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Fine-controlled sub-nano metal particle in a dendrimer reactor

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We show that tin chlorides, SnCl_2 and FeCl_3 complexes to the imines groups of a spherical poly (phenyl 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 nano meter 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, Sn^{2+} , complex to the imines groups of a spherical poly (phenyl 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. 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 or fine controlled clusters for advanced nano catalysts.

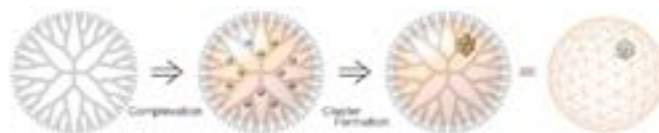


Figure: Precision synthesis of sub nanoparticles using dendrimers.

Biography

Kimihiya Yamamoto has completed his PhD in Polymer Chemistry at Waseda University, 1990. He joined as Professor in Department of Chemistry at Keio University, 1997. Currently, he is a Professor in the Chemical Resources Laboratory at Tokyo Institute of Technology since 2010. His present research interests are in developing supra-metallo molecules for nano synthesizers involving nanoparticles, sub nanoparticles and super atoms..

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