

Water Oxidation Catalyzed by Metal Complexes Composed of Ubiquitous Elements

Shigeyuki Masaoka : Institute for Molecular Science

Water oxidation ($2\text{H}_2\text{O} \rightarrow \text{O}_2 + 4\text{H}^+ + 4\text{e}^-$) is considered the main bottleneck in the production of chemical fuels from sunlight and/or electricity. In nature, the oxidation of water is efficiently catalysed by the oxygen-evolving complex (OEC) in photosystem II (PSII). Because extraction of the OEC is extremely difficult, various synthetic molecular catalysts have been investigated over the last decades. However, the development of efficient, robust and abundant metal-based molecular catalysts remains a challenge.

Inspired by the reaction mechanism of the OEC as well as based on our previous research findings [1,2], we have assumed that the active catalysts for water oxidation can be obtained by constructing metal complexes that have multinuclear structure and neighbouring water-activation sites. On the basis of the strategy, we successfully reported that a pentanuclear iron complex serves as an efficient catalyst for water oxidation (Figure 1).[3]

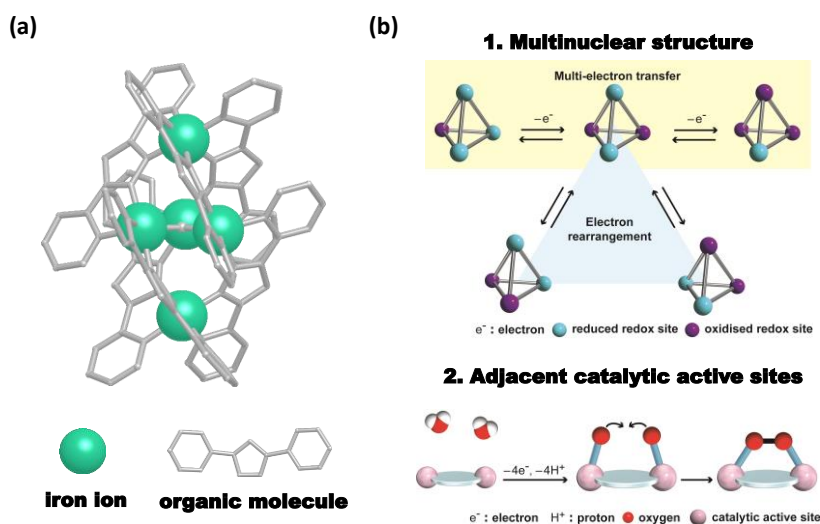


Figure 1. Structure (a) and characteristics (b) of the Fe_5 catalyst.

Bibliography

- [1] M. Yoshida, M. Kondo, T. Nakamura, K. Sakai, S. Masaoka, *Angew. Chem. Int. Ed.*, **53**, 11519–11523 (2014).
- [2] M. Yoshida, M. Kondo, S. Torii, K. Sakai, S. Masaoka; *Angew. Chem. Int. Ed.*, **54**, 7981–7984 (2015).
- [3] M. Okamura, M. Kondo, R. Kuga, Y. Kurashige, T. Yanai, S. Hayami, V. K. K. Praneeth, M. Yoshida, K. Yoneda, S. Kawata, S. Masaoka; *Nature*, **530**, 465–468 (2016).

External links

https://groups.ims.ac.jp/organization/masaoka_g/