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Bis(terpyridine)metal complex oligomer wires on electrodes: Constructions and their electron transport phenomena

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Stepwise preparation of metal complex oligomers and polymers is one of the attractive techniques to construct molecular systems which have desired structures and functions. Our group has developed the formation methods of bis(terpyridine)metal complex (M(tpy)2, M=Fe, Co, tpy=2,2':6',2"-terpyridine) oligomer wires on metallic and semiconducting substrates with the stepwise coordination, and evaluated their electron transport behaviors. The quantitative formations of linear, branched and hetero-metal M(tpy)2 wires revealed the availability of the stepwise coordination technique to prepare tailored molecular structures. The electron transport analyses using electrochemical methods exhibited the superior long-range electron transport abilities of these wires. The attenuation factor (β) values of the electron transfer rate constant were estimated as 0.008-0.07 Å−1 for $Fe(tpy)_2$ wires and 0.002-0.004 Å−1 for $Co(tpy)_2$ wires, suggesting that the $M(tpy)_2$ wire system is one of the most efficient charge transport molecular chains. In addition, the tuning of the electron transfer rate constant and the β values can be achieved by the selection of wire components (anchor, bridging and terminal ligands and metal ions). Furthermore, the branched $Fe(tpy)_2$ wires showed the asymmetric current-time profiles depending on the electron transport direction. The numerical simulation based on the intra-wire charge hopping mechanism could reproduce the series of the asymmetric charge transport behaviors, and allowed us to investigate the charge transport mechanism of $M(tpy)_2$ wires.

Biography

Hiroaki Maeda received his BSc in 2010, MSc in 2012 and PhD degree in 2015 from The University of Tokyo under the supervision of Prof. Hiroshi Nishihara. His current position is Project Assistant Professor, working with Prof. Nishihara at The University of Tokyo. His recent research interest lies in the synthesis of metal complex wires and nanosheets, and the evaluation of their functions for the construction of molecular-based devices.

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