Construction and Rotation Control of a Metal-centered Circular Gear System

論文の内容の要旨

論文題目： Construction and Rotation Control of a Metal-centered Circular Gear System

（金属を中心骨格とする環状ギアシステムの構築と回転運動制御）

氏名： 眞田 千馬

A molecular machine is a fundamental subject in nanotechnology, and many researchers have investigated biological and artificial molecular machines in the last 60 years. The large contribution of uncertainty in the biological molecular machines was revealed and some important mechanism for motion control in the artificial molecular machines was developed. However, the researches have just begun and various approaches would be required to put into use. A molecular gear system would be useful for molecular machines less contributed by uncertainty like macroscopic machines. This research aimed at establishment of arranging method of multiple ear unit, which would be also useful for accumulation of molecular machines. Summary and composition of this research were shown below.

Chapter 1 described background of this research and explained the importance of molecular gear systems in

artificial molecular machines. And the reason why triptycene and a metal complex were used as components of the molecular gear system was also showed.

Chapter 2 mentioned the detail of experiments in this research. At first, the molecular gear system based on a lantern-type rhodium(II) complex was synthesized in the modified method of the general synthetic method. The crystal structures confirmed the lantern-type structures, and indicated steric effects and little electronic effects on the structure. The NMR experiments also confirmed the lantern-type structures. VT NMR experiments and dynamic NMR simulations revealed that the rotational velocities of the gear system were decelerated by the steric modification at 2-position of pyridine derivatives as axial ligands. Visible absorption spectroscopies elucidated the steric and electronic effects of axial ligands on the electronic structures.

Chapter 3 summarized the results of this research and indicated the perspectives. The molecular gear system in this research showed the utility of molecular design based on a metal complex and the effects of steric modification on the molecular motion. The rotational velocities of the molecular gear system with various axial ligands also showed the effects of electronic modification.

These results indicated a post-modification method in molecular machines utilizing ligand exchange of metal complexes, and new insight for the combination of the artificial molecular machines would be obtained.