

Fiscal Year 2015 Tokyo Institute of Technology ASPIRE League Research Grant

Selected Research Projects for Type 2 in FY2015

Principal Researcher	Name	Kazuhiko Maeda
	Department and graduate school(institute) in Tokyo Tech	Department of Chemistry, Graduate School of Science and Technology
	Position	Associate Professor
Co-researchers	HKUST	Zhiyong Fan, Assistant Professor Department of Electronic & Computer Engineering
	KAIST	—
	NTU	Hua Zhang, Professor School of Materials Science and Engineering
	Tsinghua	—
Subject of the research project		Artificial photosynthesis with nanostructured semiconductors
Summary of the research project		<p>The production of fuels from inexhaustible sunlight and abundant water would be the ultimate solution to the Earth's energy and environmental problems. Water oxidation and CO₂ reduction are both important as key reactions of “artificial photosynthesis.” While significant efforts have been made so far, none have yielded a satisfactory result.</p> <p>In this research project, we will tackle two topics: (1) nano-structured semiconductor photoanodes for water oxidation operable under a wide range of visible light and (2) hybrid photocatalysts for CO₂ reduction with visible light that consist of a metal sulfide nanoparticle and a metal complex, with a focus on improving the lifetime of photogenerated charge carriers in a semiconductor, efficient utilization of solar spectrum, and facilitating the surface chemical reactions.</p> <p>The applicant has been studying semiconductor particles</p>

Summary of the research project	<p>as photocatalyst and photoelectrode materials for artificial photosynthesis. He possesses extensive experience and knowledge regarding the design of a new semiconductor and the integration of a semiconductor with a functional metal complex. A co-applicant, Prof. Fan (HKUST), is a specialist in nano-structured semiconductor electronic devices for light energy conversion. Prof. Zhang (NTU), who is also a co-applicant, is an expert of bottom-up synthesis of nano-materials including semiconductors and metals. The applicant is confident that collaboration between these three different groups that have their own special skills will contribute to the creation of a novel artificial photosynthetic device because nano-structuring of a semiconductor facilitates transportation and utilization of photogenerated charge carriers, which are fundamentally important for artificial photosynthesis.</p> <p>During the research period, the applicant plans to launch a satellite-laboratory using part of his own laboratory space in Tokyo Tech, where researchers and students from HKUST and NTU will work together. In particular, the applicant's group will accept HKUST and NTU students to perform research on a theme in common with students in the applicant's group. This will not only facilitate the progress of this joint research, but also give Japanese students an opportunity to engage in English communication, which is essential to become a global leader in the future.</p>
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