Talk-I: **Design and Understanding of Multifunctional Nanoscale Energy Materials as Electrocatalyst**

Abstract: The development of methodologies for the advancement of energy resources in a sustainable fashion is highly attractive due to its ability to overcome negative outcomes brought about by the utilization of conventional fossil fuels. Consequently, an assortment of energy conversation strategies, for example, PEC water splitting, electrocatalytic water splitting, methanol oxidation, N2 reduction, CO2 reduction, and rechargeable metal-air batteries, have been paid increasingly more consideration inferable from their extraordinary potential for reducing the concern of energy needs. Among those, the electrocatalytic water oxidation reaction to produce oxygen can be regarded as a green and sustainable approach for generating alternative energy. It is well established that electrocatalytic OER is engaged with different energy conversion frameworks and has been broadly concentrated in ongoing years. However, the improvement of an effective electrocatalyst toward OER still remains an overwhelming test, as OER catalysts experience a large overpotential and poor sustainability. So far, noble metal-based materials are considered to be the most proficient catalysts in electrochemical OER. However, the significant expense and low abundance of such noble metal electrocatalysts incredibly hinder their huge scope of applications. Therefore, it is recommendable to build high-action and noble-metal-free OER catalysts with more extensive adaptability. In this talk, I will describe different methodologies for the fabrication of metal-semiconductor and transitions metal-based heterostructure and their successful applications in electrochemical activity.

Talk-II: **A Strategy to Design Efficient Commercial Catalyst: From Pollution to Power.**

Abstract: Stubble burning has been reckoned among the major contributors to air pollution especially in South Asia. It is a significant source of gaseous pollutants such as carbon dioxide (CO2), carbon monoxide (CO), nitrogen oxides (NOx), sulfur oxides (SOx), and methane (CH4) as well as particulate matter (PM10 and PM2.5) causing serious damage to human health and the environment. To address those issues, researchers have been investigating for decades to explore more economical ways to make full use of crop stubble. Rice straw/husks of stubble are a tough and bulky biomass with a high silica content from rice production. Studies have shown that RH contains ca. 15−28 wt % silica depending on the variety, origin, climate, and geographic location and about 72−85 wt % of lignocellulose (LC), including cellulose (ca.

35−40 wt %), hemicellulose (ca. 15−20 wt %), and lignin (ca. 20−25 wt %). Recently, Siliceous materials including silicon (Si), silica (SiO2), and silicates play a major role in the production of catalysts and the development of novel nanocatalysts for thermocatalytic CO_2 conversion. Therefore my proposed research is as follows.

1) Atomically defined silica catalysts using nanoarchitecture and single-atom catalysts (SACs) have rarely been reported. The idea is to develop well-designed catalysts that contain precisely incorporated Si elements along with other transition metals to form atomically coordinated metal-Si structures (MSi_x) with a defined architecture at the atomic level from rice straw/husk.
2) Preparation of efficient catalyst for electrochemical hydrogenation and hydrogenolysis reaction.