Molecular Fuel Cell

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Molecular hydrogen is considered to be the most promising of chemical fuels in terms of removing our dependence on fossil fuels, but the development of cheap, efficient, fuel-cell systems has not yet been realized. Currently, fuel cells are based on the heterogeneous, homolytic splitting of H_2 on a platinum surface, but these fuel cells have the obvious problem that Pt is both scarce and expensive. Furthermore, few improvements in efficiency have been achieved in over a hundred years, so a new model for fuel-cell catalysis is required to generate a fuel-cell-based economy. Though a few related systems have been reported, the successful construction of a new type of fuel cell has not been achieved to date.

Fuel-cell development can be taken in an entirely new direction by the introduction of molecular catalysts capable of working in homogeneous solutions. Molecular catalysts have the advantage of being highly variable in terms of design, and solution-phase catalysis is important because it enables us to directly observe the details of the mechanism. By combining these two features, we can view the path to greater efficiency. We have developed such a molecular catalysts for fuel cell (Figure 1a), which generated electric power (Figure 1b).[1-3]

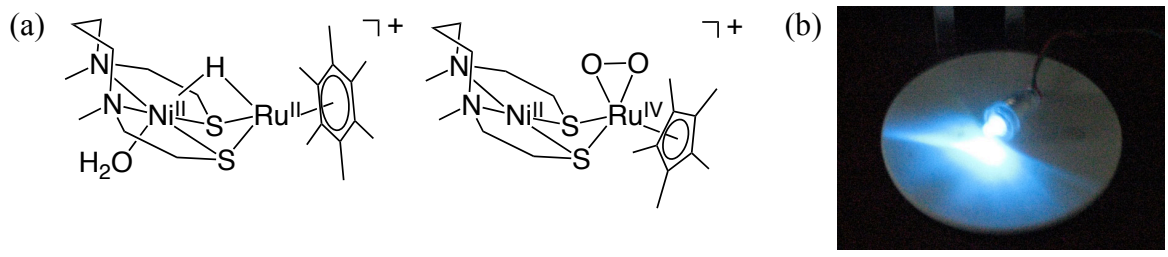

Figure 1. (a) Molecular catalysts for fuel cell. (b) Power generation of molecular fuel cell.

[1] Matsumoto, T.; Kim, K.; Ogo, S. *Angew. Chem. Int. Ed.* **2011**, *50*, 11202-11205.
[2] Kim, K.; Matsumoto, T.; Robertson, A.; Nakai, H.; Ogo, S. *Chem. Asian J.* **2012**, *7*, 1394-1400.
[3] Matsumoto, T.; Kim, K.; Nakai, H.; Hibino, T. Ogo, S. *submitted.*