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Elucidating Why Immiscible Elements Homogeneously Mix in Nanoparticle —Toward Creaction of Novel Functional Materials—

Alloy is widely used in a variety of application field. It is well-known that some combinations of metal elements do not mix each other likewise the case of oil and water. A novel approach known as “interelement fusion”, an approach to mix the immiscible elements homogeneously at the atomic level, is attracting much attention recently. Thus, the homogeneously mixed solid solution alloy of immiscible combinations of elements, such as Pd and Pt, Ag and Rh, are synthesized recently. However, there are open fundamental questions such as why immiscible combination mixes?, is the homogeneous alloying realized under a specific condition or is it thermodynamically stable in the nano-scale?
This study elucidate that the immiscible combinations of elements can mix stably in the nano-scale, meaning the change in the thermodynamics. If we can control the mixture state, i.e. if we can mix or demix the elements, we can design materials of excellent or unknown properties at our will for the purposes of, for example, the automotive exhaust catalyst to support our daily life free from air pollution, advanced fuel cell catalysts for highly efficient use of hydrogen fuel, and decomposition catalyst of environmental endocrine disrupters to support a good indoor air quality. We will continue the research for development of highly advanced materials based on the present achievements.

Message from Researchers :

We obtained a guiding principle to prepare a recipe to homogeneously mix the elements that are described as immiscible in the textbook.

There are huge number of unexplored combinations of immiscible elements. We will move forward the creation of alloys possessing properties unknown so far.

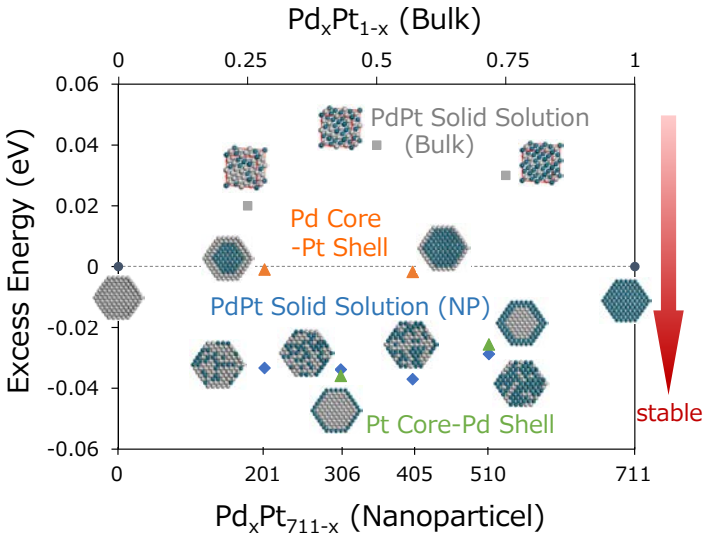

Fig. 1
Stability of different configuration of Pt (gray sphere) and Pd (turquoise sphere). Lower in the figure means stable.

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