PHOTOCATALYSTS FOR HYDROGEN GENERATION AND THE FUTURE OF ENERGY

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Abstract:
The use of fossil fuels as an energy source has sustained a 10-fold global population growth since the Industrial Revolution, but there is a dire need to find novel and clean energy sources to reduce the emission and consequences of greenhouse gases. Artificial photosynthesis (AP) is a promising energy alternative to fossil fuels that can generate hydrogen gas as a fuel source from aqueous solutions by designing an AP system with a catalyst, chromophore and electron donor. Optimizing catalysts using earth-abundant first row transition metals to be covalently bonded to TiO_2 nanoparticles (NP) can be a stable, efficient, and cost-effective alternative to precious metal catalytic systems. Herein, a previously explored catalyst is modified and immobilized on TiO_2 NP and found to be highly active for hydrogen generation, with turnover numbers of over 12,000 in 48 hours. The catalyst can be recycled after the degradation of the chromophore and electron donor for additional hydrogen generation, and can be utilized in sea water to produce fuel from impure water systems.