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Synthesis and characterization of stable electrochromic polyimides with quinolin-8-yloxy-substituted triphenylamine units

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ABSTRACT

Herein, three kinds of electrochromic aromatic polyimides (PIs) were synthesized from 4,4'-diamino-4''-(quinolin-8-yloxy) triphenylamine (DAQTPA) with different dianhydrides, respectively. These PIs showed good thermostability below 450 °C even in air atmosphere. The maximum UV-vis absorption bands of PIs located at 321-338 nm for solid films. The highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) energy levels of the PIs were calculated from the cyclic voltammetry (CV) test as -5.42 to -5.44 eV and -3.53 to -3.85 eV, respectively. These PIs performed stable reversible electrochromic properties with optical transmittance change (ΔT) around 28-43% and coloration efficiency (η) around 74-117 cm^2 C^{-1}.

Keywords: Polyimide; Electrochromic; Triphenylamine; Electrochemistry; Redox

1. Introduction

The applications of electrochromic materials that can change transmittance or color are becoming more and more extensive, described as follows: the switchable green-brown electrochromic materials can be applied to military camouflage to ensure the safety of the soldiers [1]; the excellent response of stretchable electrochromic electronic skin is good news for the medical industry to monitor the health of the human body [2]; the user-controlled brown electrochromic eyewear can meet the needs of protecting eyesight in life [3]; the dimmable windows manufactured by Gentexthe is used in the Boeing 787 Dreamliner to provide an adjustable brightness for passengers who want to view the scenery outside the window or need to rest [4, 5]; the attractive smart window that integrates the functions of energy storage and electrochromism