

DEPARTMENTAL SEMINAR

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TOPIC	Precise Synthesis of Platinum and Alloy Clusters and Elucidation of Their Structures
SPEAKER	Professor Yuichi NEGISHI <i>Tokyo University of Science, Japan</i>
HOST	Assoc Professor XIE Jianping <i>Department of Chemical and Biomolecular Engineering</i>
DATE	Tuesday, 24 July 2018
TIME	3:00 – 4:00 pm
VENUE	E5-02-32, Faculty of Engineering, National University of Singapore NUS Campus Map & NUS: Faculty of Engineering
SYNOPSIS	<p>In recent years, it has become possible to synthesize gold clusters, silver clusters, and alloy clusters with atomic precision using thiolate or phosphine (PR₃) as a ligand. The electronic/geometric structures and size-specific physical/chemical properties of these metal clusters have also been investigated extensively. Similar to these metal clusters, platinum (Pt) clusters have also attracted much interest. An attractive feature of Pt clusters is their high catalytic activity in a variety of reactions. In the precise synthesis of these Pt clusters, carbon monoxide (CO) or PR₃ is used as the main ligand. However, little information has been obtained on the electronic structure and physical/chemical properties of Pt_n(CO)_m(PR₃)_l clusters to date.</p> <p>In this research, the final objective is to obtain experimental information about the largely unknown electronic structure of Pt_n(CO)_m(PR₃)_l clusters. To this end, we precisely synthesized a Pt₁₇ cluster $[\text{Pt}_{17}(\text{CO})_{12}(\text{PPh}_3)_8]^{n+}$; $n = 1, 2$ protected by CO and triphenylphosphine (PPh₃) by a simple method and studied its geometric and electronic structure. Mass spectrometry, elemental analysis, and single-crystal X-ray structural analysis of the product revealed that the obtained Pt₁₇(CO)₁₂(PPh₃)₈ comprises positively charged $[\text{Pt}_{17}(\text{CO})_{12}(\text{PPh}_3)_8]^+$ and $[\text{Pt}_{17}(\text{CO})_{12}(\text{PPh}_3)_8]^{2+}$, having a geometric structure similar to that of neutral Pt₁₇(CO)₁₂(PET₃)₈. The optical absorption spectroscopy and electrochemical measurements of $[\text{Pt}_{17}(\text{CO})_{12}(\text{PPh}_3)_8][(\text{SbF}_6)_n]$ ($n = 1, 2$) demonstrated that Pt₁₇(CO)₁₂(PPh₃)₈[(SbF₆)_n] ($n = 1, 2$) has a discrete electronic structure. Furthermore, the emission spectroscopy revealed that Pt₁₇(CO)₁₂(PPh₃)₈[(SbF₆)_n] ($n = 1, 2$) exhibits photoluminescence in the near-infrared region. In this presentation, I also talk about our recent results on the precise synthesis and one-dimensional structures of alloy clusters including Pt element.</p>
BIOGRAPHY	Dr. Yuichi Negishi is a full professor in Tokyo University of Science, Japan. He received his Ph.D. degree in 2001 from Keio University, under the guidance of Prof. Atsushi Nakajima (Keio University) and Prof. Koji Kaya, focusing on the electronic structures of small metal- and semiconductor clusters. He was selected as a Research Fellow of the Japan Society for the Promotion of Science (JSPS) in 1999–



2000. During the winter of 1999, as a visiting fellow, he worked in the group of Prof. Benoit Simard, National Research Council Canada. Before joining the Tokyo University of Science in 2008, he was employed at Keio University and at the Institute for Molecular Science (IMS). Since 2013, he has been an Associate Professor at the Tokyo University of Science. Since 2014, he was also a visiting associate professor in IMS. He has been awarded several prizes, including the PCCP Prize (2007), CSJ Award for Young Chemists (2008), Japan Society of Molecular Science Award for Young Chemists (2012), and Yagami Prize (2017).

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