

# MERIT Research Training (Internship) Activity Report

Department of Advanced Materials Science, Graduate School of Frontier Sciences

MERIT 3rd

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Period of Stay : 2017/3/14 - 4/21

Host: National Institute of Advanced Industrial Science and Technology (AIST)

## Theme

The novel synthesis method and application of prussian blue analogues, one of metal cyano complex, have been studied in my internship host, Nanoparticle Functional Design Group, Nanomaterials Research Institute, AIST. Recently, this group showed that prussian blue, which has been used as a blue pigment and its analogues have larger  $\text{NH}_3$  capacity compared to conventional adsorbent such as activated carbon (A. Takahashi *et al.*: *J. Am. Chem. Soc.* **138** (2016) 6376.). And, a rapid production of prussian blue as large as 600 g/h was accomplished by "micromixer", where a flow in the reaction field is controlled (A. Takahashi *et al.*: *Green Chem.* **17** (2015) 4228.).

Prussian blue has chemical formula  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ . Its crystal structure is cubic with space group Fm-3m (Figure 1). It can adsorb alkali metal ion and  $\text{NH}_4^+$  and so on with electric neutrality balanced by changing the valency of iron or introducing vacancy of

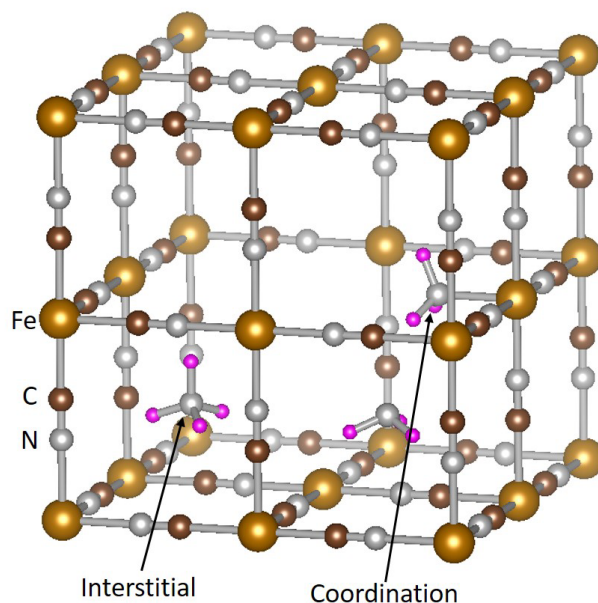


図 1 Crystal structure of prussian blue[1]

[Fe(CN)<sub>6</sub>]. The adsorbed ions are set into interstitial sites or coordination sites, where the adsorbed ions are coordinated to iron ions “exposed” by the vacancy of [Fe(CN)<sub>6</sub>]. There are many prussian blue analogues, containing V, Co, Zn and so on as substitute for Fe.

In this internship, the synthesis and physical property measurement were conducted to search the novel application of prussian blue analogues. My PhD study is concerning solid state properties of bulk materials, so I’m amateur in the application of cyano complex nanoparticle. I thought this internship was a precious opportunity to experience application study and this group allowed me to do such study. I cannot explain this study in detail here because it is still unpublished.

[1]K. Momma and F. Izumi, ”VESTA 3 for three-dimensional visualization of crystal, volumetric and morphology data,” J. Appl. Crystallogr., 44, 1272-1276 (2011).

### **Impression**

This internship was a precious opportunity to experience the research environment in national laboratory, AIST. There are many application studies such as collaborative research with a company in addition to the basic study as is done in a university. There are few students but many technical assistants. One of the most important works of researchers is the construction of experimental system done by assistants. It seems that time efficiency of such system is very important. From these viewpoint, I felt atmosphere different from a university. And it gave me a good opportunity to rethink my study plan in the university.

AIST Tsukuba central is 15-20 -minute bus ride away from Tsukuba station (Tsukuba express). In this internship, I spent very comfortable days using accommodation of this institute. There are many food shop and supermarket near AIST.

Nanoparticle Functional Design Group, Nanomaterials Research Institute, AIST welcomes the internship of the students with different backgrounds. If you are interested in the study of this group, please apply to the internship.

### **Acknowledgement**

I’d like to thank AIST and MERIT for the acceptance of this internship. Also, I thank Dr. T. Kawamoto, Dr. A. Takahashi, and the other members in Nanoparticle Functional Design Group for research training, and my supervisor Prof. Z. Hiroi for allowing this internship.