Water Splitting Reaction under Visible Light using Artificial Photosynthesis (Z-Scheme) Mechanism

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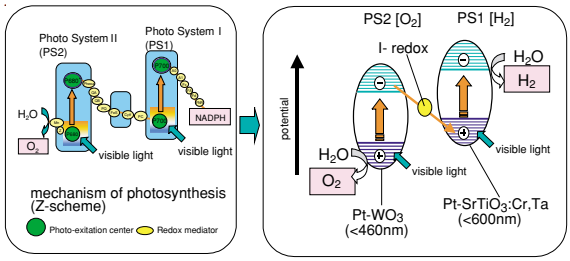
The stoichiometric water decomposition into H_2 and O_2 ($H_2/O_2 = 2$) under visible light irradiation (> 410 nm) took place for the first time using an IO_3-/I- redox mediator and mixture of Pt-WO_3 and Pt-$SrTiO_3$ (Cr-Ta doped) photocatalysts suspension. The quantum efficiency was ca. 0.03% (at 420.7 nm).



Mimetic mechanism of photosynthesis in plant (artificial photosynthesis)

Development of Silicon Nitride with High Wear Resistance

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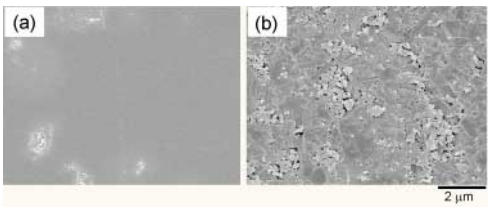
Advanced structural ceramics such as Al_2O_3, SiC and Si_3N_4, are promising frictional materials. Because of their high hardness, high heat resistance and chemical stability, Among them, silicon nitride (Si_3N_4) is well known as a representative structural ceramic having excellent mechanical and thermal properties. However, the wear resistance of Si_3N_4 is rather low compared to Al_2O_3 or SiC as the relatively weak interfacial strength between the Si_3N_4 grains gives rise to grains dropping during sliding. This problem could be resolved in Si_3N_4 with uni-directionally aligned elongated grains, which can be fabricated by the combination of seeding and extrusion: the plane normal to the grain alignment in the textured Si_3N_4 exhibits a low wear rate (1/10 compared to the conventional Si_3N_4) combined with a low friction coefficient (about 0.3). The worn surface after sliding was quite smooth in the specimen, although that for the conventional Si_3N_4 was irregular owing to grain dropping, as shown in the figure. The high wear resistance achieved in this plane is attributable to the inhibition of crack propagation along the sliding surface by the stacked elongated grains normal to the sliding surface. It is expected that this material can be used in a wide range of applications as a frictional material having superior mechanical, thermal and wear properties.



Worn surfaces of (a) the plane normal to grain alignment in a textured Si_3N_4, and (b) a conventional Si_3N_4: wear tests were carried out using a Block-on-Ring tester under dry condition in air at a sliding speed of 1.5 m/s, a normal load of 5 N and a sliding distance of 75 m.