



Visible Light Photoreduction of CO₂ Using Heterostructured Catalysts

Opportunity

Research is currently active on the patent-pending technology “Visible Light Photoreduction of CO₂ Using Heterostructured Catalysts.” The technology is available for licensing and/or further collaborative research from the U.S. Department of Energy’s National Energy Technology Laboratory.

Overview

In this invention, small semiconductor particles function as photocatalysts to promote various oxidation and reduction reactions under sunlight through the application of solar energy. Research data indicated a significant new finding for the photocatalytic reuse of carbon dioxide (CO₂) or, simply, that the lower energy “tails” of the solar spectrum can be used for this application. As such, the results demonstrated an initial step toward creating more efficient photocatalysts for CO₂ capture and reuse.

The inventors found that titanium dioxide (TiO₂) is a promising material for application as a photocatalyst because it is efficient, relatively inexpensive, and environmentally friendly. However, the material’s widespread use has been hindered because it cannot be activated without ultraviolet (UV) light and UV light does not make up a significant amount of the solar spectrum. To overcome the hindrance, the inventors were able to shift the optical response of TiO₂ from UV to the visible spectral range.

Specifically, researchers synthesized new heterostructured photocatalysts made from CdSe nanocrystals, TiO₂ nanocrystals, and Pt nanoparticles and demonstrated their activity toward the reduction of CO₂ with H₂O using only visible light. No ultraviolet light was required to initiate CO₂ reduction reaction with H₂O, and the value-added products of methanol, methane, and H₂ were produced.

In summary, the photocatalytic reduction of CO₂ uses readily available sunlight to convert CO₂ into valuable chemicals, such as methanol or methane, in a carbon friendly manner.

Patent Details

U.S. Patent-pending No. S-119,750; titled “Visible Light Photoreduction of CO₂ Using Heterostructured Catalysts.”

Inventor(s): Chris Matranga, Congjun Wang, and Robert L. Thompson

Contact

NETL Technology Transfer Group

techtransfer@netl.doe.gov

Significance

- CdSe photosensitizer gives the TiO₂ catalyst visible light photoactivity
- The photosensitizer is photochemically and thermally stable
- It will not degrade
- It proved superior to impurity doping methods

Applications

- CO₂ capture and management applications
- Self-decontaminating surfaces in hospital, military, and general use
- Self-cleaning applications for glasses and windows

September 2012

