

A Sketch of the Solid State-Nuclear Sciences

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Since the discovery of nuclear reactions in PdD_x alloys in 1989, there have been accumulated very many experimental data sets showing existence of nuclear reactions in materials composed of transition metals and occluded hydrogen isotopes (let us call them the *CF materials*, for short)). As the cause of these nuclear reactions in the CFP, we have got to accept the existence of the interactions between nucleons in the CF material through the nuclear force (let us call this interaction the *nuclear-force interaction*, for short).

Even if the nuclear force has recognized as the cause of nuclear reactions observed in the CFP since its discovery in 1989, there should be its fingerprints in other phenomena in solid state physics and chemistry occurring in materials with similar compositions to the CF material (let us call these materials the *nuclear-solid materials*, for short). Since the Graham's discovery of the absorption of hydrogen by palladium and palladium-silver alloys in 1866, the physics of the transition metal hydrides has shown a great development revealing various characteristics of the physics in them especially the extremely high diffusivity of hydrogen in metals and alloys (let us call this phenomenon as the *super-diffusivity*, for short). We have noticed the relation between the CFP and the super-diffusivity and explained some characteristics of the CFP using the data of the super-diffusivity. On the other hand in the electrochemistry, there have been observed such wonderful events closely related to the interaction between the transition metals and the hydrogen at the electrode surface as the hydrogen electrode reaction (HER) and the underpotential deposition (UPD). There are many characteristics of the HER and UPD remaining unexplained for more than 80 years after the formulation of the problem in 1933 by A.N. Frumkin. Furthermore, there have been discovered the *exotic nuclei* with a large unbalance of the numbers of protons and neutrons in the isolated nucleus in these 20 years.

In this paper, we point out several characteristic events in the super-diffusivity of hydrogen isotopes in transition metals and alloys, HER and UPD in electrochemistry, and the exotic nucleus interacting with occluded hydrogen isotopes in the nuclear-solid materials which seem to have close relations to the nuclear-force interaction noticed in the CFP.