Ligand Induced Low Operation Voltage Ru-based Metallo-supramolecular Polymer as Energy Saving Electrochromic Film with Long Optical Memory

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In recent years, considerable interest has been addressed towards smart window in building applications. The effective utilization of electrochromic device (ECD) as "smart window" they must have acceptable levels in performance. Especially, with energy saving and highly stable ECD has received much attention on the development of active smart windows. To realize specific use in buildings large area EC smart windows must shows low power operation, highly stable, fast response, high coloration efficiency and a distinct optical memory effect etc. are important parameters from an industrial perspective. For these purpose metallo-supramolecular polymers have attracted attention and shown benefits as a new type of electrochromic (EC) materials.[1,2] In a metallo-supramolecular polymer system terpyridine ligands are usually used because of high metallophilic effect with there is a strong metal–ligand chelating effect.

Herein, we report ligand induced low voltage operated Ru^{2+} based metallo-supramolecular polymer(**polyRu-Bip**) for efficient and durable electrochromic (**EC**) applications. The polymer coated conductive substrate exhibited low-voltage (0 →+0.6 V) operation for coloration/bleaching. The color change polymer film associated with appearance/disappearance of metal-to-ligand charge transfer (**MLCT**) band upon redox transformation of $Ru^{2+} \rightarrow Ru^{3+}$. The ECD of **polyRu-Bip** exhibited **EC** response was very fast (t_b= 1.37 s and t_c= 0.67 s), high color contrast (ΔT= 54%) and high coloration efficiency (~571 cm^2/C). The presence of four electron rich N-methylbenzimidazole moieties in each monomeric unit of the polymer, induced the redox transformation of metal center ($Ru^{2+/3+}$) at low voltage which influence cyclic stability (20,000 cycles). Moreover, the bridging ligand was also involved for stabilization the high oxidation state of Ru^{3+}, which restrict the self-bleaching of polymer film implies enhancement of optical memory effect until 1 hour. Therefore, continuous electrical power source is not necessary to maintain a bleached state, which increases the power consumption for ECD operation.

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References.

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