Solar energy research and development tokyo

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Effective utilization of solar energy, which is one of the flagship renewable energy sources, plays a crucial role when considering energy and environmental issues. Particularly, there is a demand for the enhancement and functionalization of solar cells capable of directly converting solar energy into electricity.

The utilization of indoor and outdoor light energy, beyond daylight, present in our daily surroundings, is increasingly vital as an energy harvest for realizing an IoT society. Therefore, we also engage in research and development of energy harvesting devices capable of operating in various light environments, including dye-sensitized solar cells enabling high-efficiency power generation even in low-light conditions.

To efficiently advance these research endeavors, we prioritize collaborative research with domestic and international universities and research institutions. Furthermore, to promote the societal implementation of our research outcomes, collaboration between industry and academia is crucial. Hence, while collaborating with various industries, we focus on research and development of energy materials and devices, primarily centering on next-generation photoelectric conversion devices.

ObjectivesTopropose a foundation for stable and low-cost power supply/management,and to activate and promote research, development and education ofrenewable energy utilization technology at TUS.Through activeinteraction among the Division members from different backgrounds, wewill promote both internal and external joint research and to createnovel concepts for renewable energytechnology.

To achieve carbon neutrality, CO2-free hydrogen is indispensable. Disruptive installation of photovoltaic is expected as a power source to produce green hydrogen in the regions with high irradiance. For this purpose, there is a growing expectation for high efficiency solar cells, far superior to conventional silicon solar cells. The key to achieving high efficiency lies in semiconductor nanocrystal technology. We are conducting research and development rooted in material chemistry and physics, from crystal growth to system evaluation of solar cells.

Photocatalysis is expected to be the ultimate technology for lowcost solar hydrogen production. In order to improve the efficiency of photocatalysts, it is essential to investigate the band structure of the interface between the semiconductor, which is responsible for the generation of photovoltaic power, and water, and to design a structure that can learn from high-efficiency solar cells. We are simultaneously developing new analytical methods and exploring highly efficient photocatalysts.

In order to supply fuels that cannot be covered by CO2-free hydrogen, it is expected to realize a system to produce green chemicals by reducing the recovered CO2 with renewable energy. We are developing systems that take advantage of the benefits of electrochemistry, such as the development of a reaction field that can

efficiently produce the desired hydrocarbons from CO2, utilizing our knowledge of fuel cells and water electrolyzers.

In response to the trend of times, this division is created by reorganizing the Photovoltaic Sci & Tech Division established in 2010. We are composed of members from different fields of expertise in various renewable energy devices and systems. We will develop unique renewable energy and integrated systems/infrastructures such as solar-wind-biomass power generation.

(i) Development of power generation materials that reduce the installation and operation costs to the same level as power generation by fossil fuels.(i i) Development of highly efficient management technology for electric power from various power generation methods.(i i i) Development of new materials and new system technologies.(i v) Collaborations between our research division and external research institutes.

As a research and development hub for renewable energy technology, we will realize novel renewable energy materials and power generation systems through vertical integration of technologies, as well as educate the next generation of researchers and disseminate the technology to society. Specifically, the following activities will be carried out:

(i) Proposal of ultra-high efficiency power generation device by tandem configuration of thin film solar cells/thermoelectric generation elements.(i i) Establishment of hydrogen production technology using solar cell thin films and charging technology such as supercapacitors.(i i i) Development of ultra-low-cost solar and fuel cell materials and manufacturing methods, and examination of their common basic technology.

(i) Development of technologies of failure diagnosis, remote diagnosis, power generation prediction and AI utilization for energy loss control.(i i) Integration of smoothing technology development for wind x solar power generation and power storage technology such as batteries and flywheels.(i i i) Solar matching for agriculture and application of renewable energy technologies to smart houses.