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Improving the Memory Efect and Long-Term Stability of the Ru(II)-Based Metallo-Supramolecular Polymer

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Recently, metallo-supramolecular polymers (MEPE) have attracted lots interest for application as electrochomic device (ECD). Among them, Ru(II)-based MEPE and Fe(II)-based MEPE have potential for practical application due to their ability to offer high optical change. However, the poor stability and memory effect are the two major concerns, especially for Ru(II)-based MEPE. To tackle these issues, surface modification is attempted in this study. The redox reaction of Ru(II)-based MEPE thin film is accompanied by the perchlorate ions to maintain the electroneutrality condition. Additional carbon material, such as graphene (G), graphene oxide (GO), or carbon nanotube (CNT), was introduced into the thin film because of its preferential adsorption of perchlorateions. Among them, GO shows most significant improvement on the memory effect (about 22% enhancement in ΔTafter 10 min), as it plays an excellent adsorbent for perchlorate ions. Moreover, the corresponding Ru-GO ECD has better long-term stability than that of the original Ru ECD, as seen in Fig 1 (ΔT=57.0% at 502 nm after 5,000 cycles (94.9% retention)). On the other hand, to observe how anion diffusion would affect the morphology and performance, the electrochemical analysis was employed. The pretreated Ru(II)-MEPE thin film shows obvious morphology and thickness change as seen in Fig 2. by the scanning electron microscope (SEM). The pretreated Ru ECD is much stable (ΔT=63.9% after 5,000 cycles (99.5% retention)) than the other two samples. The anionic diffusion was confirmed by an electrochemical quartz crystal microbalance (EQCM). It was concluded that the surface modification with adsorbed carbon materials can enhance both the memory effect and long-term stability, while the electrochemical pretreatment can effectively improve the long-term stability of the Ru(II)-MEPEECD.

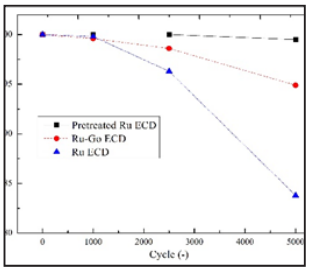

Fig 1. Comparison of long-term stability for various ECDs.

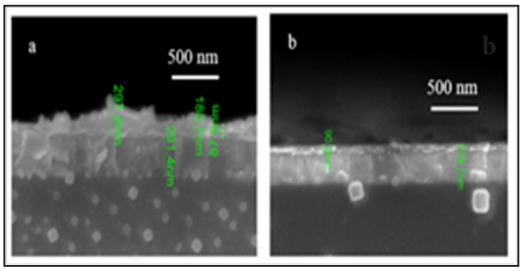

Fig 2. SEM cross-sectional images of (a) Ru(II)-MEPE thin film (b) pretreated Ru(II)-MEPE thin film.

Biography

Guan-Lun Fong received his BS degree in Department of Chemical Engineering from the National Taiwan University, Taiwan in June 2018. He started his MS in Electro-Optical Materials Laboratory at the Department of Chemical Engineering from the National Taiwan University, Taiwan in August 2018. His research works mainly focus on the electrochromic application and improvement of metallo-supramolecular polymers.