ABSTRACT **Index No.:162/18/Chem./26**

Thesis title: "Electro-polymerization of organic derivatives and their electrochromic effects"

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Electrochromic materials modulate optical transmission and/or reflection in a controllable manner and are attractive in energy-saving and color-tuning applications. Under these circumstances, research related to energy-saving electrochromic material has paramount importance. This thesis entitled "**Electro-polymerization of organic derivatives and their electrochromic effects**" presents an investigation of some electrochromic material with high optical contrast, less switching time and very long cycle stability with a noticeable color change in low working potential. The first part of the thesis discusses the influence of the number of electropolymerizable groups of the donor side on electrochromic behaviors. Here, three donor-acceptor-donor type monomers containing isonaphthalene diimide as the acceptor core and electropolymerizable triphenylamine (TPA) as the donor moiety have been designed and successfully synthesized via imidization of isonaphthalene anhydride with corresponding TPA derivatives. The polymers reversibly show multi-electrochromic properties with the color change from colorless to brown to blue at a low working potential. Next, we have focused on developing the effect of different acceptor cores like pyromellitic dianhydride, naphthalenetetracarboxylic dianhydride, perylenetetracarboxylic dianhydride and terminal triphenylamine-based three DAD type monomers which are subsequently electropolymerized on a conductive glass surface to have polymers which are explored by cyclic voltammetry studies. These polymers exhibit the reversible multiple color changes of colorless to brown to deep blue in the anodic region with the application of voltage 0 to 1 to 1.2 V and turn colorless to deep pink in the cathodic region (voltage window of 0 to -2 V) with attractive response times, optical contrast, switching stabilities, and coloration efficiencies. These polymers can be switched up to 10,000 cycles with a coloration efficiency of 800 cm^2/C in the anodic process and 600 cycles for the cathodic process in a three electrodes setup. Later, we investigated several triphenylamines end-capped to substituted central naphthalene tetracarboxylic diimide based four donor-acceptor-donor type electroactive monomers to explore the effect of substituent on the formation of electropolymers and subsequent the chromic effect of prepared films on the conductive surface. In a three-electrode configuration, reversible multiple color changes from brown to deep blue and deep pink with the different applied voltages are investigated and these polymers overwhelmingly exhibit good response times, optical contrast, switching stabilities, and coloration efficiencies.

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