Mai Thanh Nguyen and Tetsu Yonezawa

Faculty of Engineering, Hokkaido University

E-mail: mai_nt@eng.hokudai.ac.jp (Mai Thanh Nguyen)

Synthesis of solid solution alloy nanoparticles and study of their structure transition

Solid solution alloy nanoparticles are considered as a promising candidate for a wide range of advanced applications in such as catalysis and optics. Using a co-sputter deposition technique, we have been successfully synthesized binary and ternary solid solution alloy nanoparticles composed of various metal systems including those typically miscible in the bulk or with large miscibility gaps, with composition of intermetallic compounds.[1-4] Our findings demonstrate the ability to control both particle size and tuning particle elemental composition across a broad range.

It is well established that the solid solution alloy nanoparticles can undergo changes in their crystal structure when subjected to elevated temperatures, particularly under catalytic conditions. In this current study, we focus on the structure transition behavior of binary solid solution alloy nanoparticles, specifically those with composition lying within the bulk miscibility gaps or corresponding to intermetallic compounds. We observe temperature dependent transition from solid solution alloy to intermetallic structure. A detailed discussion for a case study of AgPt nanoparticles will be presented to illustrate this transformation.

1) Nguyen, M. T., Zhang, H., Deng, L., Yonezawa, T., Tokunaga, T., *Langmuir*, **33**, 12389 (2017).

2) Deng, L., Nguyen, M. T., Shi, J., Chau, Y.-t. R., Tokunaga, T., Kudo, M., Matsumura, S., Hashimoto, N., Yonezawa, T., *Langmuir*, **36**, 3004 (2020).

3) Zhu, M., Nguyen, M. T., Chau, Y.-t. R., Deng, L., Yonezawa, T., *Langmuir*, **37**, 6096 (2021).

4) Zhu, M., Nguyen, M. T., Sim, W. J., Yonezawa, T., *Mater. Adv.*, 3, 8967 (2022).