Nanostructured polythiophene materials for electrochromic applications

Tiago Moreira[1], César A.T. Laia[1], A. Jorge Parola[1], Francesca Di Maria[2], Mattia Zangoli[2], Marta Maia[1], Antoine Stopin[3], Davide Bonifazi[3]

1. *LAQV-REQUIMTE, Departamento de Química, Faculdade de Ciências e Tecnologia, NOVA School of Science and Technology, 2829-516, Caparica, Portugal*
2. *CNR-ISOF and Mediteknology srl, Area Ricerca CNR, 41100, Bologna, Italy*
3. *Institute of Organic Chemistry, Faculty of Chemistry, University of Vienna, Währinger Strasse 38, 1090, Vienna, Austria*

In an increasingly connected world full of smart objects and devices, electrochromic materials-based systems have the potential to become the most practical and widely deployable human interfaces for ambient intelligence. Polythiophenes are semiconductor organic polymers with remarkable electrochromic properties in terms of the color palette variety, color contrast and switching times. However, their implementation at an industrial scale (except for the well-known PEDOT) is still hampered by stability issues in plastic or glass substrates. We propose to move forward in terms of, processability, fast switching times and durability using two different approaches: a) by producing novel water-dispersible nanoparticles with poly(thiophene/ electron-acceptor monomers) with tunable size; and b) by tailoring the polythiophenes with aromatic systems to promote strong interactions with carbon nanomaterials that will contribute to a higher stability. These strategies lead to processable inks deposited as nanoparticles films and highly stable thin films, assembled in electrochromic devices, while structural changes introduce new electrochromic colors increasing the color palette.

Additionally, other substrates such as paper represent significant challenges, since optimal solutions require the avoidance of ITO as conductive layer. Here we present a development of a novel type of electrochromic devices using paper as substrate by assembling high-pressure laminates (HPL) producing multi-layered electrochromic devices (HPL-ECD) avoiding ITO or other metal oxide semiconductor.

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