H2ERE NETWORK
Hydrogen Energy Research and Enterprise network

CNR IFN
Istituto di Fotonica e Nanotecnologie

Photonics for hydrogen energy research

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Un progetto di:

ASSOLOMBARDA H2IT LE2C LOMBARDY ENERGY CLEANTECH CLUSTER

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Photonics for advancing hydrogen energy research

- **Solar-to-Hydrogen Conversion**:

Photonic technologies help in designing photocatalyst materials that efficiently absorb and utilize sunlight to drive chemical reactions

- **Optical Sensing and Monitoring**:

Detection and measurement of hydrogen concentrations and impurities. Detection of Hydrogen leaks.

- **Photonic Materials for Catalysis**:

Development of new photonic materials can enhance the performance of catalysts used in electrochemical processes for hydrogen production

- **Advanced Characterization**:

Photonics-based techniques, such as Raman and infrared spectroscopy, allow for the detailed characterization of materials and reactions involved in hydrogen production and use

Advanced spectroscopy for hydrogen

- **Hydrogen Purity Analysis**:

Assess hydrogen purity by detecting impurities that can affect fuel cell performance

- **Monitoring Catalysts**:

Understanding and improving catalysts used in hydrogen production processes

- **In-situ Spectroscopy**:

Real-time monitoring of chemical reactions and processes in hydrogen production and storage

- **Solar Hydrogen Production:**

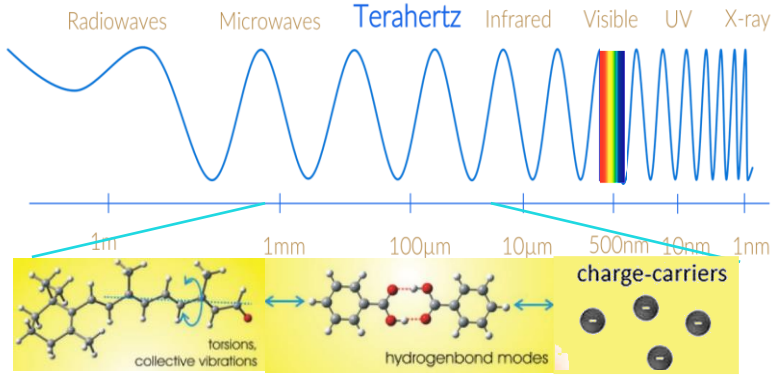
Development of photocatalysts for solar-driven hydrogen production

- **Safety and Leak Detection:**

Rapid detection of hydrogen leaks

1. Advanced material characterization for green H_2 chain

THz spectroscopy
for chemo-sensitive non-invasive material inspection:



inspection of materials for green H_2 chain and CO_2 capturing
graphene from PET pyrolisis, perovskites, MOFs

biomass gasification
gas sensing, syngas/sorbent interaction to maximise H_2 gas

purification efficiency
investigation of THz assisted process for H_2 production

nffa-di

MOST
CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

NEST
NETWORK FOR ENERGY SUSTAINABLE TRANSITION

2. Raman analysis of gas mixture

- Full-optical technique giving the gas mixture composition: methane and other hydrocarbons, hydrogen, carbon dioxide, nitrogen
- From mixture composition, all the measurements required by the Italian law for natural gas diagnostics are obtained:
  - Calorific Power [kJ/m3], i.e., the amount of ENERGY in form of heat released by the combustion of a specific volume of the mixture
  - amount of carbon dioxide
  - amount of hydrogen (in view of possible hydrogen blending)
- Measurements defined by ISO 6976:2016 standard and OIML R 140 recommendation