Reduced graphene oxide based nanocomposite films for enhanced electrochromic performance

Bhushan Gadgil, Pia Damlin, **Carita Kvarnström**

University of Turku, Turku University Centre for Materials and Surfaces (MATSURF), Laboratory of Materials Chemistry and Chemical Analysis, Vatselankatu 2, FIN-20014 Turku, Finland

carkva@utu.fi

Abstract

Reduced graphene oxide has been investigated [1,2] and applied as component in polymer composites. Polyviologen (PV)-reduced graphene oxide (rGO) nanocomposite films were fabricated by simple, one-step reductive electropolymerization of cyanopyridinium based precursor monomer (CNP) in an aqueous dispersion of graphene oxide (GO). Since the polymer formation and reduction of graphene oxide occurs within the same potential window, electrocodeposition method was preferred for obtaining nanostructured PV-rGO films. Cyclic voltammetry experiments of PV-rGO displayed two well resolved, reversible one-electron redox processes typical of viologen. Being a redox polymer, incorporation of rGO further enhances the electroactivity of the PV in the composite films. Vibrational spectral analysis with surface characterization revealed structural changes after composite formation along with subsequent reduction of GO within the polymer matrix. The PV-rGO nanostructured film exhibits a high-contrast electrochromism with low driving voltage induced striking color changes from transparent (0 V) to purple (-0.6 V), high coloration efficiency, fast response times and better cycling stability compared to a pristine PV film [3,4]. This performance can be attributed to the high stability of the electrochrome in the composite assembly induced by electrostatically driven non-covalent interactions between redox PV2+ and negatively charged rGO, improved electrical conductivity and enlarged surface area accessed through reinforced nanostructured graphene sheets for tethering PV molecules.

References

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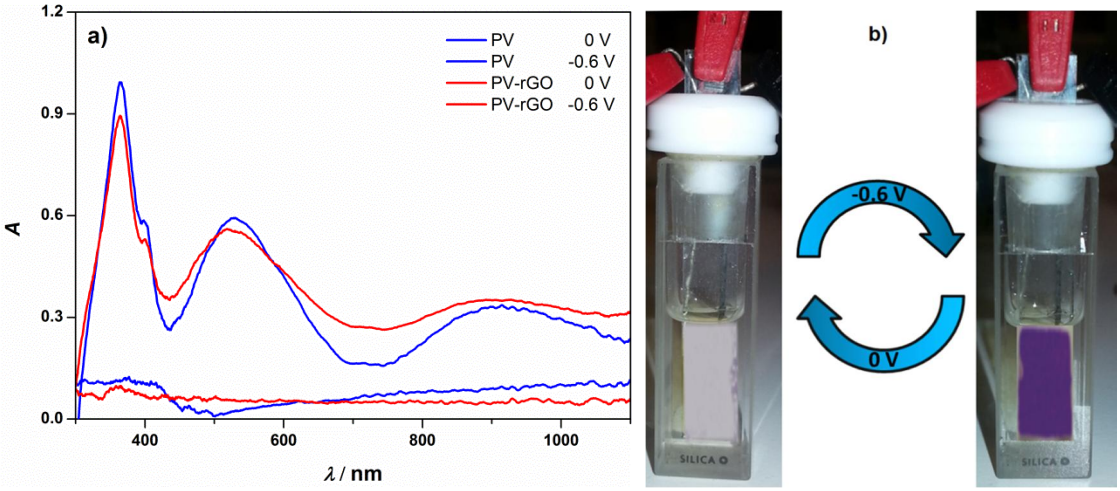

Figure 1. Changes in the UV-vis absorption spectra for bleached state (0 V) and colored state (-0.6 V) for PV (blue line) and PV-rGO (red line) films with 0.1 M KCl in water.