SYNTHESIS OF NOVEL CARBAZOLE CONTAINING POLYMERS FOR USE IN ORGANIC ELECTRONIC DEVICES

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Background

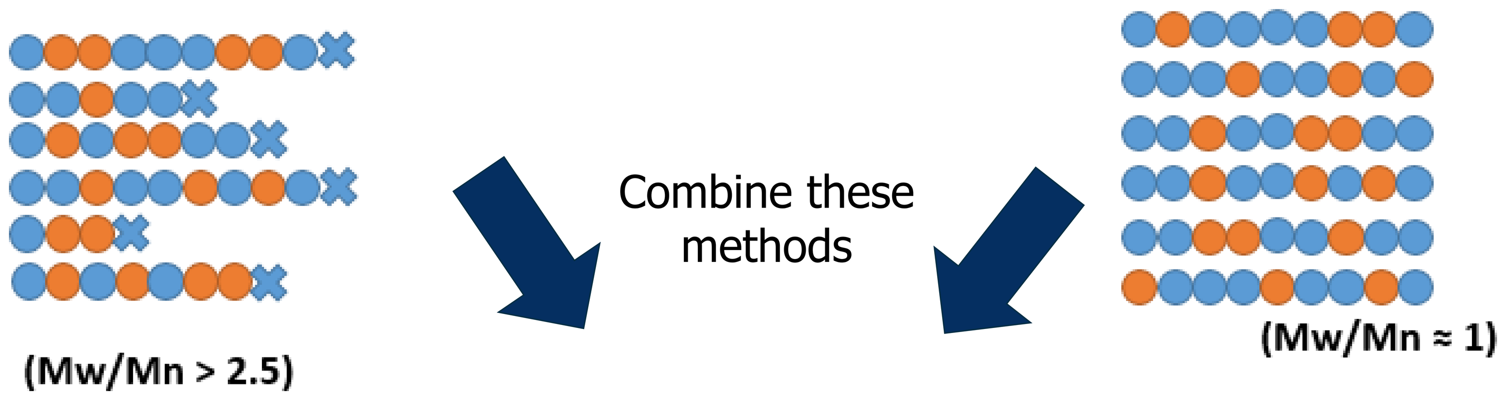
Two major methods of polymerization used in Industry and Academia

Free radical polymerization

Easy/robust = industrially friendly
Fast initiation + termination
Poor molecular control

Living Polymerization

Technically demanding
No termination
Perfect molecular control



Controlled Polymerization (CRP) takes the best of both methods, yielding a robust, industry friendly method of mass producing polymers while allowing for exceptional molecular control to make finely tuned materials for advanced applications.

Organic Electronics

Organic electronics made from carbon-based materials such as polymers and small molecules are **industrially relevant and cost effective to produce.**

Organic Light Emitting Diodes (OLEDs) and **Organic Thin Film Transistors (OTFTs)** are both examples of organic electronic devices that can be made from inherently flexible polymeric materials

Major advantages in production of materials for organic electronic applications is that they can be **processed inexpensively from solution.**

Synthesis of Carbazole Containing Polymers

The copolymerization of 2-(9H-Carbazol-9-yl)-ethyl methacrylate (MVAK) was carried out using Nitroxide Mediated Polymerization (NMP), a scalable technique which also allows polymers to be synthesized with a very narrow molecular weight distribution.

Synthesising polymers with Carbazole moieties are useful because some carbazole-containing compounds exhibit **relatively high charge carrier mobility** and **high thermal and photochemical stability**

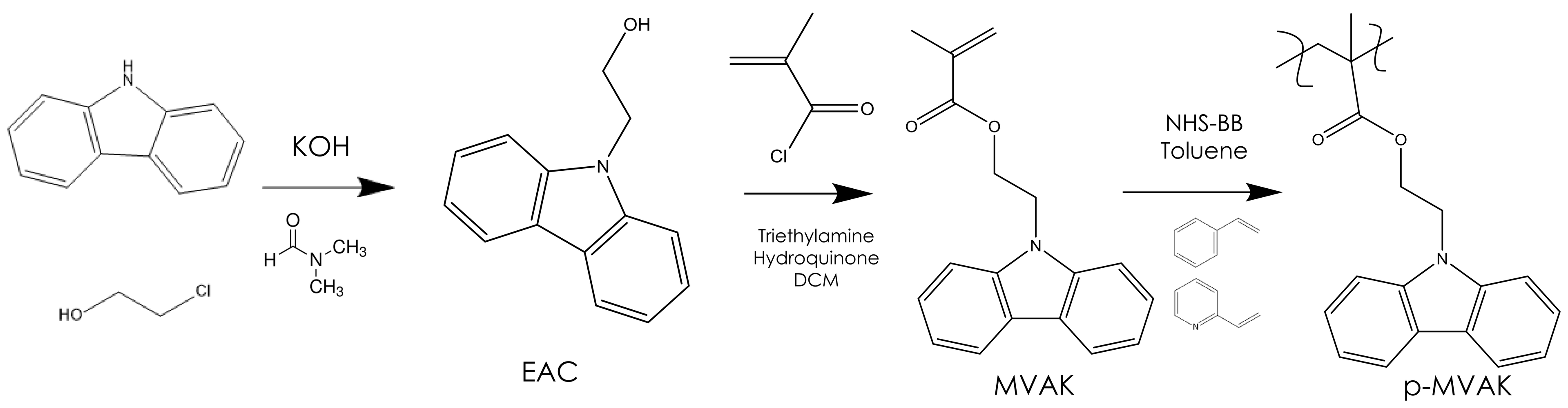
cynora GmbH, 2012

Methodology

Reaction Procedure

- Copolymerization of MVAK was carried out by Nitroxide Mediated Polymerization (NMP) in a 50mL reactor flask at 90°C using 0.02g of NHS-BlocBuilder as an initiator.
- In each reaction, approximately 1.0g of MVAK was used with 5-10% of controlling comonomer added to the system along with 5mL of solvent
- Samples were taken over expanding time intervals to test for conversion and polymer dispersity over time. Products were precipitated in hexanes and collected using filtration
- Monomer conversion was determined by gravimetry and analysis of ^{1}H NMR spectra through observing the relative ratios of vinyl protons to aromatic protons

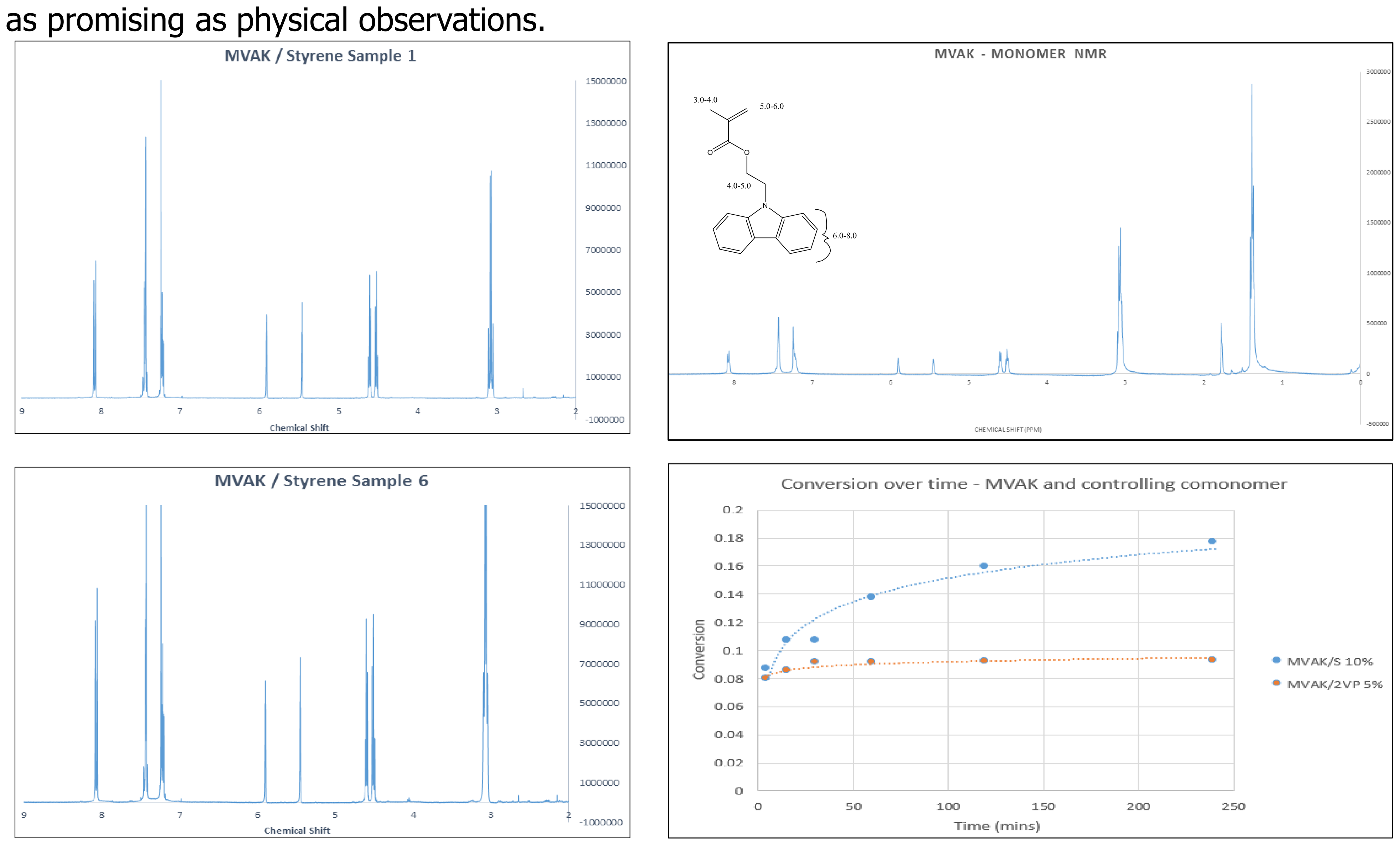
Synthetic Route – Monomer & Polymer



Results

Nuclear Magnetic Resonance Spectroscopy (^{1}H NMR)

Proton NMR results for testing conversion were not as promising as physical observations.

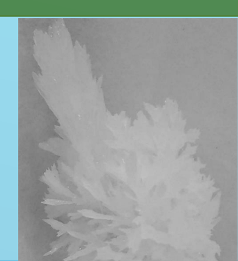


Conclusions

- Initial results conclude that the copolymerizations of MVAK is possible
- Polymer dispersity of the MVAK / Styrene system is below 2.0 is significantly lower than any previously published value to date
- NMR results were disappointing, but these results can be attributed to lack of monomer purity

Ongoing Work

- Re-crystallization of monomer for greater purity
- Different percentages of controlling co-monomers
- Testing on different systems such as VAK
- Exploration of optical and electrical properties of these novel materials



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Acknowledgements

I would like to thank Dr. Benoit Lessard for his guidance and assistance with this project, as well as every member of the Lessard Research Group for having a hand in the development of my research skills.
I would also like to thank the University of Ottawa's Office of Undergraduate Research for providing me with this great opportunity, as well as NSERC for providing me with a research award that will allow me to continue my research this summer.