An Electrochromic Ionic Liquid: Device optoelectronic properties as a function of current flow.

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**INTRODUCTION**

- Electrochromic devices (ECD’s) undergo a change in their optical properties in response to an applied voltage [1].
- Viologens are attractive materials for ECD’s as they can switch between complete transparent and coloured states reversibly [2].
- ECD’s are fabricated by placing the redox sensitive material between two electrodes, in the presence of an electrolyte [3].
- Ionic liquids (ILs) / ionogels have evolved as a new type of device platform for ECD’s, mainly due to the ionic conductivity endowed on the polymer by the IL in the solid state [4].

**AIMS**

- To synthesise an IL capable of acting as the electrolyte and the optically active redox salt to form a functioning ECD.
- Characterise the optical output of the novel IL as part of the ECD.

**MATERIAL SYNTHESIS**

- The electrochromic IL was prepared via two individual quaternisation reactions:
  1. Trioctylphosphine was allowed to undergo a thermally controlled S₂,S₂ addition reaction with a dihaloalkane, producing the precursor IL capable of undergoing further addition reactions (Fig. 1 (a)).
  2. The precursor IL was then allowed to react with a mono-alkylated viologen precursor to produce the electrochromic IL (Fig. 1 (b)).

**DEVICE FABRICATION**

- An ionogel containing the synthesised electrochromic IL functioned as an ECD when photo-polymerised between two electrodes.
- The ECD exhibited the transparent (V²⁺, oxidised) and coloured (V⁺ reduced) states (Figure 2, bottom).

**DEVICE OUTPUT**

- The optical output of the ECD was found to differ under various electrochemical conditions.
- By pumping D.C into the device, it was found to maintain 60% of its coloured state after 100 minutes, under open circuit.
- Figure 4 (bottom) shows the steps taken to optimise the colouration reversibility of the ECD.

**CONCLUSIONS**

- Although a highly viscous wax, the synthesised material proved capable of acting as the electrolyte and the electrochrome as part of an ECD.
- The ECD proved capable of differing optical outputs as a function of the nature of the current being passed through the device.

**REFERENCES**


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