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Effects of Surface Functional Groups and Pore Size Distributions of an Activated Carbon Powder on Electrochemical Double Layer Capacitance

활성탄소의 표면관능기와 기공크기분포가 전기 화학적 이중층 커패시턴스에 미치는 영향

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The effects of surface functional groups and pore size distributions of an activated carbon powder on electrochemical double layer capacitance in a 30 wt.% H_2SO_4 solution were investigated using nitrogen gas adsorption, Boehm method, galvanostatic charge/discharge experiment, and cyclic voltammetry. The activated carbon powder specimens with various pore size distributions and surface areas were prepared from the re-activation process of commercially activated carbon powder MSC-25 at 1000 ℃ under a CO_2/CO gas mixture for various activation times. The pore size distributions and surface areas were determined with help of nitrogen gas adsorption at 77 K. In exploring the role of surface functional groups in electrochemical double layer capacitance, the activated carbon powder was subjected to heat treatment in order to control the amount of surface functional groups. From the results of Boehm method, it was shown that the amount of surface functional groups of the activated carbon powder increased with the duration of heat treatment at 350 ℃ in air atmosphere and the main constituents of surface functional groups were identified as carboxyl, lactone, phenolic, and carbonyl groups. From the galvanostatic charge/discharge experiment and cyclic voltammetry, it was found that the electrochemical double layer capacitance is closely related to surface functional groups and pore size distributions of an activated carbon powder: the higher the amount of surface functional groups of the activated carbon powder is, the lower results the electrochemical double layer capacitance and the higher occurs the leakage current. In addition, the critical pore size necessary for the formation of surface functional groups on activated carbon powder and corresponding electrochemical double layer capacitance were evaluated.