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Short Communication

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Fine-controlled subano-metal particles in a dendrimer reactor

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Abstract

We show that tin chlorides, SnCl2 and FeCl3 complexes to the imines groups of a spherical polyphenyl-azomethine dendrimer in a stepwise fashion according to an electron gradient, with complexation in a more peripheral generation proceeding only after complexation in generations closer to the core has been completed. The metal-assembly in a discrete molecule can be converted to a size-regulated metal cluster with a size smaller than 1 nm as a molecular reactor. Due to the well-defined number of metal clusters in the sub-nanometer size region, its property is much different from that of bulk or general metal nanoparticles. Dendrimers are highly branched organic macromolecules with successive layers or "generations" of branch units surrounding a central core. Organic inorganic hybrid versions have also been produced, by trapping metal ions or metal clusters within the voids of the dendrimers. Their unusual, tree-like topology endows these nanometer-sized macromolecules with a gradient in branch density from the interior to the exterior, which can be exploited to direct the transfer of charge and energy from the dendrimer periphery to its core. Here we show that tin ions, Sn2+, complex to the imines groups of a spherical poly phenyl azo-methane dendrimer in a stepwise fashion according to an electron gradient, with complexation in a more peripheral generation proceeding only after complexation in generations closer to the core has been completed. By attaching an electron-withdrawing group to the dendrimer core, we are able to change the complexation pattern, so that the core imines are complexed in the last. By further extending this strategy, it should be possible to control the number and location of metal ions incorporated into dendrimer structures, which can be used as tailored catalysts, building blocks, or fine-controlled clusters for advanced materials.

Biography

Kimihisa Yamamoto has received his PhD degrees from Waseda University in Polymer Chemistry in 1990. He joined the Department of Chemistry at Keio University in 1997 as a Professor. Currently, he is a Professor in the Chemical Resources Laboratory, Tokyo Institute of Technology, since 2010. His present research interests are in developing supra-metallomolecules for nanosynthesizers involving nanoparticles, subnanoparticles and superatoms.

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