

Title: Additives in redox electrolytes for reduction of loss current of electrochromic windows

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Abstract

The investigated electrochromic device consists of a nanoporous electrochromic layer (WO_3) on a transparent electrode ($\text{SnO}_2:\text{F}$), an electrolyte with a redox couple such as iodide/triiodide (I^-/I_3^-) or tetramethylthiourea/tetramethylformaminium disulfide ($\text{TMTU}/\text{TMFDS}^{2+}$), which is highly transparent, and thin Pt on a second transparent electrode. For window applications, low current densities below $10 \mu\text{A}/\text{cm}^2$ of transfer of electrons from WO_3 to the redox couple are required, as this can be considered as a loss current, not contributing to the coloration of the device, but creating high potentials due to the limited conductivity of the transparent electrode. For that, additives were introduced in the redox electrolyte to reduce the current of electron transfer. WO_3 layers were prepared by sputtering process. As additives, NMBI (N-methyl-benzimidazole), 4-TBP (4-tert-butyl pyridine) and urea were investigated. As a result, for all additives there is some reduction of loss current for redox couple I_3^-/I^- , whereas a striking reduction of loss current was achieved for redox couple $\text{TMTU}/[\text{TMFDS}]^{2+}$ with additive 4-TBP or NMBI.