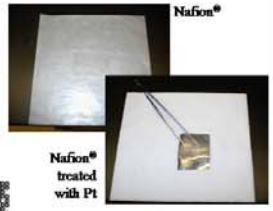
- Needed to evaluate how actuators work
- Used Nafion® 117 in acid form plated with platinum as test subject
- Ran several types of experiments to evaluate behavior under applied voltage
  - Different voltages tested
  - Different beam lengths tested(1, 1.5, 2cm)
  - Multiple plated samples tested

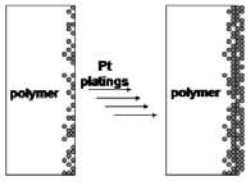


PLATINUM TREATMENT

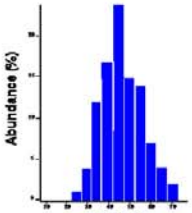
TWO STEP PROCESS:
1- In situ colloid formation
2- Form colloid then deposit

Platinum coatings are 5-20 mm thick for minimum resistance at interface

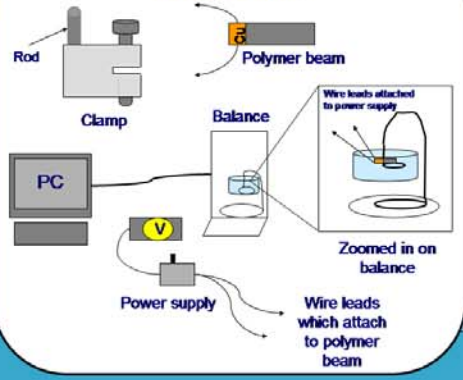




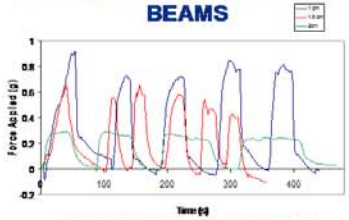
Several platings required to minimize resistance at interface.



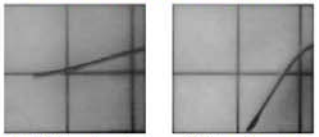
EXPERIMENTAL SETUP AND PROCEDURE



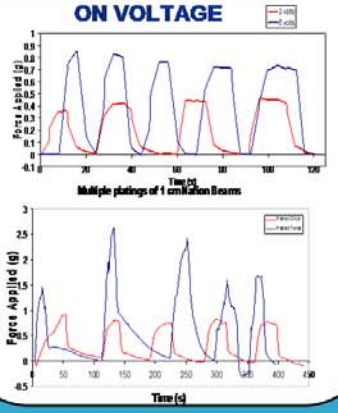
VARIED LENGTHS OF NAFION BEAMS



ACTUATION IN MOTION



1 CM BEAM DEPENDENCE ON VOLTAGE



CONCLUSIONS

- Shorter beam lengths gave greater force
- Multiple platings gave greater force
- Force applied dependant on voltage

FUTURE WORK

- Study of Nafion actuators pave the way to test new materials
- Can begin to mathematically model behavior of actuators when voltage is applied

ACKNOWLEDGEMENTS

- UD-CCM
- CMT
- Donovan Harris-ARL
- Ryan Emerson-ARL