PALLADIUM-BISMUTH BIMETALLIC CATALYSTS EVALUTED FOR PERFORMANCE IMPROVEMENT OF DIRECT FORMIC ACID FUEL CELL

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Recently, there have been demands for development of highly efficient fuel cell for electronic devices of medical and military purposes. Polymer electrolyte membrane fuel cell (PEMFC) was regarded the system because of high fuel efficacy and high durability [1]. But, cost is paid more for addressing the sealing issue of explosive hydrogen gas. To alleviate the difficulties, as alternative way, direct formic acid fuel cell (DFAFC) is therefore getting paid attention [2].

The DFAFC using formic acid as fuel is emerging in that it can reduce roadblocks of PEMFC. It is becoming seriously considered due to the following reasons. First, it is safe for human body. Second, it is well fragmented with proton and formate anion third, crossover rate of formic acid is low due to repulsive force between formate ion and ion cluster of membrane.

As catalysts for increasing activity of formic acid oxidation reaction (FAOE), Pt and Pd have been considered [3], while metals like Cu, Ni and Co were used to enhance catalytic activity of the FAOE. Although Pt was mainly considered as the baseline one for FAOE, CO-poisoning and expensive price banned its business and hence, attempts to find new ones changing Pt were made. Pd was regarded as the alternative owing to less CO poisoning, But, Pd has even still issues in durability and price. To relieve the problems of Pd, PdM bimetallic catalysts including cheap transition metal like Bi and Mn were regarded [4,5]. Of them, in particular, PdBi catalyst induced enhancement of FAOE activity and low cost.

In present research, Pd is alloyed with Bi by using polyol method to configure PdBi catalyst [5]. With formation of the PdBi catalyst, its reaction mechanism was inspected by analyzing catalytic activity and DFAFC performance. In addition, its CO-poisoning issue was elucidated. In a bid to do that, chemical, optical and electrochemical experiments such as TEM, XPS, CV and polarization curve were performed. Furthermore, to decrease degree of aggregation of the PdBi particles, special surfactant was also introduced and used [6]. By inflicting the changes in amount of adopted surfactant and molar ratio between Pd and Bi particles, catalytic activity of PdBi particles was improved and mutual effect and reaction mechanism were also investigated.

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