Synthesis and properties of heterogeneous elemental blended Sn clusters using dendrimer template synthesis method

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Keywords: cluster, sub-nano particle, iron, tin, magnetic property

Metal clusters are known to exhibit unique properties different from those of the bulk. Some of these can mimic elemental atoms[1)], and are expected for elemental substitutions based on their peculiar properties. However, such clusters are only synthesized in small amounts in the gas phase or in stable clusters with a magic number in the liquid phase. Therefore, the preparation method to control atoms in the clusters are expected. In our laboratory, cluster synthesis using dendrimers has been developed for tuning the constituting atoms. The dendrimers have an electron density gradient enabling coordination of metal salts from the inner imines. By using this method, we have synthesized various metal clusters and revealed the properties depending on the number of constituent atoms and composition[2,3)]. In this study, we synthesized $FeSn_{12}$ as a Fe-Sn alloy cluster and develop its functions.

$FeCl_3$ and $SnCl_2$ were integrated into a fourth-generation dendrimer (pyTPM-DPA G4). 9-isoabsorption points were observed in the UV-Vis spectrum, indicating a stepwise complexation from the pyridine in the inner layer to the imine in the outer layer (**Fig. 1a, b**). Therefore, we synthesized clusters using pyTPM-DPA G4 as a template (**Fig. 1c**) and investigated their properties. The magnetic moment of $FeSn_{12}$ is larger than that of other Fe clusters synthesized in the same way.

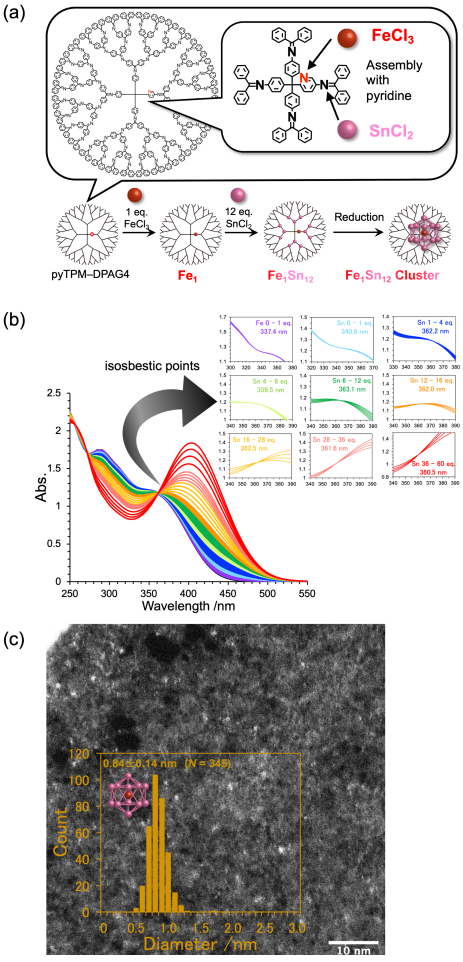

Fig. 1 (a) Images of this study, (b) UV-vis tightening of $FeCl_3/SnCl_2$ vs. pyTPM-DPA G4, (c) STEM image and size distribution of $FeSn_{12}$.

1) D. E. Bergeron *et al.*, *Science*, **2004**, *304*, 84. 2) K. Yamamoto *et al.*, *Nature*, **2002**, *415*, 509. 3) K. Yamamoto *et al.*, *Acc. Chem. Res.*, **2014**, *47*, 1127.

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