The Effect of Carbon Materials on the Performance of a Direct Carbon Fuel Cell with Molten Hydroxide Electrolyte

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The direct carbon fuel cells (DCFCs) belong to new generation of energy conversion devices that are characterized by much higher efficiencies and lower emission of pollutants than conventional coal-fired power plants.[1]Over the past several decades fuel cell technologies have been treated as promising candidates for various utility applications.Today fuel cells are still considered an environmentally friendly and highly efficient electricity generating systems and extensive research has been conducted worldwide to improve this technology.The direct carbon fuel cell (DCFC) is a unique type of fuel cell able to convert efficiently the chemical energy of solid carbonaceous fuels directly into electricity without the combustion of the fuels. The theoretical maximum efficiency of carbon conversion in the DCFC is 100%,but practical efficiencies have been demonstrated at roughly 80% [2].

The direct carbon fuel cell (DCFC) can be used to generate electricity directly from almost any carbonaceous fuel, including carbonaceous waste materials, graphite, charcoals,carbon blacks, carbon fiber, and coals.[3]Here we focused different carbon materials such as commercial graphite,carbon black,commercial hard coal,biochar and active carbon,thus can find a better material for the improvement of the molten hydroxide direct carbon fuel cell.

Biomass carbon sources with an inter-connected multirole pore or beneficial element through a green route are a new generation of electrode, which is rapidly expanding research area. The extraordinary synthetic approach presented here opens the door of green chemistry for biomass-based the direct carbon fuel cell, which considers various pore geometries and dipping of element to design electrode materials with improved battery performance. Above all, the routes used to synthesize this carbon-based electrode are readily scalable to industrial levels.

References

[1] A. Kacprzak, R. Kobyłecki, R. Włodarczyk, Z. Bis, Efficiency of non-optimized direct carbon fuel cell with molten alkaline electrolyte fueled by carbonized biomass, J Power Sources, 321 (2016) 233-240.

[2] A. Kacprzak, R. Kobylecki, Z. Bis, Influence of temperature and composition of NaOH–KOH and NaOH–LiOH electrolytes on the performance of a direct carbon fuel cell, J Power Sources, 239 (2013) 409-414.
[3] L. Guo, J.M. Calo, C. Kearney, P. Grimshaw, The anodic reaction zone and performance of different carbonaceous fuels in a batch molten hydroxide direct carbon fuel cell, Appl Energ, 129 (2014) 32-38.