

《Chemical Solutions for Carbon Resource Issues》 Glossary

artificial photosynthesis: 【人工光合成】 A research field that attempts to replicate the natural process of photosynthesis, which is converting sunlight, water, and carbon dioxide into carbohydrates and oxygen. Splitting water into hydrogen and oxygen by using sunlight energy is also referred to as artificial photosynthesis.

biomass: 【バイオマス】 Biological materials from living, or recently living organisms, such as wood, waste, (hydrogen) gas, and alcohol fuels.

biofuel: 【バイオ燃料】 A type of fuel which is in some way derived from biomass. The term covers solid biomass, liquid fuels and various biogases.

bandgap: 【バンドギャップ】 In solid state physics, a band gap, also called an energy gap or bandgap, is an energy range in a solid where no electron states can exist. In graphs of the electronic band structure of solids, the band gap generally refers to the energy difference (in electron volts) between the top of the valence band and the bottom of the conduction band in insulators and semiconductors. Photocatalysis on semiconductor is initiated by absorption of photons with higher energies than the semiconductor band gap, leading to the generation of electron (e^-) – hole (h^+) pairs.

conduction band: 【伝導帯】 In the solid state physics field of semiconductors and insulators, the conduction band is the range of electron energies, higher than that of the valence band, sufficient to free an electron from binding with its individual atom and allow it to move freely within the atomic lattice of the material. In the photocatalytic water splitting reaction, it is thermodynamically necessary that the bottom of the conduction band must be more negative than the reduction potential of water to produce H_2 .

heterogeneous: 【不均一系】 In chemistry, heterogeneous catalysis (or photocatalysis) refers to the form of catalysis where the phase of the catalyst (or photocatalyst) differs from that of the reactants. Phase here refers not only to solid, liquid, vs. gas, but also immiscible liquids, e.g. oil and water. The great majority of practical heterogeneous catalysts are solids and the great majority of reactants are gases or liquids.

Honda-Fujishima effect: 【本多-藤嶋効果】 The demonstration of photoelectrochemical water splitting using a single-crystal TiO_2 (rutile) photoanode and a Pt counter electrode with an external bias.

Low-carbon fuel: 【低炭素燃料】 Alternative fuels such as H_2 gas or alcohols, and cleaner fossil fuels such as natural gas (CNG and LPG), which have lower CO_2 emission compared to the conventional fossil fuels.

metal oxide: 【金属酸化物】

oxidant: 【酸化剤】

photosynthesis: 【光合成】

reductant: 【還元剤】

photoexcited electrons: 【光励起された電子】

photoelectrochemical water splitting: 【光電気化学的水分解】

photocatalytic water splitting: 【光触媒の水分解】

semiconductor: 【半導体】

ultraviolet (UV): 【紫外線】

valence band: 【価電子帯】 In solids, the valence band is the highest range of electron energies in which electrons are normally present at absolute zero temperature. On a graph of the electronic band structure of a material, the valence band is located below the conduction band, separated from it in insulators and semiconductors by a band gap. In the photocatalytic water splitting reaction, it is thermodynamically necessary that the top of the valence band must be more positive than the oxidation potential of water to produce O_2 .

visible light: 【可視光】 Electromagnetic radiation that is visible to the human eye, and is responsible for the sense of sight. Visible light has wavelength in a range from about 400 nanometers to about 800 nm, which accounts for almost half of the solar spectrum on the Earth's surface.

Z-Scheme photocatalytic system: 【光合成型光触媒反応系】