

Multifunctional Catalysts Mimicking Enzymes for H₂/CO-O₂/H₂O₂ Fuel Cells

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Hydrogen fuel cells are one of the promising devices for energy conversion. However, crucial issues in fuel cells are poisoning of platinum catalysts by CO, which is contained in commercial supplies of H₂ at the anode, and damage of non-Pt catalysts and membranes by H₂O₂, which is produced by incomplete reduction of O₂ at the cathode. In order to address these problems, much researches have focused on catalysts that can function in their presence or even utilize them as part of the feed stream.

Oxidations of H₂ and CO in biological systems are catalyzed by [NiFe]hydrogenase ([NiFe]H₂ase) and CO dehydrogenase (CODH), respectively. Furthermore, O₂-tolerant [NiFe]H₂ase catalyzes the reduction of O₂ and decomposition of H₂O₂. Here, we report a NiIr catalyst as models for both [NiFe]H₂ase and CODH, which can catalyze simultaneous oxidations of both H₂ and CO, and a NiRu catalyst as a model for O₂-tolerant [NiFe]H₂ase, which is capable of catalyzing simultaneous reductions of both O₂ and H₂O₂ (Figure 1)^{1,2}. Furthermore, we have succeeded in construction of fuel cells fabricated with these two multifunctional catalysts running on H₂/CO and O₂/H₂O₂ for the first time.^{1,2}

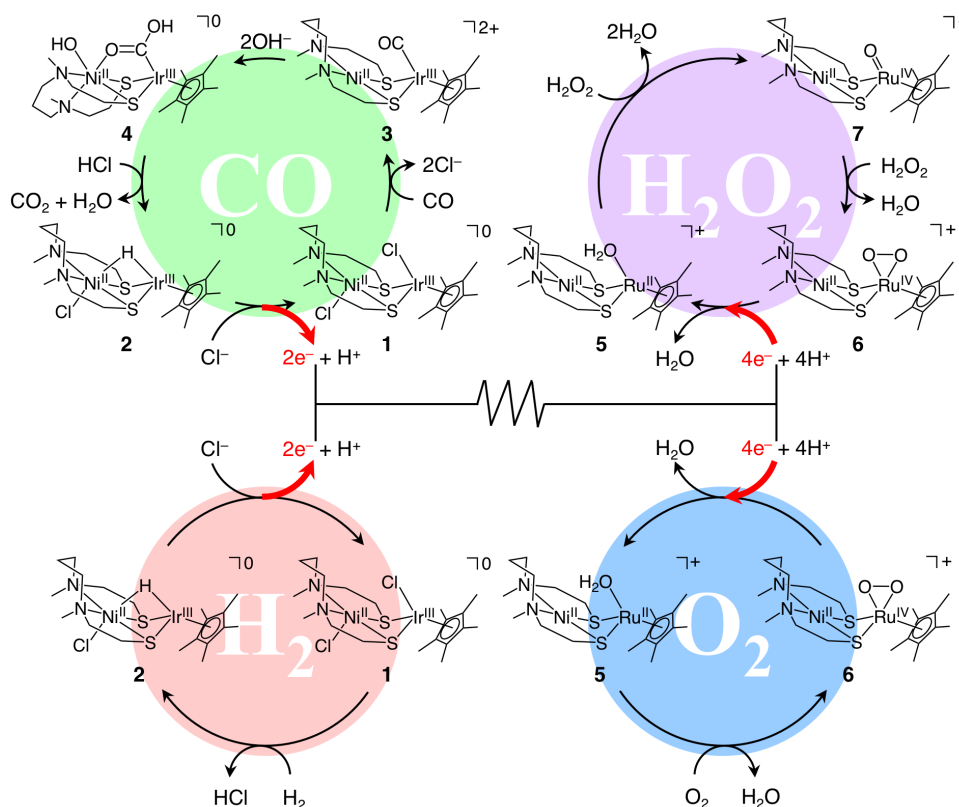


Figure 1. Simultaneous activation of H₂, CO, O₂ and H₂O₂ by the NiIr and NiRu catalysts for H₂/CO–O₂/H₂O₂ fuel cells.

References

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