Production of Renewable Hydrogen by Solar Irradiation Using Metal Oxide

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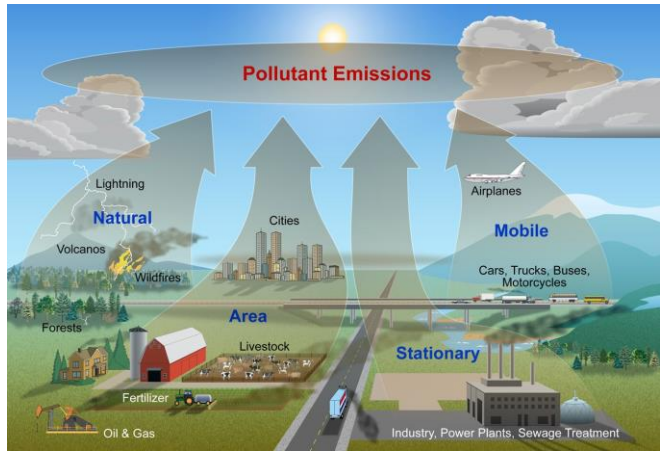
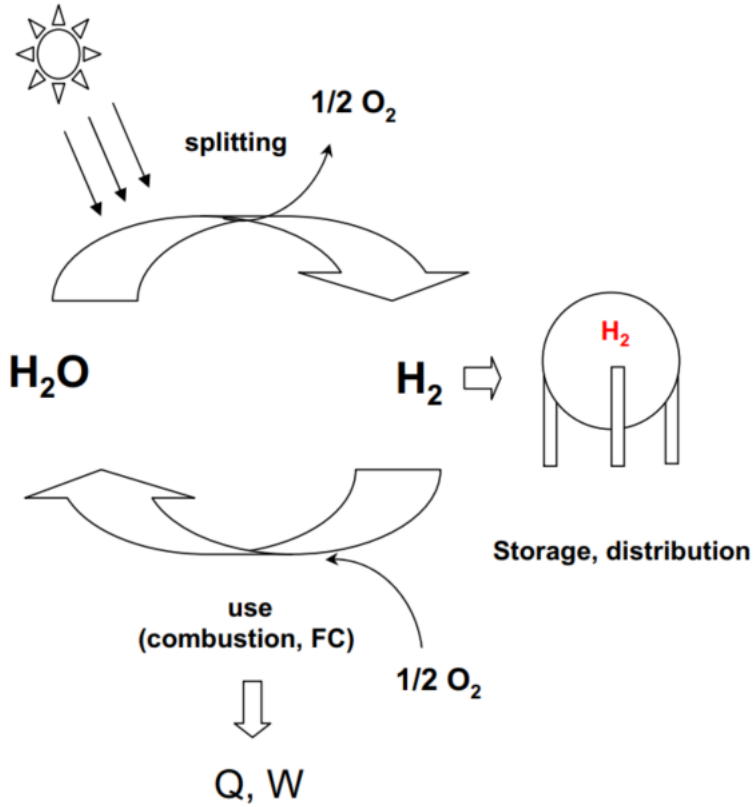
Context

The extensive use of fossil fuels promotes the emission of pollutants that cause various harmful effects on the environment and human health. Furthermore, the depletion of fossil fuels can lead humanity to an energy dilemma.

The development of alternative and non-polluting sources to ensure a future of energy security and sustainability.



Photocatalytic Generation of H_2 as a Green and Sustainable Technology.



Metal oxide as catalysts for H_2 photoproduction

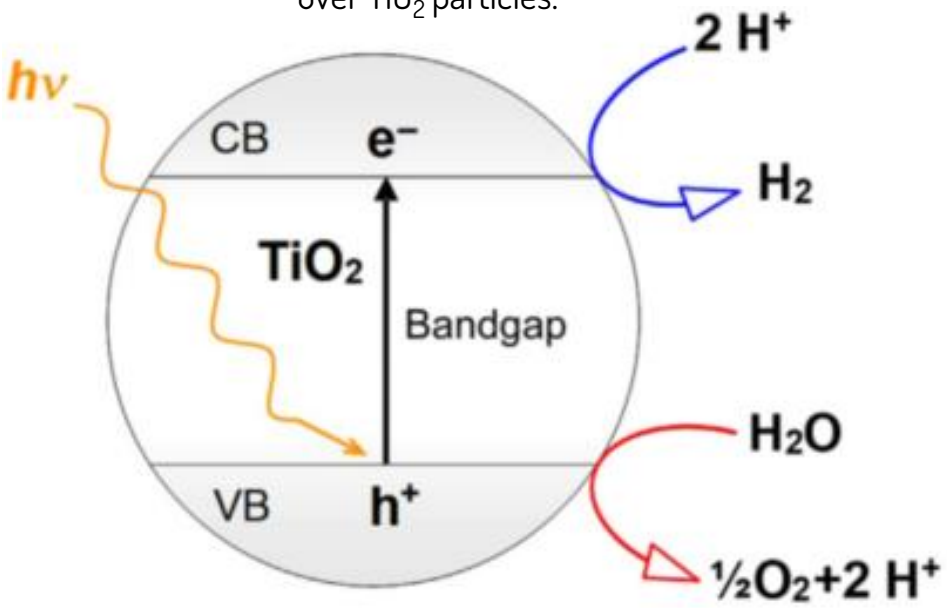
$$photocatalyst + h\nu \rightarrow e^-_{CB} + h^+_{VB}$$

$$H_2O + 2h^+_{VB} \rightarrow \frac{1}{2}O_2 + 2H^+$$

$$2H^+ + 2e^-_{CB} \rightarrow H_2$$

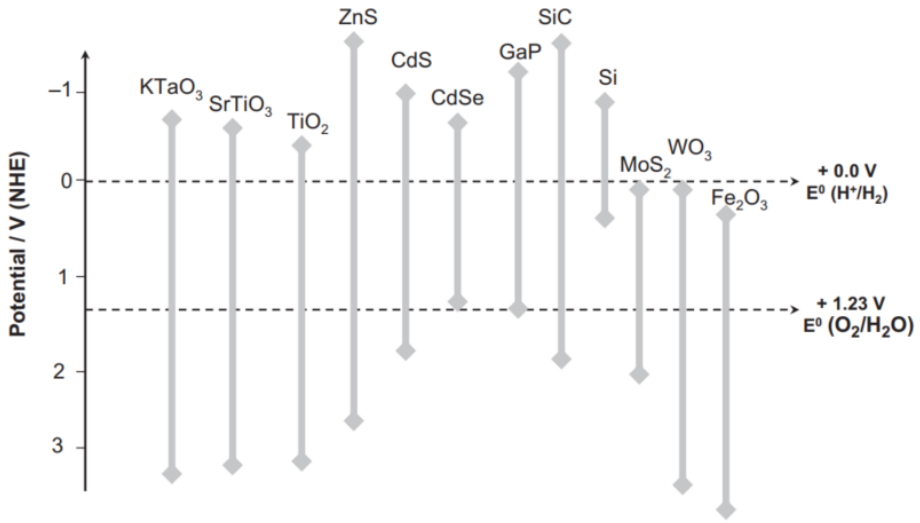
$$H_2O + 2h\nu \rightarrow H_2 + \frac{1}{2}O_2 \qquad \Delta G^\circ_r = 237\ \text{kJ/mol}$$

Figure 1: Schematic representation of the photocatalytic water splitting over TiO_2 particles.



doi: 10.1016/B978-0-12-819960-2.00022-5

Figure 2: Band gap energy and relative band position of different photocatalysts with respect to the potentials (NHE) for water oxidation/reduction reactions.

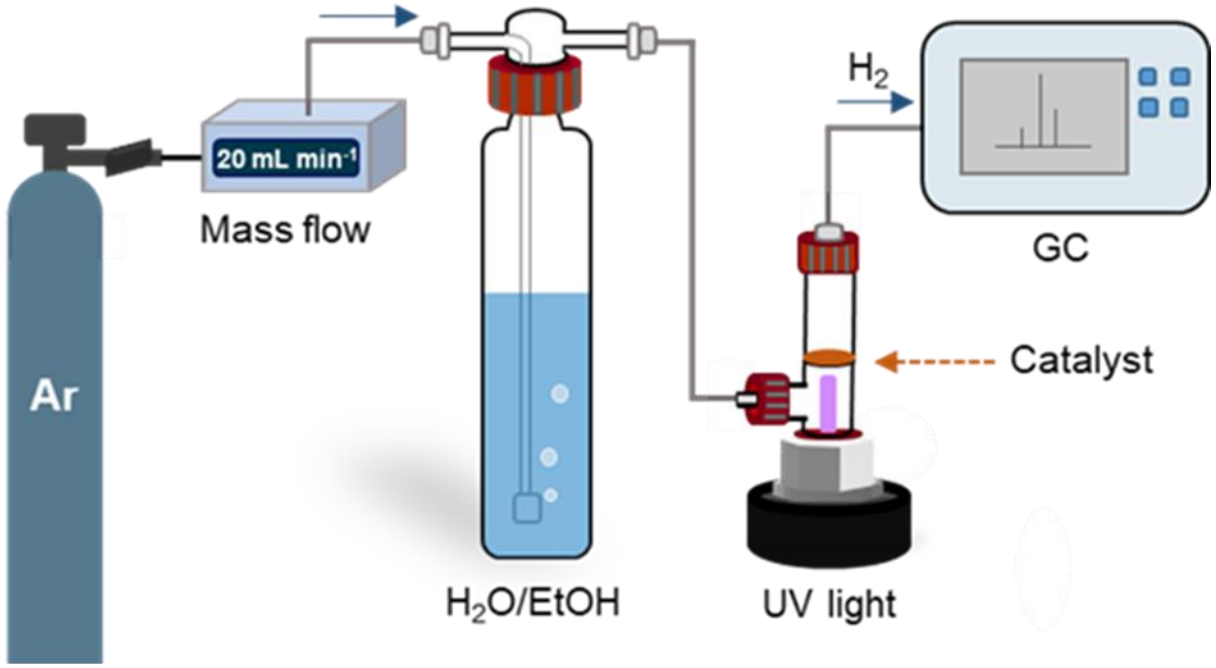


doi: 10.1016/B978-0-444-56352-1.00001-5

Methodology: H_2 photoproduction

- The photocatalysts are dispersed by sonication and dripped onto cellulose paper;
- After that, the paper containing the catalyst is dried in an oven;
- The paper containing the catalyst is positioned in the reactor chamber as shown in the scheme;
- An argon flow is bubbled through a bottle containing a liquid mixture of 87.5 g H_2O and 9.92 g Ethanol to obtain (a water:ethanol vapor mixture of 9:1 molar ratio). Gas products are analyzed with a time interval of 4 min with a gas chromatograph;
- When the oxygen fraction is below 0.015, the light is turned on to carry out the H_2 photoproduction.

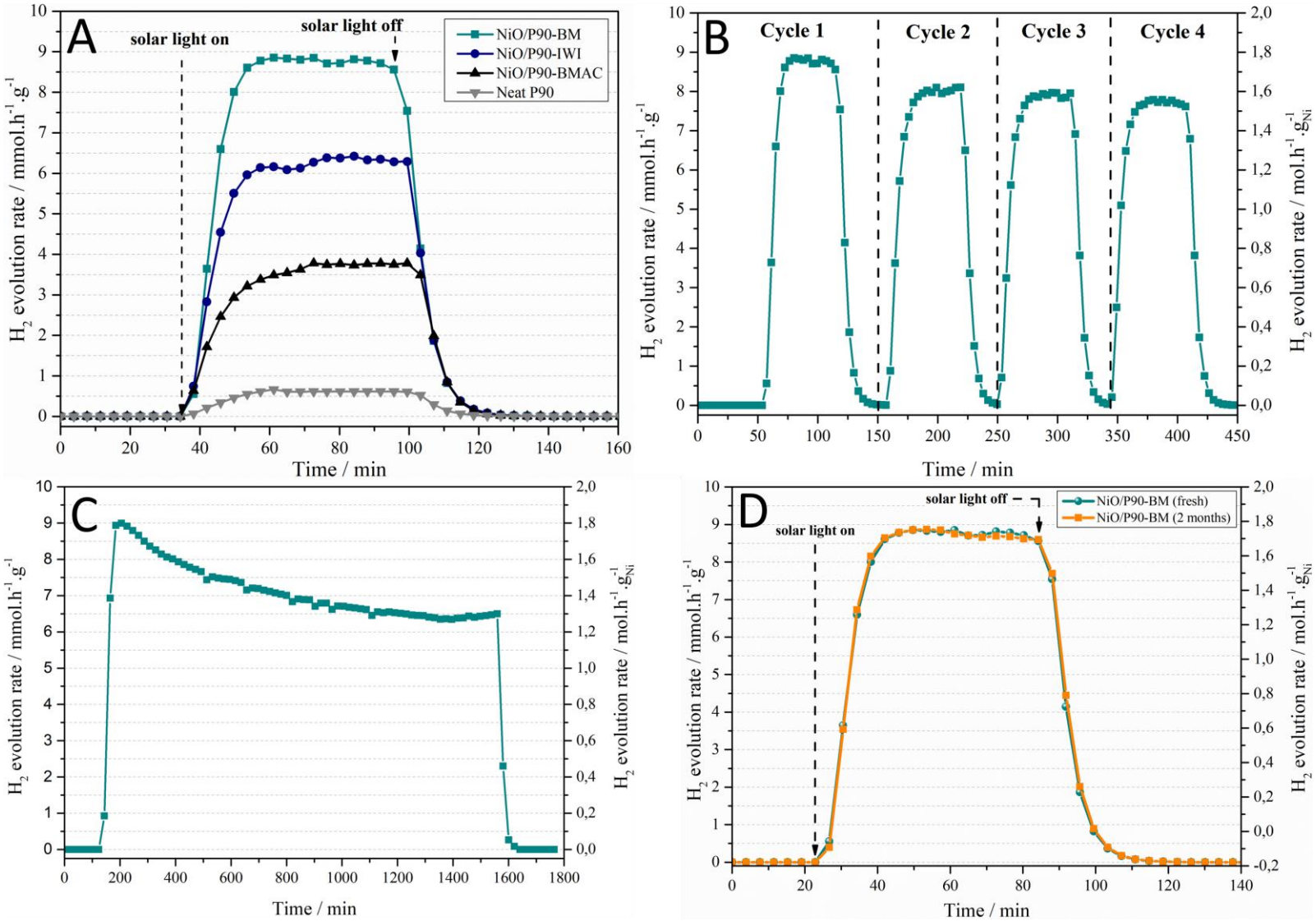
Figure 3: Schematic representation of H_2 photoproduction system.



Y. Chen et al. (2022), doi: 10.1016/j.apcatb.2022.121275.

Teaser: some results

Figure 4: (A) H_2 photoproduction tests of different NiO/TiO_2 samples, (B) Cycles, (C) long-term, and (D) aging tests of the best sample.



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Thank you!

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