

前瞻高能量超高電容器整合製程及其應用平台開發

執行單位

國立交通大學電子工程研究所

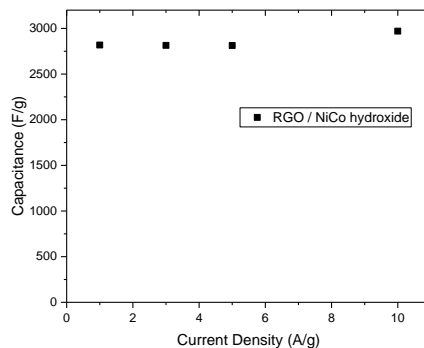
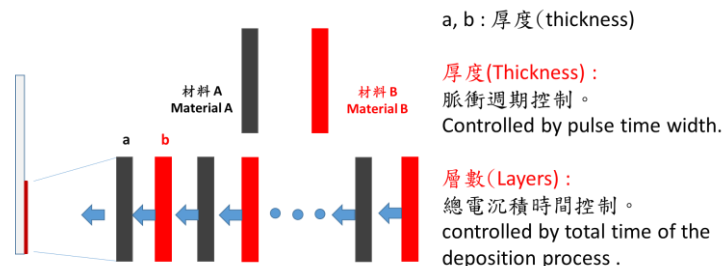
計畫主持人

曾俊元

- 能源材料遲遲無法取代石油的瓶頸，在於充放時間過長、價格較昂貴，本計畫研發具高充放電特性的複合電極材料，即使在超高速充放電流密度下，仍具有良好的儲能效率，具有高能量及高功率密度特性。

已申請之專利：

- 複合電極材料及其製造方法
- 電極用複合組成物及其製造方法



- 使用脈衝式電沉積法製備複合材料電極，在連續的正負電壓切換，可重複堆疊結構，且每層厚度可由脈衝週期控制，總電沉積時間可控制堆疊層數，此技術可讓材料間有很好的混合及鍵結，提升儲能裝置的效能。以石墨烯/鎳鈷氫氧化物複合材料來說，其比電容值高達2,818 F/g (於電流密度1 A/g下)，即使在高電流密度10 A/g的充放電狀況下，比電容值仍然維持2,970 F/g，代表充電速度增加10倍，電容量不會衰退，此優點可大幅降低充電時間。不僅如此，此技術可製備其他材料，例如將氧化石墨烯置換成摻雜之氧化石墨烯、導電高分子單體，如苯胺...等，金屬氫氧化物也可置換成金屬硫氧化物、金屬氧化物、金屬硫化物、金屬氟化物、金屬，可以製備多種不同類型之複合材料。此技術可以輔助高性能儲能材料的製作，兼具高電量及快速充電之性質，不再只是構想，可用此技術達成。
- 本案已通過中華民國專利，美國專利審核中。

Forward-looking high energy ultra-high capacitor integration process and its application platform development

Execution Unit

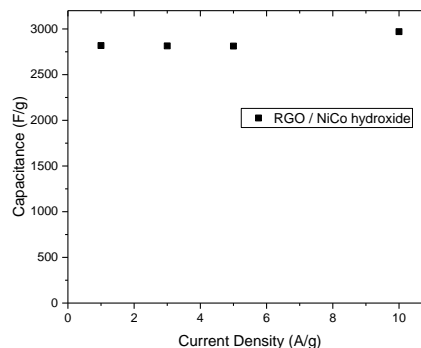
Department of Electronics Engineering, NCTU

Project Director

Tseng, Tseung-Yuen

- The one of the barriers to use supercapacitors replacing petroleum is that it is difficult to obtain high power density and high energy density in the mean time. This study is to synthesize new composite electrodes using in high current charging/discharging applications.

➤ MANUFACTURING METHOD OF COMPOSITE ELECTRODE MATERIAL



- Pulse electrodeposition is a good method to prepare composites electrodes. We made the alternating structure with alternating positive and negative voltages. The thickness and number of layers can be controlled by pulse time width and the total time of deposition process. Therefore, composites has well-mixing and good contact between materials. For example, we made the reduced graphene oxide (RGO) / NiCo hydroxide as an electrode demonstrating high specific capacitance 2,818 F/g at current density 1 A/g. Even though applying the high current density 10 A/g, the capacitance maintains the similar capacitance about 2,970 F/g. This means we can spend only 0.1 time to charge the energy device. It shortens the charging time largely. Moreover, graphene can be replaced by conductive polymers, doped graphene, and NiCo hydroxide can also be replaced by other metal hydroxides, metal hydrosulfide, metal oxide, metal sulfide, and metal fluoride to prepare several kinds of composites. It is possible to make high energy density and fast-charging energy device by using this method.
- Taiwan patents are accepted. US patents are audited.