

The Magic of Catalysis :

Can We Realize Materials Outperform Platinum?

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In recent years, hydrogen energy society has attractive attentions, from the backgrounds of global warming and depletion of fossil fuels. Ideally, hydrogen should be generated by water electrolysis powered by renewable energy sources, such as photovoltaic cells. In addition, in case of using hydrogen, fuel cells are favorable energy devises which can covert hydrogen's chemical energy to electrical energy with high efficiency (Figure 1).



Figure 1 Fuel Cell Vehicles (FCV)

Platinum (Pt) is currently used for catalytic materials (Figure 2) both for reactions in water electrolyzer and fuel cells. Furthermore, it also has been applied for various chemical processes, because of the high catalytic activity and high chemical stability. So, what are physical and chemical origin of high catalytic properties of platinum among transition metal elements (Figure 3) ? Would it be possible to develop alternative catalysts for platinum?

In this course, we study the origin of high catalytic properties of platinum through experiments of water electrolysis hydrogen evolution reaction activity evaluations for various metals and metal compounds. Furthermore, we discuss possibility of novel catalysts which show higher catalytic activity than platinum and make a blueprint for catalyst materials development. The seminar will be held face-to-face.

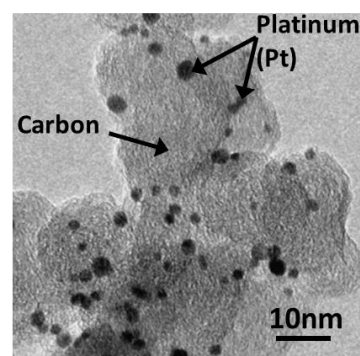


Figure 2 Transmission Electron Microscope (TEM) image of Pt nanoparticles on carbon black

3d-5d Transition Metals

Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd
Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg

Figure 3 Various transition metal elements