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Synthesis of platinum sub-nano catalyst using a dendrimer reactor

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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. We show that tinchloride, $SnCl_2$ and $FeCl_3$ complexes to the imines groups of a spherical polyphenylazomethine 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 last. By further extending this strategy, it should be possible to control the number and location of metal ions incorporated into dendrimer structures, which might and uses as tailored catalysts, building blocks, or fine controlled clusters for advanced materials. The metal assembly in a discrete molecule can be converted to a size regulated metal particle with a size smaller than 1nm as a molecular reactor. Due to the well-defined number of metal particles in the subnanometer size region, its property is much different from that of bulk or general metal nanoparticles.

Biography

Kimihisa Yamamoto received PhD degrees from Waseda University in Polymer Chemistry in 1990. He joined the Department of Chemistry at Keio University from 1997 as Professor. Currently, he is a Professor in 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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