



Conducting polymer ionic liquid composites (CPILC) formation and investigation

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In the presentation



In the presentation

- Why New Zealand



In the presentation

- Why New Zealand
- Electromechanical actuators



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- Electromechanical actuators
- Motivation



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- Motivation
- PIL synthesis



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- CP and PIL composites



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- Electromechanical actuators
- Motivation
- PIL synthesis
- CP and PIL composites
- Conclusions



New Zealand and ESNAM



New Zealand and ESNAM

- *European Scientific Network for Artificial Muscles*



New Zealand and ESNAM

- *European Scientific Network for Artificial Muscles*
- *Short-Term Scientific Missions*



New Zealand and ESNAM

- *European Scientific Network for Artificial Muscles*
- *Short-Term Scientific Missions*
 - contribute to the scientific objectives of ESNAM



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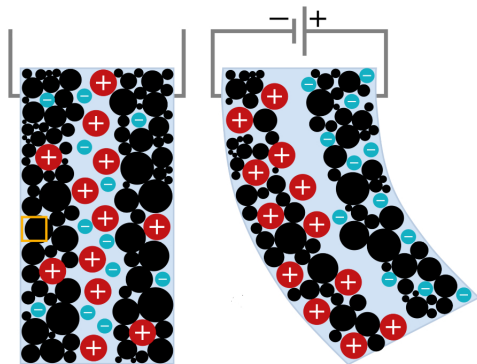


New Zealand and ESNAM

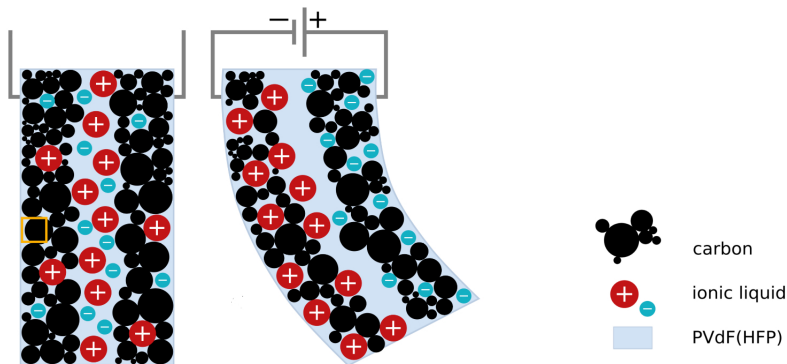
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Carbon-Polymer Composite Electromechanical Actuators



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Actuation



Click on picture to play the movie



Ideal Membrane



Ideal Membrane

- In air operation



Ideal Membrane

- In air operation
- Chemical and thermal stability



Ideal Membrane

- In air operation
- Chemical and thermal stability
- Electrochemically stable



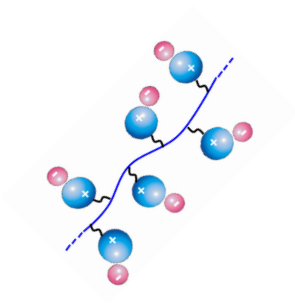
Ideal Membrane

- In air operation
- Chemical and thermal stability
- Electrochemically stable
- Ion permable



Ideal Membrane

- In air operation
- Chemical and thermal stability
- Electrochemically stable
- Ion permable
- Solvent/electrolyte free



Ionic Liquids



Ionic Liquids

- Molecules with a permanent charge



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- Molecules with a permanent charge
- Negligible vapour pressure



Ionic Liquids

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- Negligible vapour pressure
- Non-flammable



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- High ionic conductivity



Ionic Liquids

- Molecules with a permanent charge
- Negligible vapour pressure
- Non-flammable
- High ionic conductivity
- Wide electrochemical window

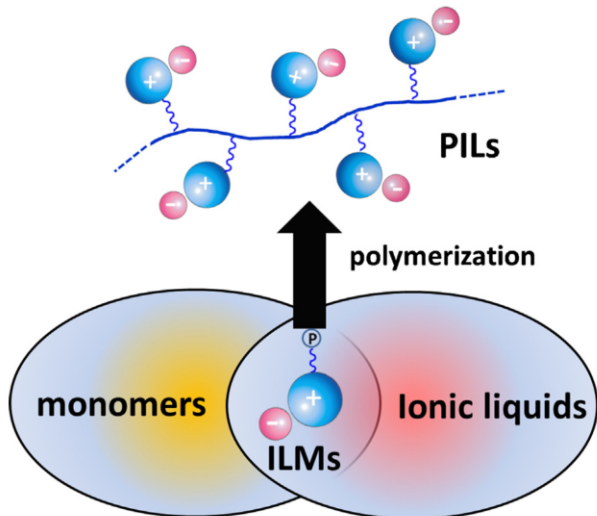


Ionic Liquids

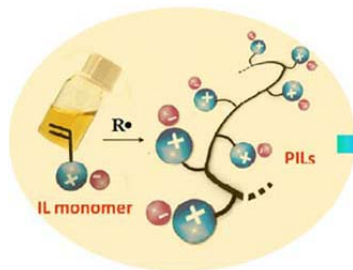
- Molecules with a permanent charge
- Negligible vapour pressure
- Non-flammable
- High ionic conductivity
- Wide electrochemical window
- Good chemical, thermal stability



Polymerized Ionic Liquids



Polymerized Ionic Liquids



- PIL's incorporate the IL's moiety into the polymer macromolecular structure
- Properties strongly associated with polymer and IL structure

PIL synthesis



PIL synthesis

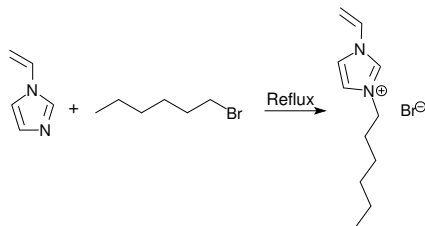


Figure: *Monomer synthesis*

PIL synthesis

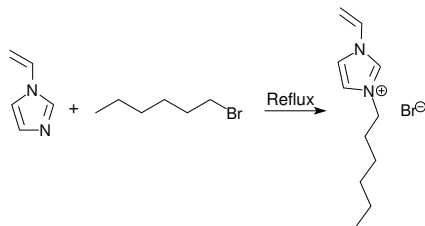


Figure: *Monomer synthesis*

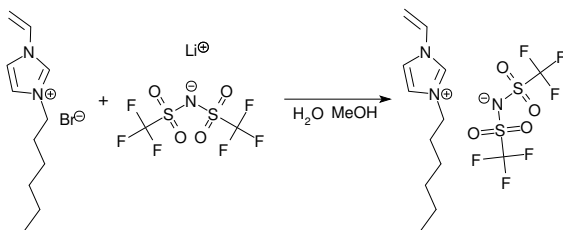


Figure: *Anion metathesis*



Conducting polymers

and polymerizable IL's



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- Incorporate the IL into CP matrix



Conducting polymers

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- Incorporate the IL into CP matrix
- Electrochemical polymerization of CP



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- Polymerization of IL with UV, initiator ...



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- Better conductivity for the PIL membranes



Conducting polymers

and polymerizable IL's

- Incorporate the IL into CP matrix
- Electrochemical polymerization of CP
- Polymerization of IL with UV, initiator ...
- Better conductivity for the PIL membranes
- Flexible, air operable, stable, solvent free



PIL-CP composites

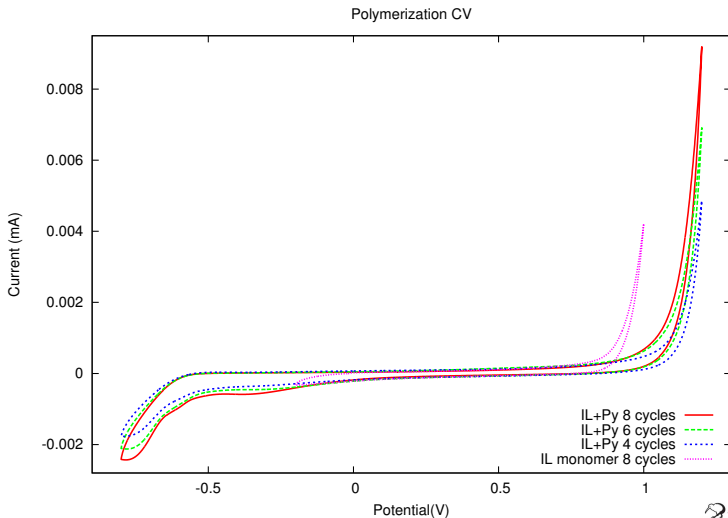


Figure: Polymerization of PIL and PPy mixture



PIL-CP composites

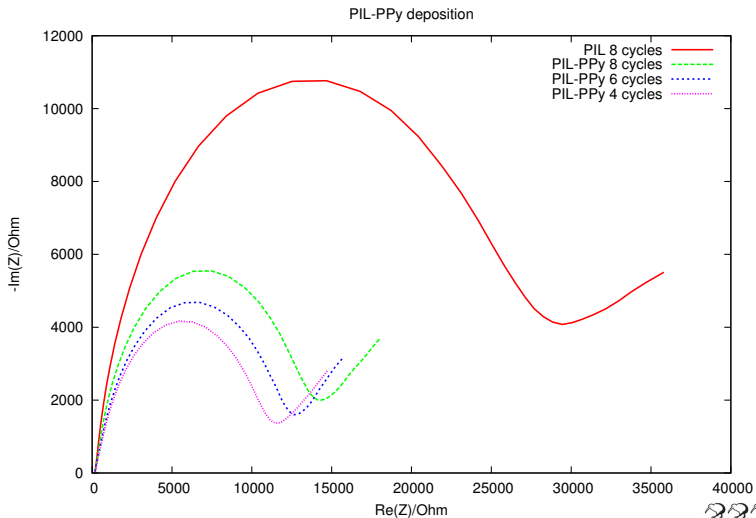


Figure: Impedance of PIL and PPy composites



PIL-CP composites

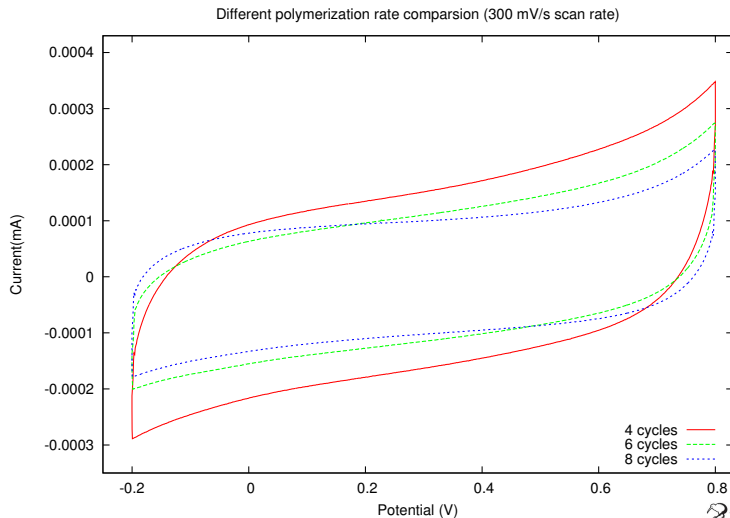


Figure: *PIL-CP CV-s*



Conclusions

and future work



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and future work

- **It can be done**



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- Freestanding film



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Conclusions

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- Freestanding film
- Actuation properties
- Different anions
- Different polymerization techniques



Thank you

