



PLATINUM GROUP METAL-BASED SOLID-SOLUTION ALLOY NANOCRYSTALS: BINARY TO HIGH-ENTROPY ALLOY

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Platinum group metal (PGM) nanoparticles (NPs) have been investigated in a variety of research fields such as catalysis and electronics. Among the types of alloys, solid-solution alloy NPs have the advantage of being capable of continuously changing their properties by tuning their composition. However, synthesizing PGM solid-solution alloy NPs with any combination and composition is not an easy task due to the metallurgical aspects. We have focused on PGM-based solid-solution alloy NPs, and particularly those with immiscible alloy systems. The physical and chemical properties of most solids are strongly correlated to their electronic structure, particularly the DOS at the EF. In 2015, we proposed the “DOS engineering” concept for designing materials as shown in Figure 1, which calls for the control not only of the location of the *d*-band center, but also of a suitable DOS shape, such as the band width and the DOS shape of unoccupied and occupied states around EF [1]. By means of “interelement fusion” where the elemental periodic table is colored by the *s*, *p*, *d*, and *f* groups, it is possible to manipulate the shape of the DOS freely by choosing elements from the *s*, *p*, *d*, and *f* groups according to the properties desired [2-7].

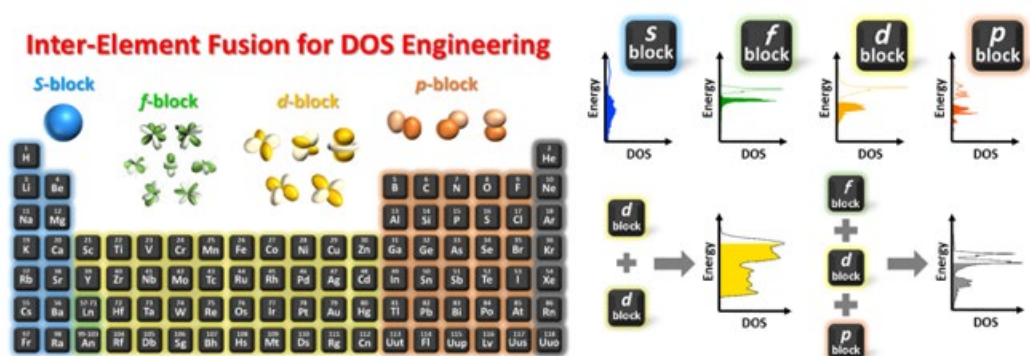


Figure 1: Density-of-states (DOS) engineering by inter-element fusion using *s*-, *p*-, *d*-, *f*-block elements for designing desired materials having the best DOS.

Ref.

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