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The effect of alkali metal-doping in carbon nanotubes on the electrochemical hydrogen storage capacity

탄소나노튜브에서 알칼리 금속 도핑이 전기화학적 수소저장 용량에 미치는 영향 연구

키브리아, 모영환, 박기수, 이영희*, 남기석

School of Chemical Engineering & Technology, *School of Science & Technology, Chonbuk National University, Chonju 561-756

Recently, it has been reported that alkali-metal doped carbon nanotubes (CNTs) can storage promising amount of hydrogen. Convinced on it, study on the hydrogen storage capacity of alkali-metal doped carbon nanotubes (CTNs) was carried out electrochemically. The CNTs were grown on Ni/Al_2O_3 catalysts by arc-discharge method and chemical vapor deposition (CVD) method. The Li, Na and K metals were doped in CNTs using metal salts and solid state reactions. The charge-discharge behaviors were tested in a cell having a Ni counter electrode and 6M KOH solution electrolyte at a current density of 0.4 mA/cm^2. Except Li-doped CNTs, the cyclic voltammograms showed two peaks resembled to Ni(II)⇔Ni(III) transformations. For the CNTs grown by CVD method, the charge capacity gradually increased and discharge capacity decreased with cycling. Except the Li-doped CNTs, the discharge capacity decreased in a rate of about 0.5%/cycle. In the first cycle, the normalize charge capacity showed a ratio of undoped: Li: Na: K-CNTs = 1.0: 3.0: 0.4: 0.2, and discharge capacity ratio about 1.0: 6.3: 1.2: 1.2. The charge-discharge capacity behavior of arc-discharged CNTs followed almost similar trend of CVD grown CNTs. The first cycle normalize charge capacity ratio remained almost unity, whereas the discharge capacity ratio varied largely. On cycling, the fading rate showed greater values than that of CVD samples. Among the tested metal-doped CNTs, the Li-doped CNTs showed the best performance.