



Smart Nanoarchitectures of Materials as Efficient Catalysts

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<http://www.msl.titech.ac.jp/~hara/index-e.html>

- Creating advanced nanoarchitectures of metals and metal-oxides
- Tunable structural, surface and electronic properties for high activity
- Development of efficient catalytic system for production of value-added chemicals and solar-fuel

1) Heterogeneous catalysis

Biomass-derived products

Fuels

Synthetic Fibers



Agrochemicals

Fine Chemicals



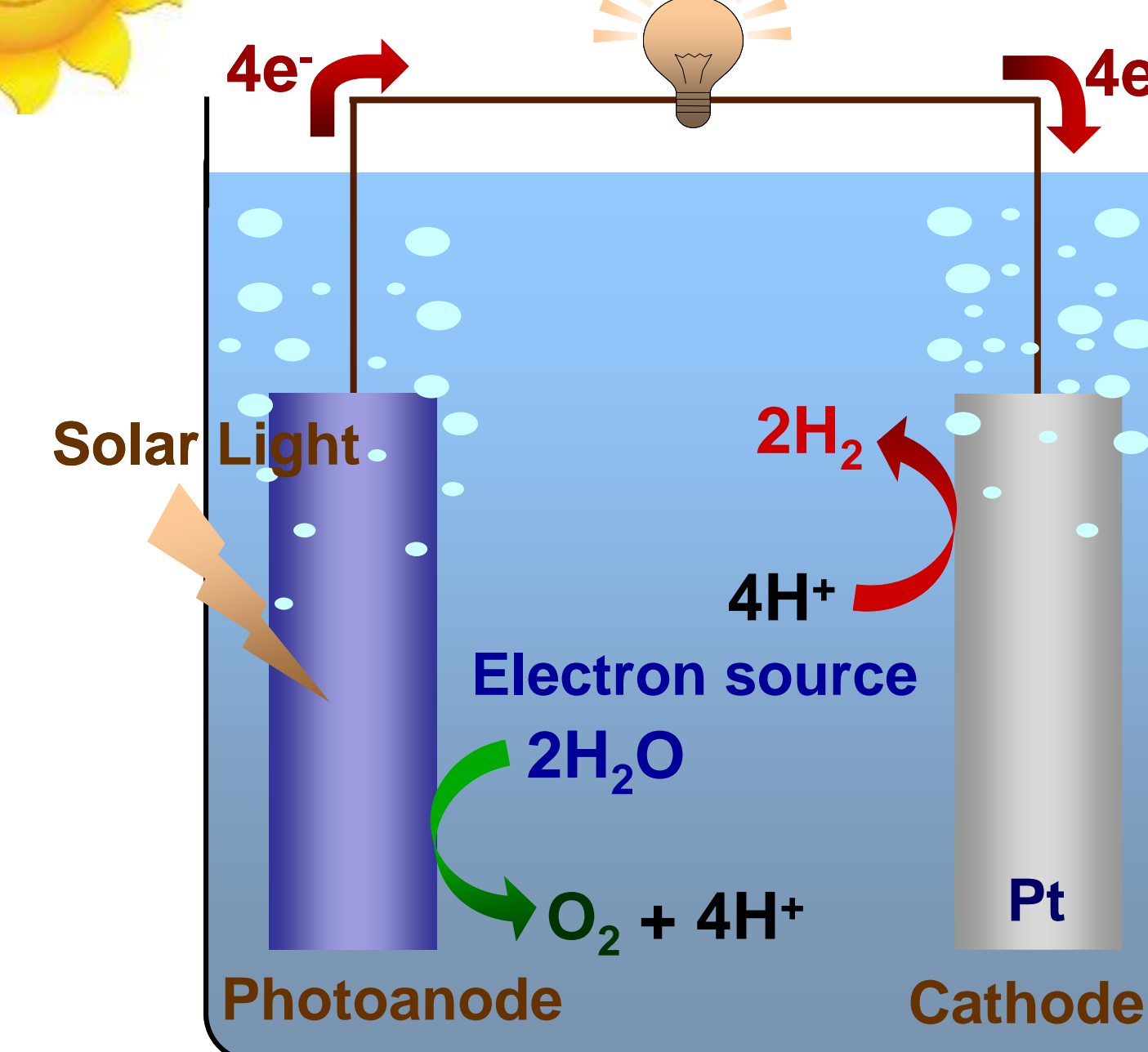
**Nanoarchitected
and Porous Materials**

High surface area
Tunable functions
Active surface structure
Efficient catalysts

2) Solar energy conversion

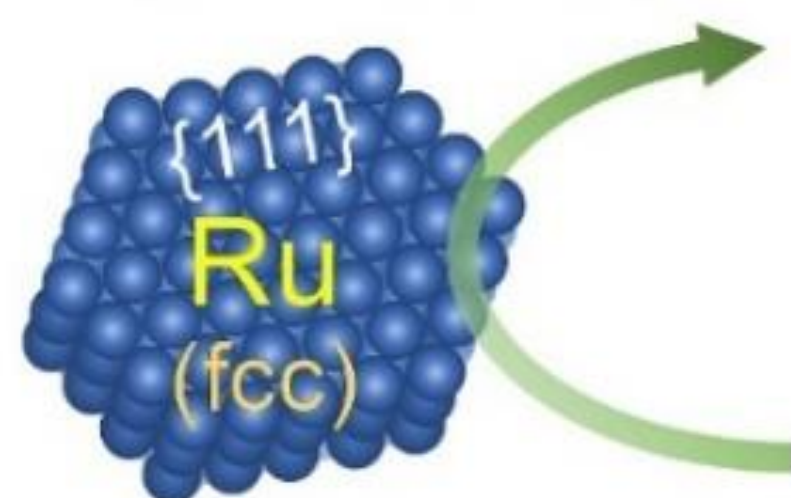


Water splitting

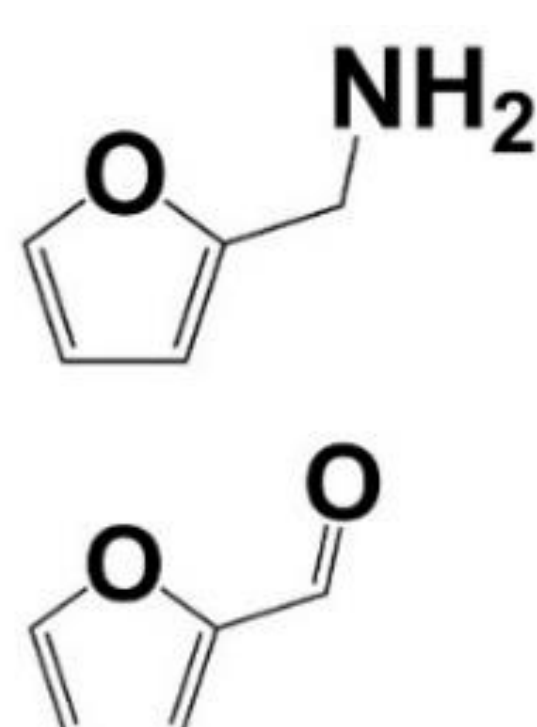


Shape-specific metal nanoparticles

TOF = 1850 h⁻¹



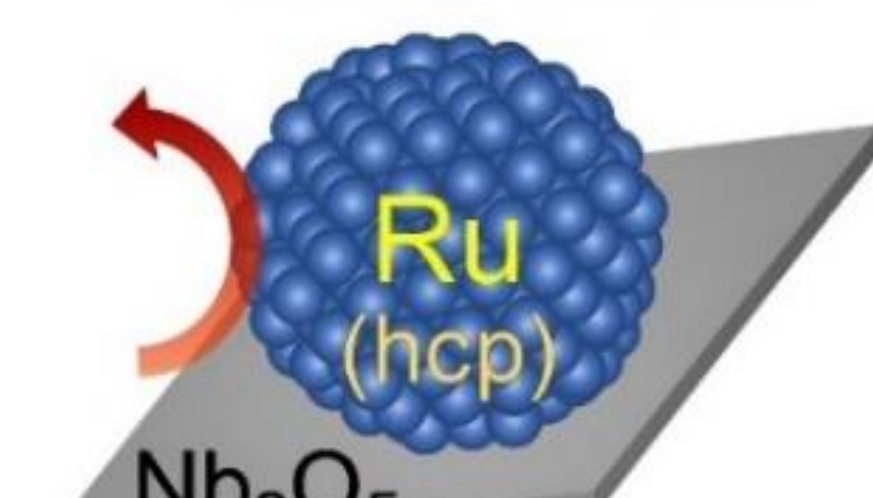
Flat-shaped nanoparticle



Reductive amination

Chem. Sci. **2018**, 9, 5949

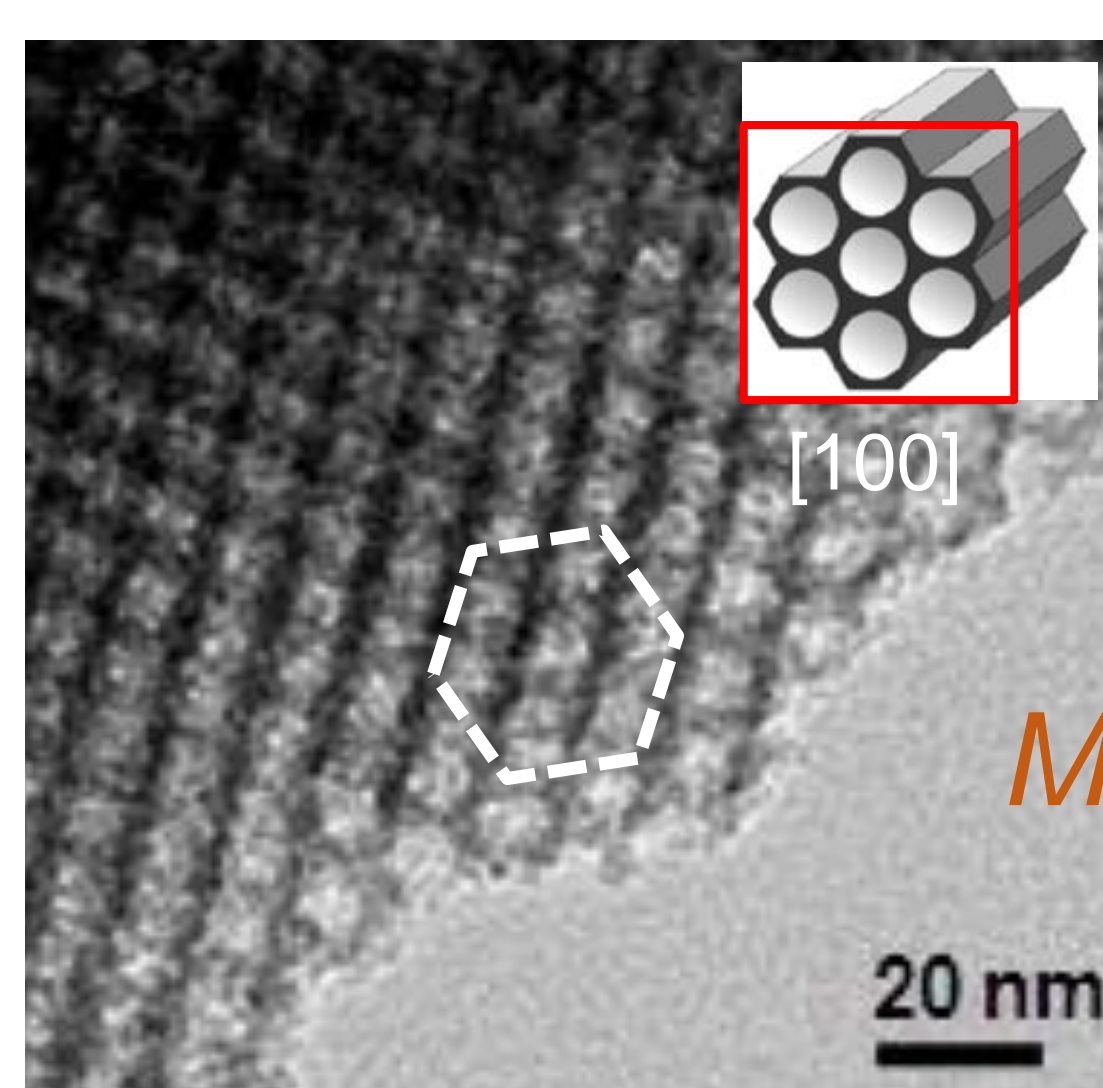
TOF = 310 h⁻¹



Supported metal catalyst

ACS Catal. **2016**, 6, 3946

IrO₂ Electrocatalysts

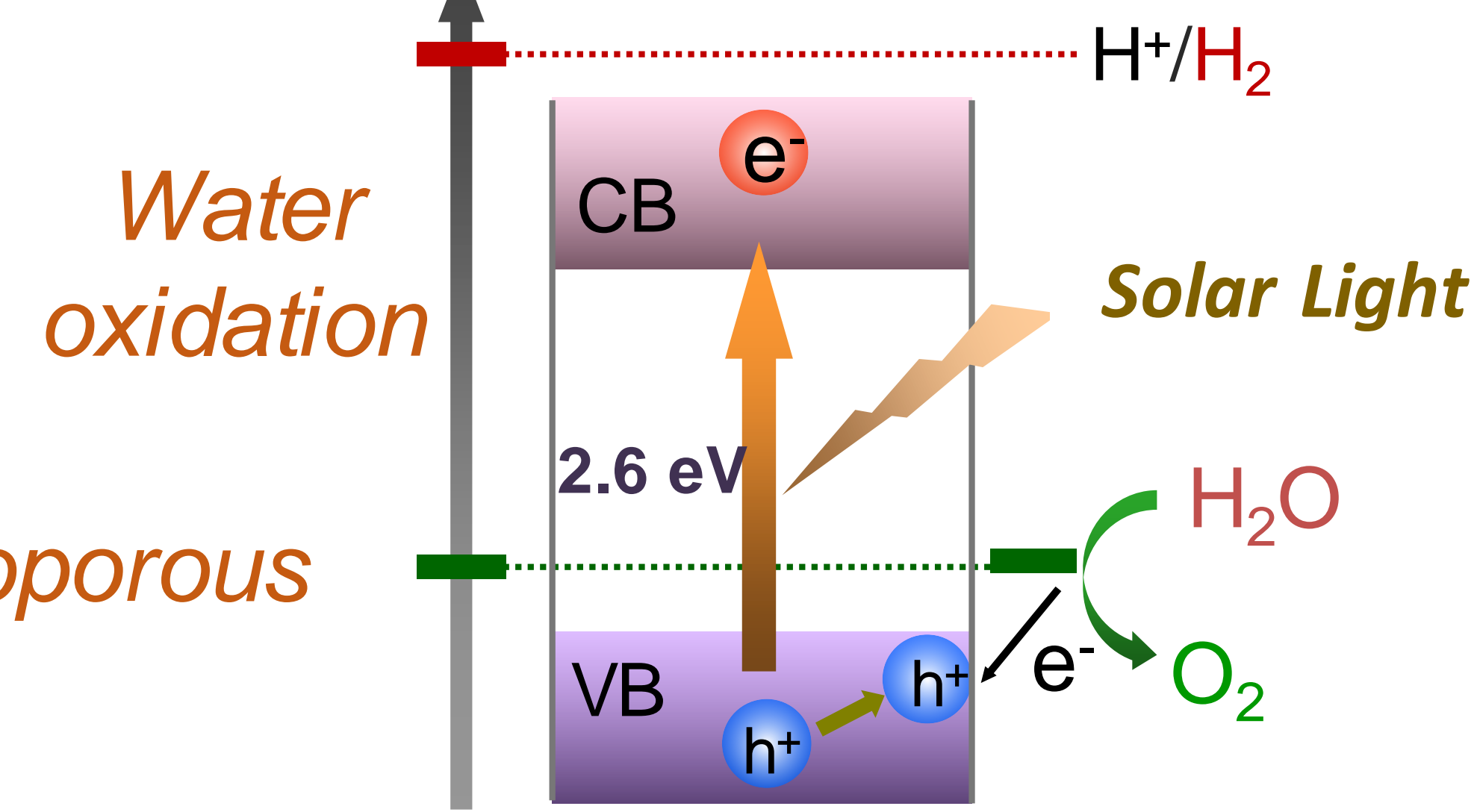


Water oxidation

Mesoporous

ACS Catal. **2016**, 6, 3946

WO₃ Photoanodes



Angew. Chem. Int. Ed. **2013**, 52, 12606

Specific flat-shaped fcc Ru nanoparticles catalyst having a large fraction of atomically active {111} facets, produce various primary amines selectively at exceedingly high reaction rates

