Nanocomposites and nanomaterials

Nanoporous activated anthracite as a prospective material for fuel cell electrodes

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The main problem for fuel cell commercialization is a cost of electrode materials, especially a cost of metals. There are many efforts directed to platinum economy [1]. The quality of carbon support is also important. Anthracite filled with carbon content up to 92-98%. The thermal and electric conductivity of anthracite is higher in comparison with ordinary coals. Activation of the Donets anthracite (AA) in special conditions permits to produce active carbon with nanopores mainly in range of 0.8-2.5 nm. Such carbon supporter is able for electrochemical applications [2,3].

Activated anthracite after de-ashing by hydrofluoric acid had surface area about 1000 m^2/g, pore volume with nitrogen about 0.6 cm^3/g, and apparent density 0.25 g/cm^3. The synthesis of electrocatalysts with Pd and Cu has performed by deposition of $PdCl_2$ and $CuCl_2$ in water solution onto surface of AA with following reduction by H_2 in flow reactor. Prepared electrocatalysts 2.5%Pd/AA, 5%Pd/AA, 10%Cu/AA, and commercial Aldrich 3%Pd/C tested in low temperature fuel cell. Polarization curves were recorded at the temperatures 22°C, 40°C, 50°C, and 70°C.

Power density of 2,5%Pd/AA was on 30-35% more and 5%Pd/AA was on 45-50% more as comparison with commercial Aldrich 3%Pd/C catalyst. Power density of 10%Cu/AA was only 60-65% of power density of commercial Aldrich 3%Pd/C catalyst. The last result is also good taking into account the low prices of Cu. So, nanoporous AA is a prospective material for fuel cell electrodes.

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