SMART MATERIALS FOR RENEWABLE ENERGY APPLICATIONS

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Aim/Big Picture

- Increasing impact of solar energy on economy.
- Ecofriendly and low cost devices.
- Decrease in greenhouse emission.
- Achieving an energy-efficient Europe

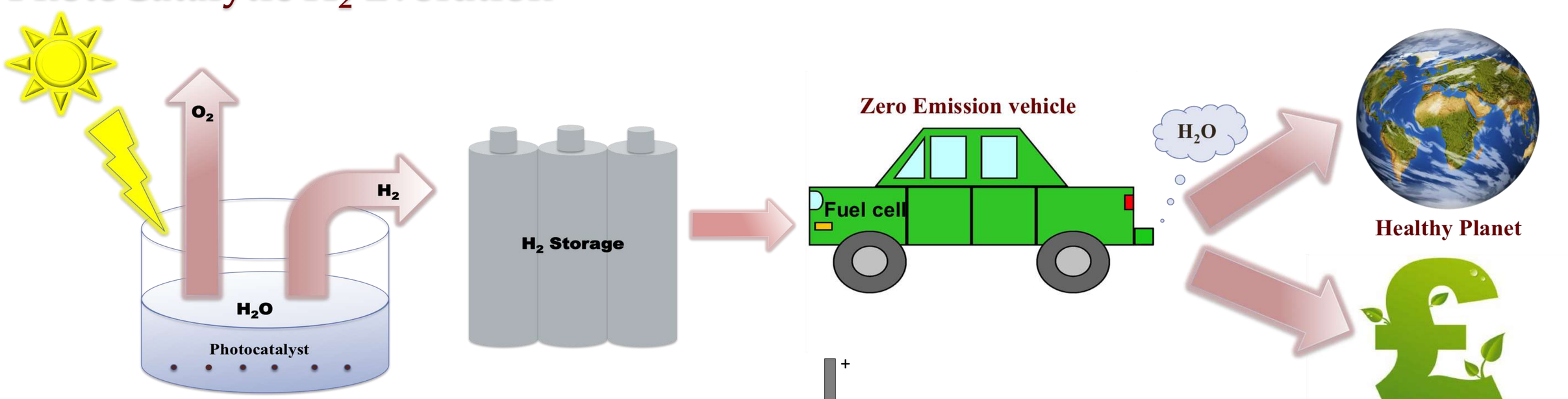
EU Framework 2030

- Greenhouse gas emissions 40% lower than 1990
- 27% of energy from renewables
- 27% increase in energy efficiency

EU Mission 2050

- Emissions to 80% below 1990 levels.

PhotoCatalytic H_2 Evolution



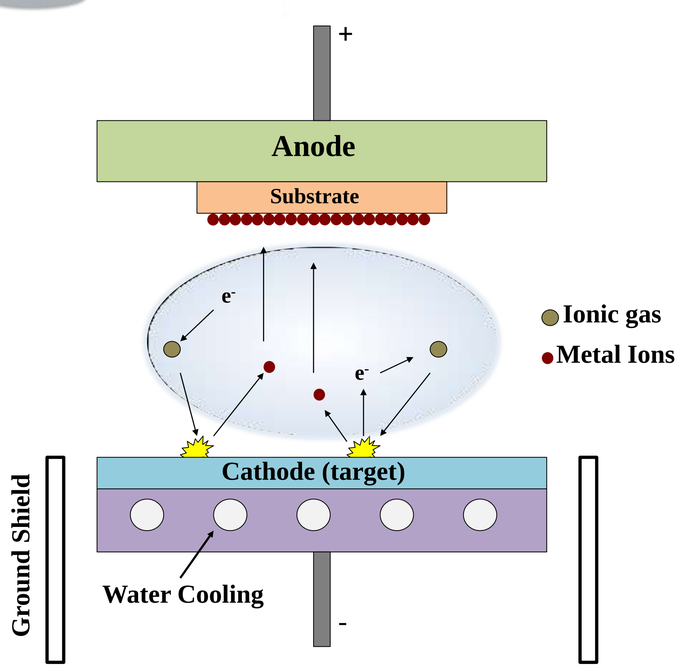
Smart Materials

Materials having unique properties arising from their nano (10^{-9}) scale dimension.

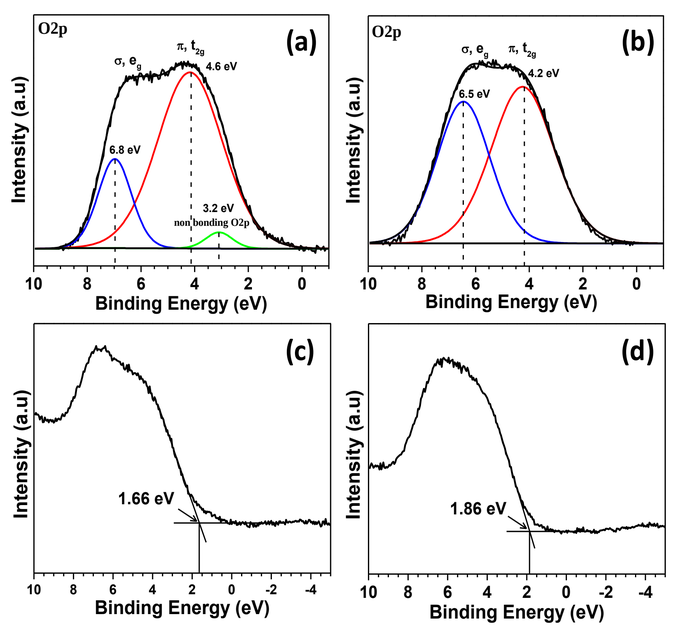
Why *billionth* of metre???

- Bridge between bulk and atomic/ molecular structure.
- Better mechanical properties.
- Large surface area.
- Superior electronic and optical properties.
- Can have dimensions ***3D, 2D, 1D, 0D***.

metre (m) → 1/1000 → centimetre (cm) → 1/1000 → micrometre (μm) → 1/1000 → nanometre (nm)



- Schematic of in-situ Hydrogen incorporation into TiO_2

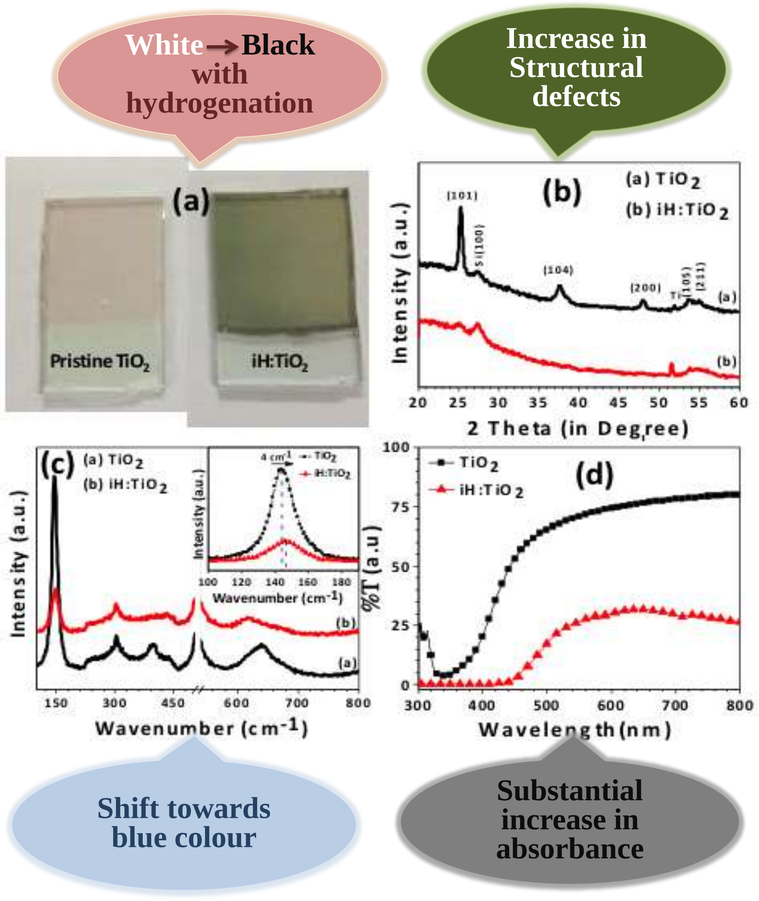


- Valence band study has been used to understand the changes in electronic properties with the structural defects of TiO_2 nanocrystals
- XPS results conclude that modified TiO_2 is more deficient in oxygen and hence more photocataytic active.
- The experimental results are in perfect match with basic chemistry.

we can capture more of the energy from sunlight

Our Research

- Enterprising research.
- Fundamental study leading to technology development.
- Environment friendly materials as Photocatalyst.(TiO_2, $BiVO_4$ & wonder material " GRAPHENE")
- Enhancing efficiency along the Visible and IR (70%) region of the solar spectrum.
- Longer life-time without decay in performance.
- Synthesis of thin Films with high surface area by Rf Sputtering.
- Introdution of defects using Hydrogen treatment.
- Annealing and Plasma treatments as viable methods for hydrogen incorporation.
- Easy and scalable synthesis for industrial production.



Conclusion

This study shows that the in-situ hydrogen treatment can be used as a fast and economic technique to modify the properties of TiO_2 as Photocatalyst.

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Publication

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