

ABSTRACT

PROJECT GOAL: Herein we propose a precise new future energy conceptual research - Plasmonic materials atomic engineering with Single & Bimetallic Atoms for the nearly carbon-negative process of Sustainable H₂ generation and CO₂ reduction alongside photocatalysis referred to as product intensification- considered to be the “two birds, one stone” approach for simultaneously carbon footprint free value-added commodities production.

DESCRIPTION OF RESEARCH: Pioneering the way forward, merging the benefits of precious-metal-free plasmonic catalyst with each metal atom in controlled environments is a unique and novel approach for conducting targeted model reactions (energy, fine chemical industries) in a sustainable and scalable fashion. The cutting-edge objectives of this project are both fundamental and applied aspects in cost-effective way. 'the use of light to make chemical reactions happen using catalyst via rational design, characterizing material and their application in H₂ generation & CO₂ reduction. Eventually; understanding the full solar spectrum (UV, *visible & infrared light*) *impact on* catalyst's behaviour at atomic scale - DFT studies optimization. Further scaling up (industrial tied-up technologies).

REASONS FOR ATTEMPTING A PARTICULAR RESEARCH TOPIC: Almost a quarter of the worldwide energy sector is dependent on the current catalytic process. For boosting the future economy, photocatalysis research has become the central development regime of new, clean protocols to generate energy. Single-site catalysis holds a new, frontier in the realm of heterogeneous photocatalysis. Designing a facile system with a defined active site leads to improved atom utilization and product selectivity; is seminal for future research.

SUBSTANTIAL RESULTS EXPECTED: UK, Europe strives to be the first climate-neutral continent, which crucially outlined the need to invest in environmentally-friendly technologies and rapidly decarbonize the chemical and energy sectors. This strong incentive, backed by policy, regulation, and industrial drive, will generate a variety of research opportunities across the board. The present RSC project specializing in the relevant field will make me ‘in demand’ talent for the foreseeable future, in academia and industrial research and innovation prospects.