Seminar

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Institute for Plasma Research

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Title: Towards the Development of A Novel Destruction Approach of Volatile Organic Compounds (VOCs) Using Non-Thermal Plasma Coupled With Heterogeneous Catalysts

Speaker: Dr. Debajyoti Ray
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Date: 17th March 2023 (Friday)

Time: 03:30 PM

Venue: Join the meeting online:
https://meet.ipr.res.in/join/2977471288?be_auth=NDE5MjAy
(Conference ID: 2977471288; Password: 419202)

Abstract

Volatile organic compounds (VOCs), e.g., acetone, benzene, formaldehyde, methylene chloride etc are characterized by their vapour pressure of $>10^{-2}$ kPa at normal pressure (101.325 kPa) and temperature (293.15 K). Therefore once emitted from stationary fuel combustion, industrial processes or moving vehicles, the VOCs remain mixed in the air. The VOCs are involved in the formation of ozone, photochemical smog, and fine particles in the atmosphere, which pose considerable threat to human health and ecosystem safety. The common VOC abatement techniques include thermal oxidation, scrubbers, carbon-absorption and advanced oxidation processes (AOPs). Amongst the AOPs, the synergistic non-thermal plasma (NTP) and heterogeneous catalysts could be a promising tool because high densities of reactive species, such as ions, radicals or vibrationally excited molecules, are generated by electron collisions and initiate a multitude of chemical reactions in the gas phase. By shifting the reaction site from the gas phase to the surface of the catalyst, the selectivity of the chemical transformation reactions can be significantly enhanced. But the untargeted collision of active particles and pollutants leads to the formation of undesirable products that are difficult to control. For example, carbon monoxide production during acetone treated with NTP + ZnO in in-plasma mode and NTP+MnO_2/Al_2O_3 in post-plasma mode. Based on experimental findings, therefore, the next task is to establish an optimum protocol by the effect of electrical and physical processing parameters viz., discharge energy, VOC concentrations, relative humidity, and waste-gas flow rate, and to analyze the degradation reactions.