



功能性氧化物實驗室 專題實作

一步溶劑熱法生長NiCo-LDH於碳布上應用於超級電容之特性探討

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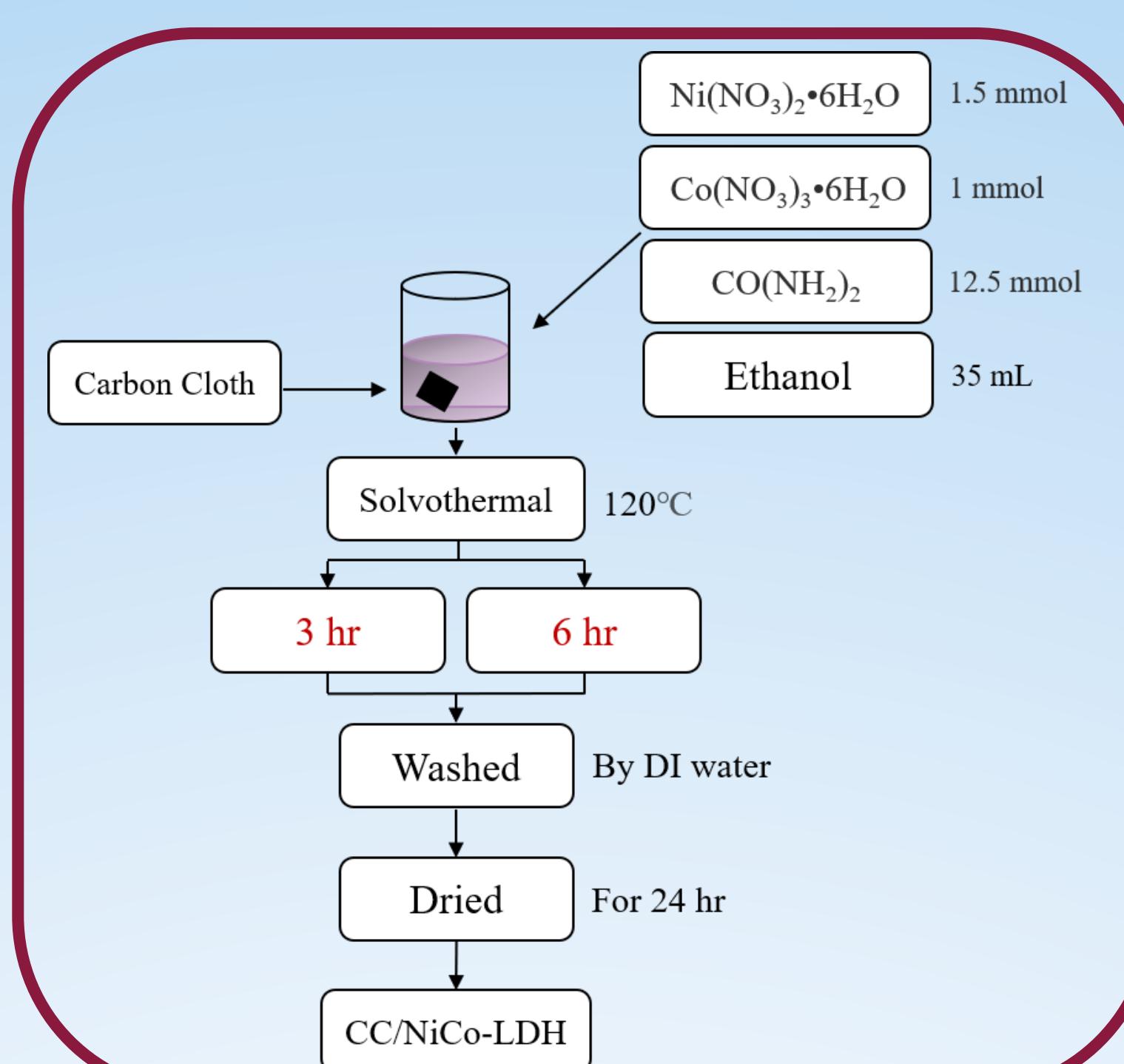
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摘要

由於碳布其良好的導電性、重量輕以及柔韌性而被認為是超級電容器良好的基材。本研究主要針對在碳布上生長層狀雙氫氧化物（LDH, Layered Double Hydroxide）的結構，而NiCo-LDH奈米陣列可確保電極的有效電荷轉移。

透過簡便的溶劑熱法，反應時間六小時的樣品，在 2 A g^{-1} 高電流密度下進行充放電測試，透過公式計算出的比電容值高達 2729 F g^{-1} 。為超級電容電極材料的製備，提供了前景以及新的方向。

實驗流程



電化學三電極系統

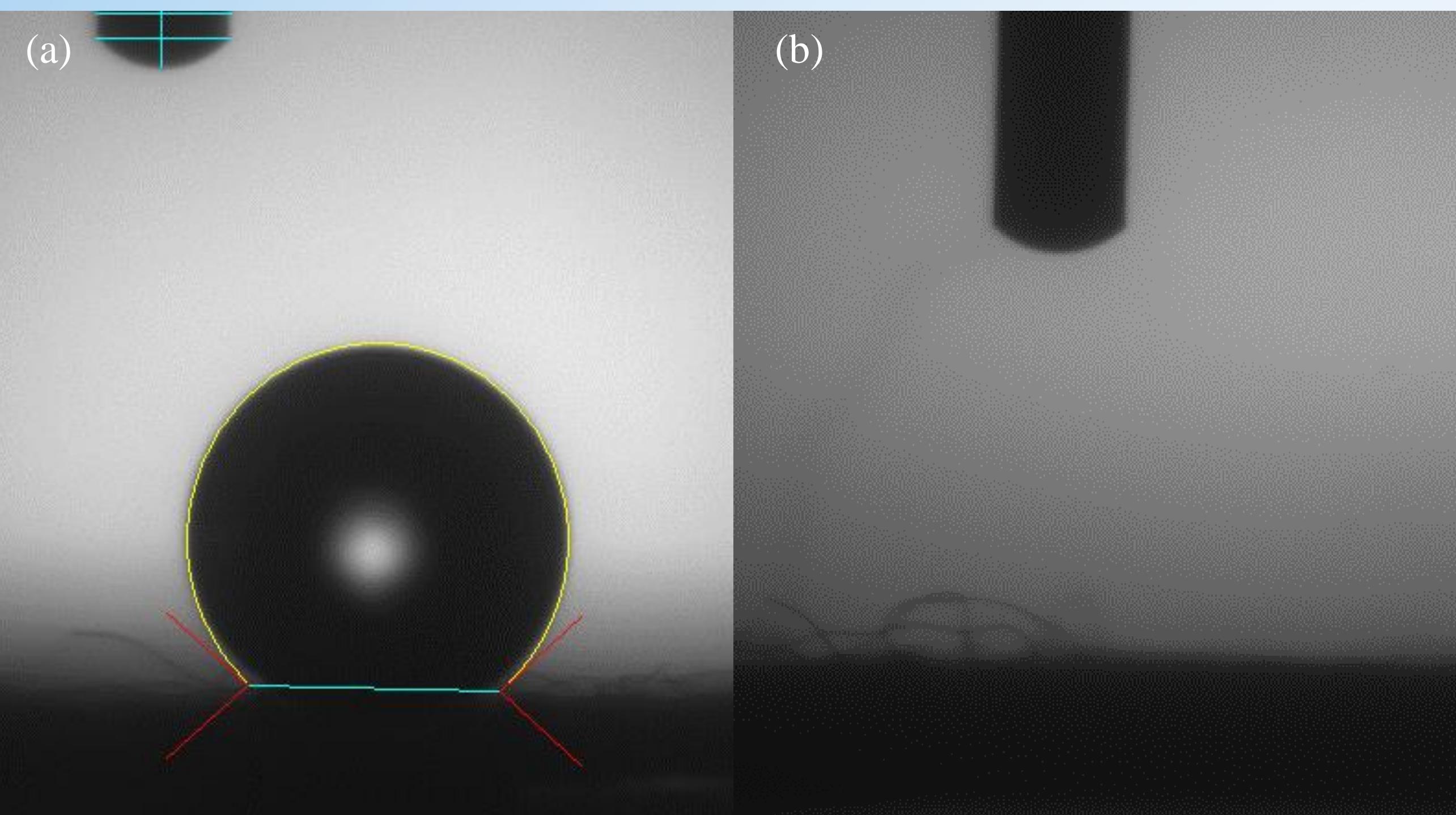
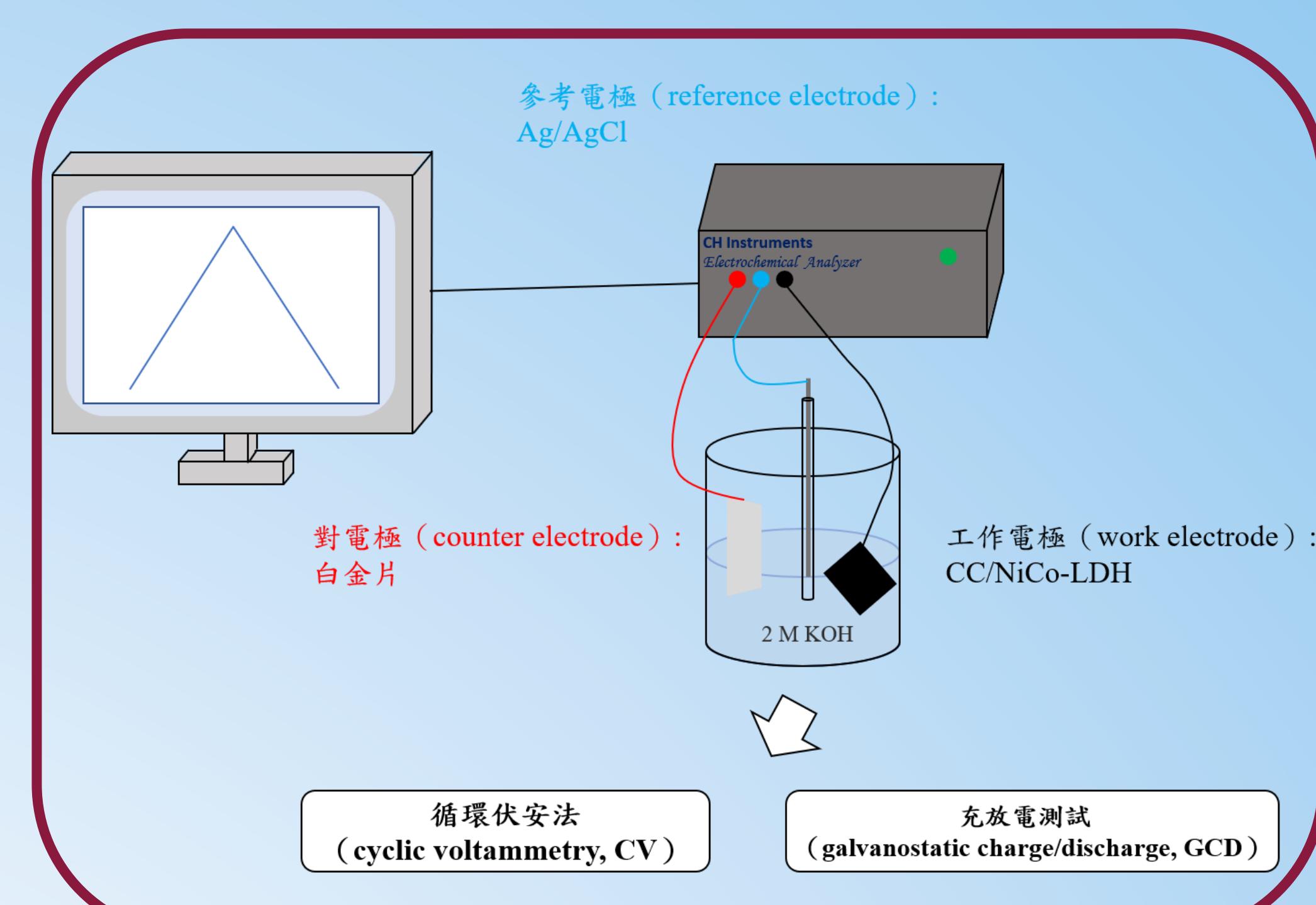


Figure 1. Contact angle of (a) water and (b) ethanol on the surface of carbon cloth.

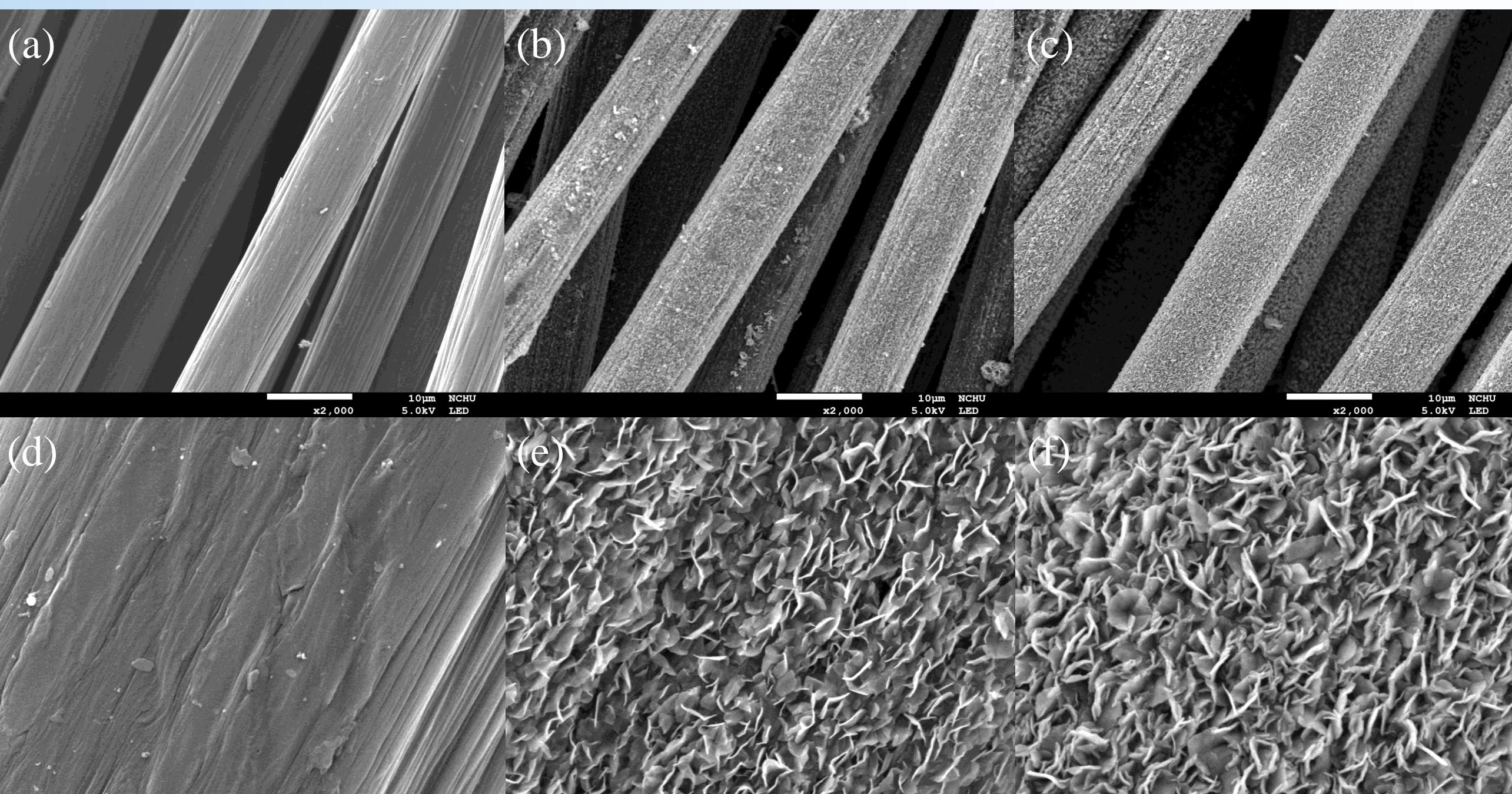


Figure 2. SEM image of (a) Bare carbon cloth (b) CC/NiCo-LDH-3h (c) CC/NiCo-LDH-6h at low magnification. Their corresponding images at high magnification are shown in (d), (e) and (f), respectively.

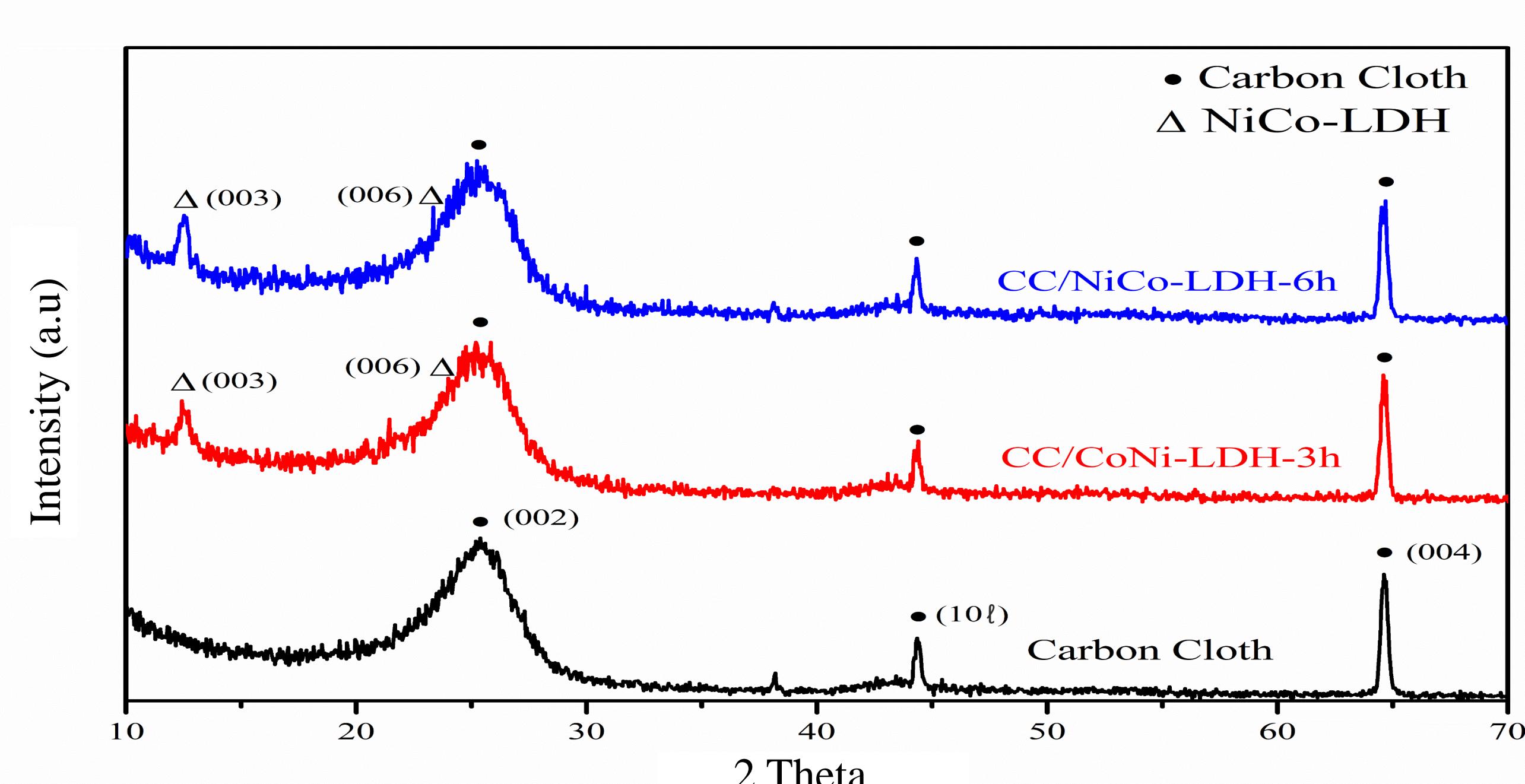


Figure 3. XRD patterns of Carbon cloth, CC/NiCo-LDH-3h and CC/NiCo-LDH-6h.

Table 1. GCD curves at 10 A g^{-1} and using GCD calculated formula of carbon cloth CC/CoNi-LDH-3h, CC/CoNi-LDH-6h.

	Current density	Specific capacitance
Carbon cloth	10 A g^{-1}	2.9 F g^{-1}
CC/NiCo-LDH-3h	10 A g^{-1}	890 F g^{-1}
CC/NiCo-LDH-6h	10 A g^{-1}	2530 F g^{-1}

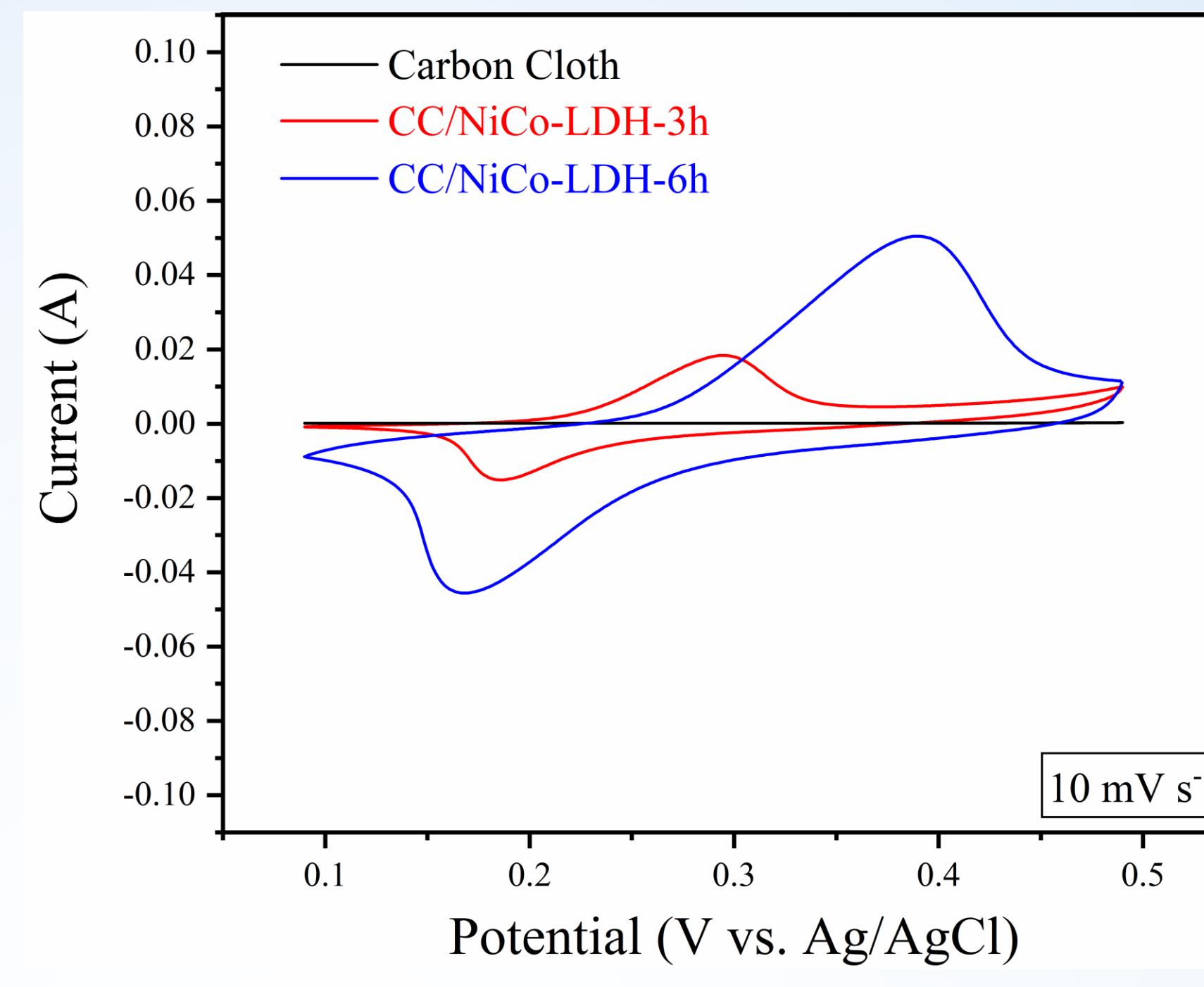


Figure 4. CV curves of carbon cloth, CC/NiCo-LDH-3h and CC/NiCo-LDH-6h at a scan rate of 10 mV s^{-1} .

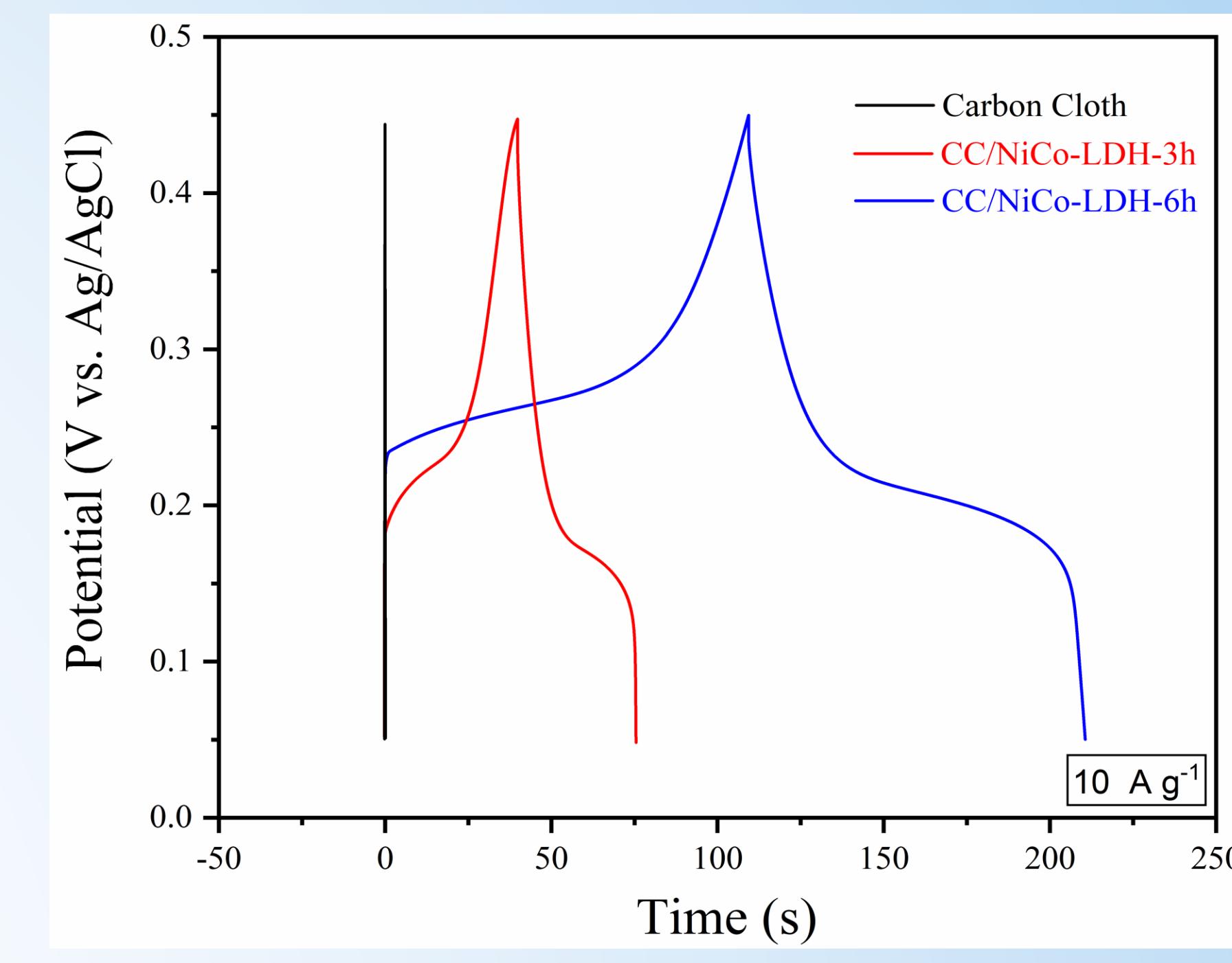


Figure 5. GCD curve of carbon cloth, CC/NiCo-LDH-3h, and CC/NiCo-LDH-6h at a current density of 10 A g^{-1} .

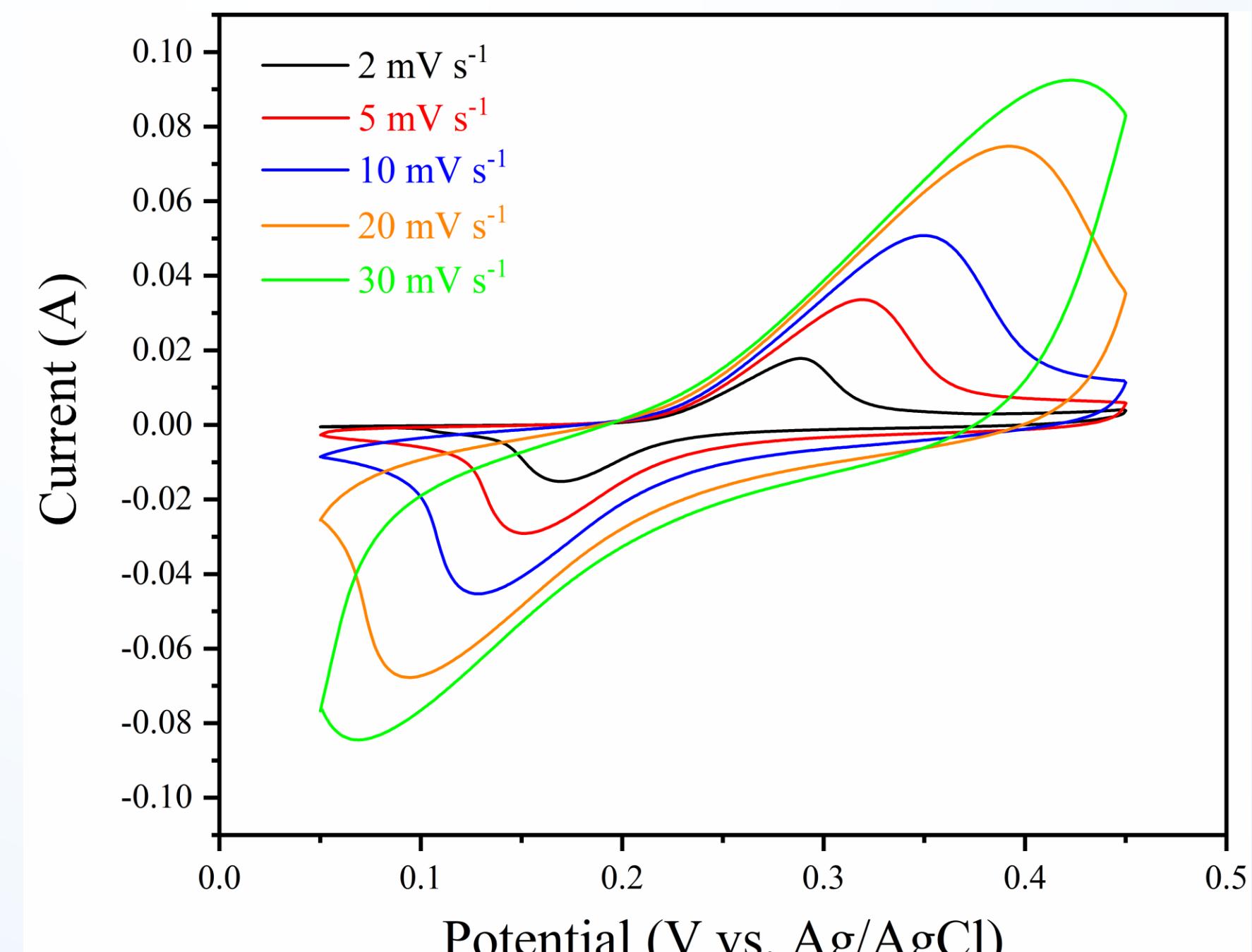


Figure 6. CV curves of CC/NiCo-LDH-6h as a function of scan rate.

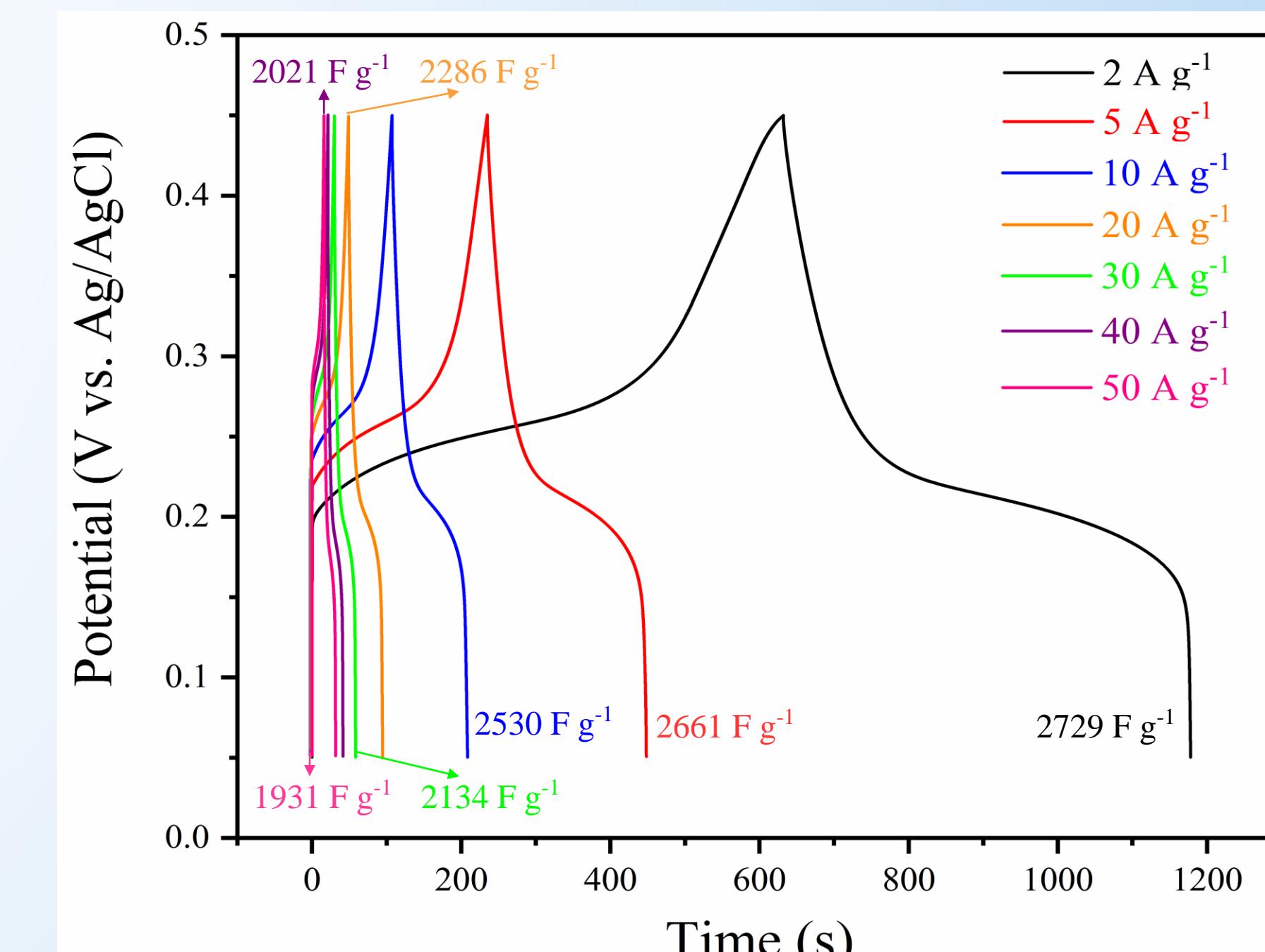


Figure 7. GCD curves of CC/NiCo-LDH-6h as a function of current density.

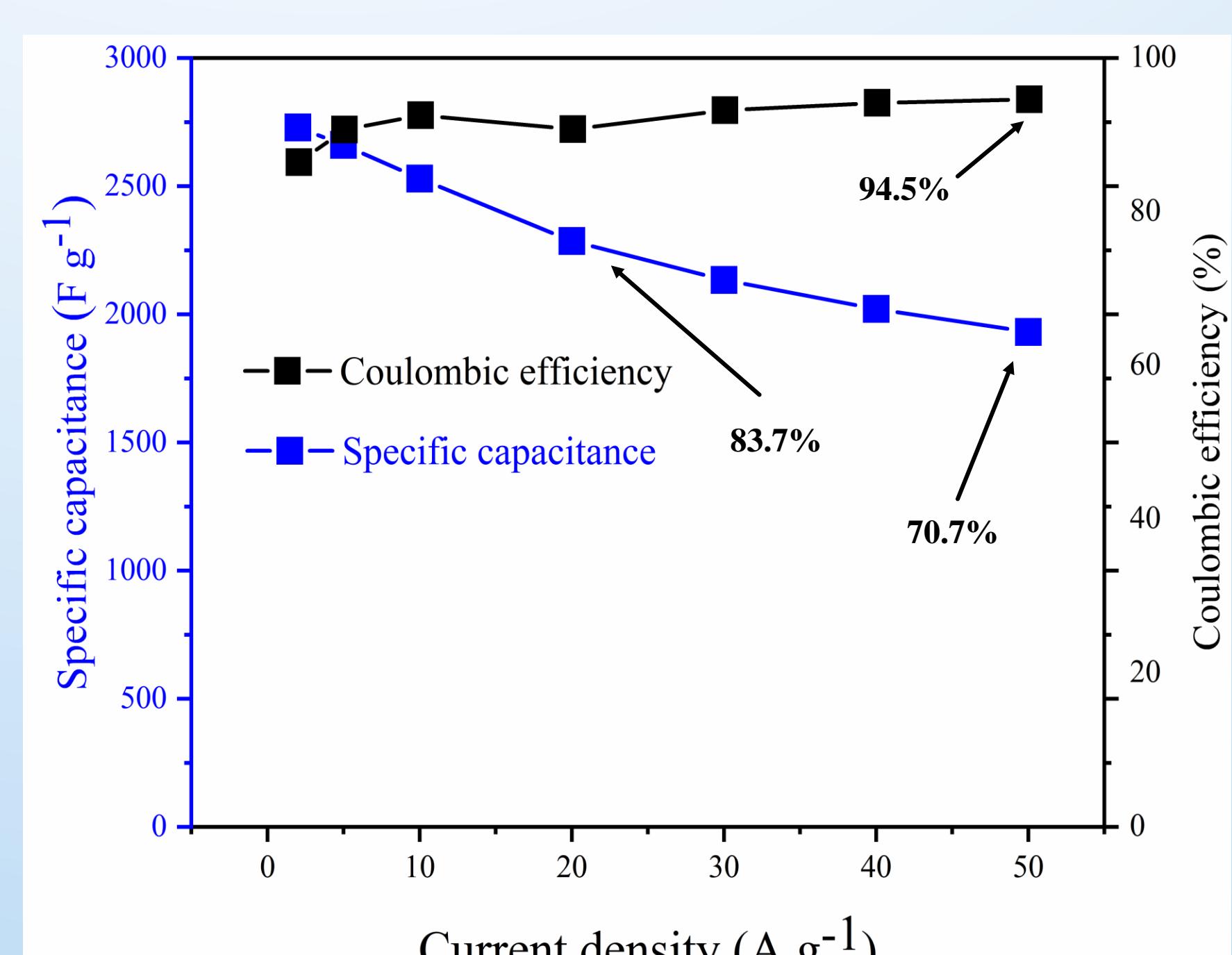


Figure 8. Specific capacitance and coulombic efficiency of CC/NiCo-LDH-6h as a function of current density.

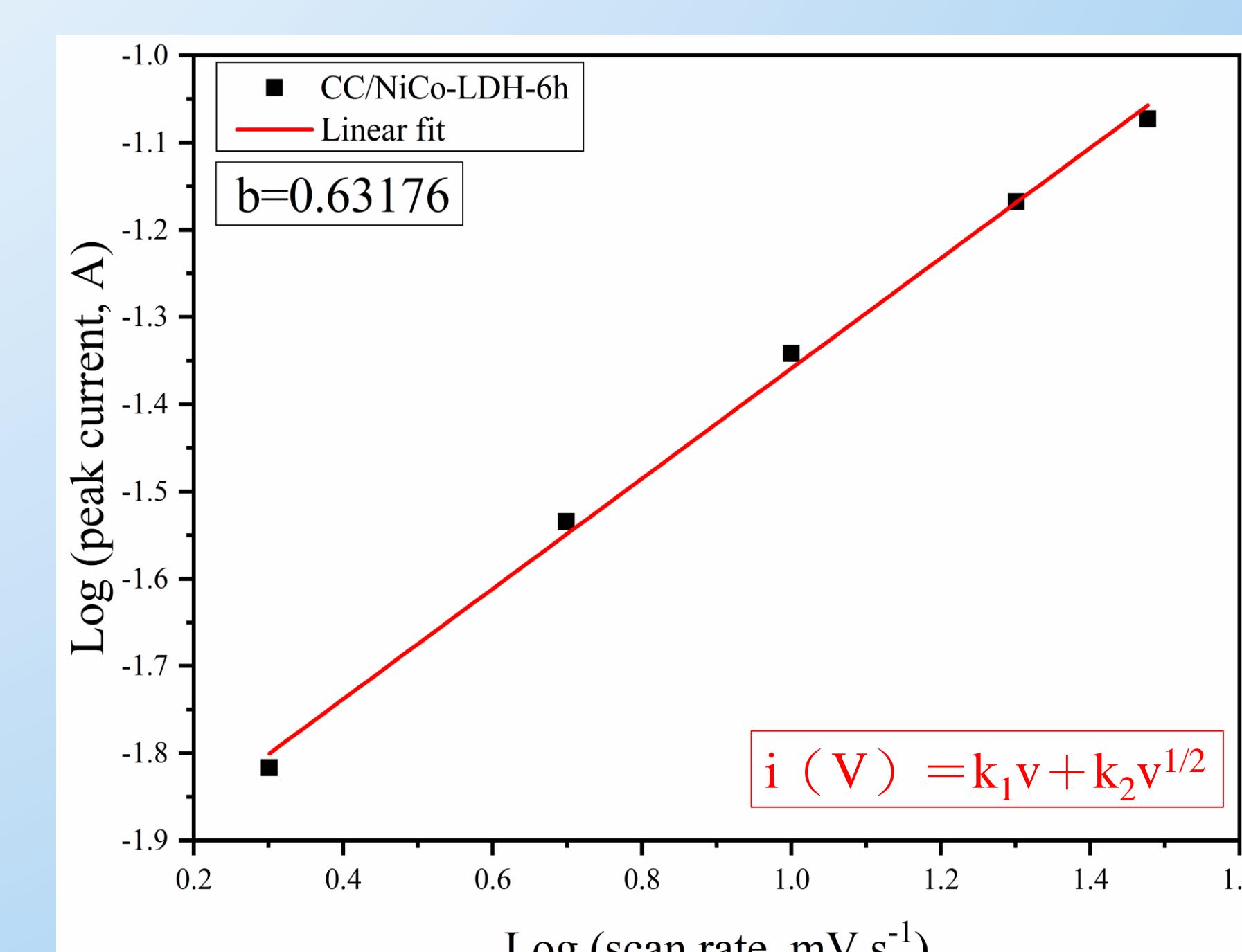


Figure 9. Linear fitting line relationship between $\log(A)$ vs. $\log(V)$ for CC/NiCo-LDH-6h.

結論

透過簡便的一步驟溶劑熱法，就能夠合成出層狀雙氫氧化物的活性材料，碳布可以提供成核點讓NiCo-LDH生長，而CC/NiCo-LDH-6h電極具有出色的電容特性（在 2 A g^{-1} 下表現出 2729 F g^{-1} 的比電容值）以及高電流放電下的穩定性（在 50 A g^{-1} 下保有70.7%的電容），也證明該電極具有良好的電化學性能。